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# Investigating the use of a web-based open source GIS prototype system for low-income communities in Cape Town

by

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## **Abstract**

The implementation of Promotion of Access to Information Act (PAIA, 2000), by the South African government in the public domain gave effect to “the constitutional right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights; and to provide for matters connected therewith” (Arthur, 2007). The government requires every public and private organization to provide access to information users manual document as contemplated by section 14 of the PAIA of 2000 for the facilitation of easy access, affordable, relevant and understandable information to the public. Despite the effort, low-income communities at Cape Town informal settlements has limited understanding of where to go or who to contact when it comes to submitting requests for access to spatial information to the City of Cape Town Council and to publicly report locale area problems. It can be assumed that one of the factors contributing to this ignorance is the geographical distance to the relevant City Council departments and the absence of the public spatial information systems that support interaction between municipality level and community level.

The Internet is a medium that can address important obstacles inhibiting information utility associated with public access to spatial information and reporting problems of concern in a society. The rise of the Internet technology has created opportunities to increase public participation in environmental decision-making by use of web-based GIS. This study aims to implement an open source web-based mapping GIS prototype system that can be used as an intermediate solution as a feasibility study for the access to spatial information rather than the manual procedure used by the City Council. It also aims to illustrate how public access to online maps can deliver improved services to lower-income communities through reporting locale problems. The web-based GIS prototype system named UCT CSIS utilize City of Cape Town Smart Cape Access Project platform at the community libraries so that it reaches a wide range of audience through internet connection.

The following approach was adopted to fulfill the purpose of the research, three investigations were conducted. The first investigation was conducted with pre-questionnaire survey at the community libraries and interview to determine the functions that will meet users needs and requirements. The second investigation conducted the selection criteria of the open source software through the review of literature of open source software technologies and, the design of web-based mapping application was based on first investigation requirement analysis. Finally, the third investigation was conducted with usability experiments of the prototype to evaluate usability and user acceptance of the prototype with the potential users at selected community libraries.

The usability findings and observations provided answers and evidence that web-based open source GIS software can be used for access to spatial information and to publicly report locale problems at informal settlements. The research showed the significance of public spatial information systems built with user involvement process and applicable usability methodologies benefited low-income communities at the informal settlement and lead to high number of system usage.

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Finally, a very special thanks to my friends and all members of my family, for their love and support throughout my study in South Africa.

# Declaration

I

**Jeofrey Ditsela Mr**

**Do hereby declare that this is my own work, and where appropriate. I have acknowledged the work of others to the best of my knowledge.**

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

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## Glossary of Terms and Abbreviations

API	Application Programming Language
CGI	Common Gateway Interface
City Council	City of Cape Town or The City
FAQ	Frequently Asked Questions
FIST	Flexible Internet Spatial Template web mapping interface
FOSS/FLOSS	Free/Libre and Open source Software
FOSS4G2008	Free and Open Source Software for GeoInformatics Conference 2008
GNOME	GNU Object Model Environment
GRASS	Geographic Resources Analysis Support System
HIV/AIDS	Human Immuno-Deficiency Virus/Acquired Immuno Deficiency Virus
HTTP	Hypertext Transfer Protocol
IE	Internet Explorer
KDE	Konqueror Desktop Environment
MS4W	Mapserver on Microsoft Windows
N2 freeway	National Road Number 2 freeway
OSI	Open Source Initiative
OGC	Open Geospatial Consortium
PHP	Hypertext Pre-processor language
QGIS	Quantum GIS
ISIS	Integrated Spatial Information Systems
Site Statistics	Website Statistics
UCT	University of Cape Town
UCT CSIS	University of Cape Town Community Spatial Information System
URL	Uniform Resource Locator
W3C	World Wide Web Consortium
WWW	World Wide Web
WFS	Web Feature Service
WMS	Web Map Service

# **CHAPTER 1**

## **INTRODUCTION**

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# Chapter 1: Introduction

## 1.1 Background

Spatial information is a key component in planning and decision making to improve service delivery in a society. New methods of using web-based interactive mapping are implemented with a specific focus on how communities at informal settlement can participate in the delivery and management of everyday services in their local areas (Kingston, 2007). In the past in South Africa, the availability and use of spatial information has been limited to government and academic institutions, with ordinary members of the public especially at informal settlements not being able to access or make use of such information (Arthur, 2007). The implementation of Promotion of Access to Information Act (PAIA) in 2000 gave effect to the right to have access to any information, which is a right provided for in the Constitution of the Country (Government Gazette No. 20852, 2000).

The Internet is a vast communication network that links millions of computers all over the world. Its integration with GIS allows GIS professionals to solve one of the most important problems inhibiting information utility: How to provide access to information and data without burdening end users with complicated and expensive software (Harish *et al*, 2005). The Internet is increasingly being used to disseminate spatial information. The adoption of the Internet by the public, government institutions and other organisations as a long-term investment technology has placed it in good position for its use as a preferred tool of promoting access to spatial information and as a public reporting tool. Traditional GIS can only serve dedicated users and few users who have the resources, resulting in a limited impact to the public (Carver *et al*, 2001). The combination of both the Internet and GIS makes it more accessible and reachable to wider range of users, planners and decision makers. The use of the Internet to disseminate spatial information will also benefit data providers, as the Internet offers the advantages of interactivity, availability and easy updating (Richard, 2000).

In South Africa, public and private organization are required to provide access to information users manual document as stipulated by section 14 of the PAIA of 2000, the purpose of the manual document is to facilitate easy access, affordable, relevant and understandable information to the public. Geographic Information Systems (GIS) are ideally suited to providing access to spatial information that communities at informal settlements require in their decision making process and for reporting spatial problems so that governments can improve service delivery. Using a combination of open source software, a web-based GIS prototype system to be developed is intended to support interaction between municipality level and community level. The prototype system to be implemented will use the City of Cape Town Smart Cape Access Project (SCAP) which uses open source software and has connected computers at community libraries as a means of providing everyone with access to basic information and communication technologies. The web-based GIS prototype system will be tested for the usability and functionality at six Cape Town informal settlement community libraries being Langa, Guguletu, Nyanga, Crossroads, Phillip East and Delft South.

## ***1.2 Statement of the Problem***

Based on the discussions within the information sector (Appendix E.1, E.2 and E.3) it can be stated that the public in Cape Town has a limited understanding of where to go or who to contact when it comes to submitting requests to access and reports of spatial information to the City Council. With regard to reporting service delivery issues, the procedure of reporting locale problems was a private process between the complainer and the council, this was a draw-back when the problems themselves are public and affected the community.

This challenges seems to be aggregated for populations in the informal settlement sector and it can be assumed that one of the factors contributing to this ignorance is the geographical distance to the relevant City Council departments. None of the public spatial information systems allow the communities at informal settlements to access spatial information and submit spatial datasets over Internet so that they can reach informed decision on developments taking place around their local areas.



## **1.3 Objectives of the Research**

### **1.3.1 Aims**

The aim of this research is to investigate how spatial information can be accessed using alternative procedures and technology means than the manual procedure used by the City Council of Cape Town to give access and it looks to enable online reporting and complaining of public spatial problems like potholes, graffiti and street lightning at the informal settlements.

And finally, this research looks to implementation a user-friendly open source web-based GIS prototype for spatial information access and test the usability and functionality of the system with the potential users at selected community libraries.

### **1.3.2 Specific objectives**

- To investigate the procedure that is used to give access by the City Council and identify user requirements of spatial information access from the communities at the informal settlements. This will enable the research to identify better means give access to spatial information.
- To develop a prototype system with web-based mapping capabilities to be used by low-income communities.
- To provide dynamic and interactive user interface that can be easily used by communities at informal settlements.
- To permit dynamic link between geo-databases and maps so that data updates are automatically reflected on maps and to permit interactive queries of information contained within the map.
- To provide statistics of the prototype system activities to the users.
- To evaluate usability and user acceptance of the prototype with the potential users at selected community libraries.

## **1.4 Research Questions**

The research question considers the possibility of using a web-based GIS prototype system as proof of concept for access to information and enable reporting of locale problems for

communities at informal settlements. The following initial question arises from undertaking this research is:

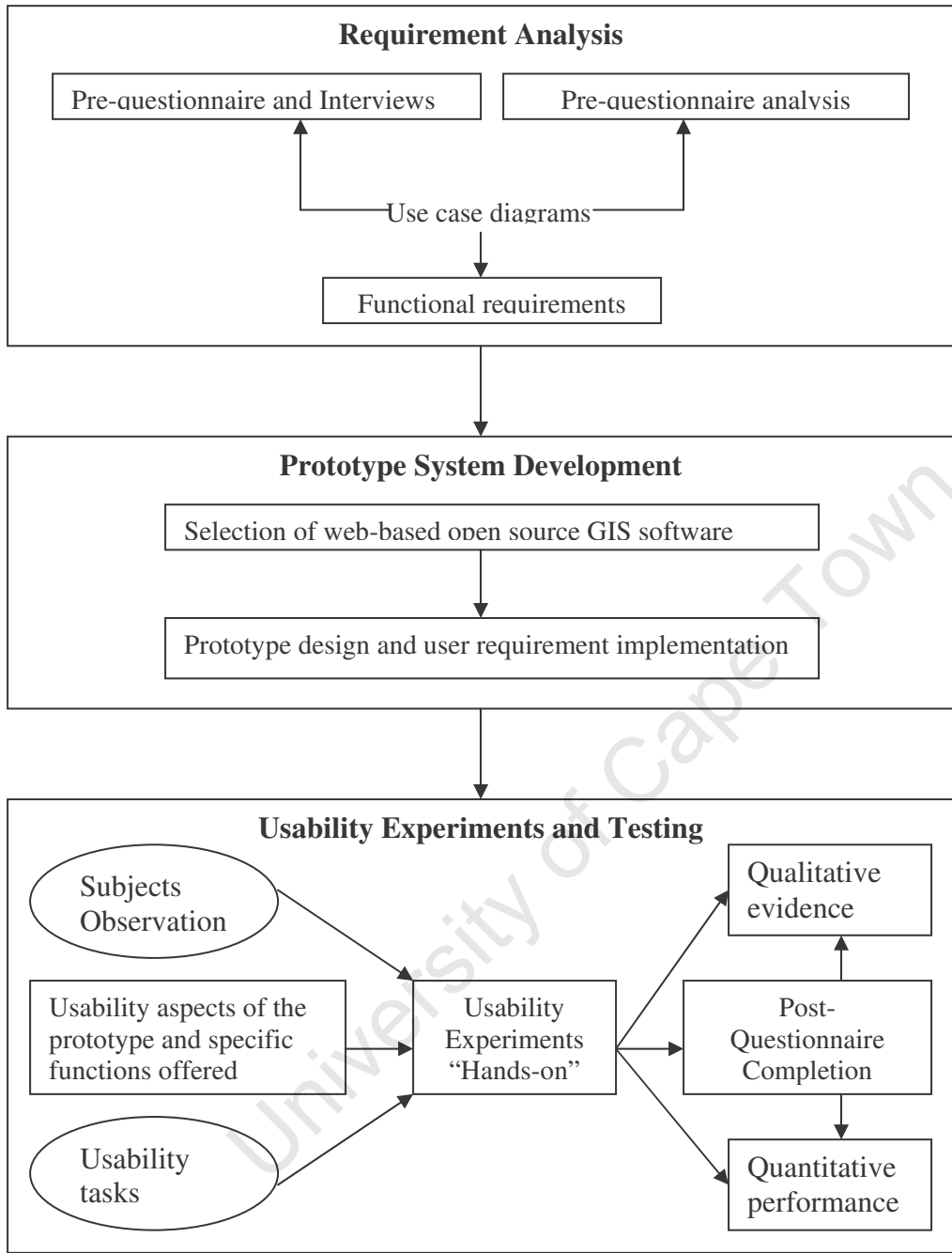
*Can web-based open source GIS application be used to access spatial information and report locale problems at informal settlements? Can it be accepted by communities living in the informal settlements?*

### **1.5 Hypothesis**

Public spatial information systems are convenient solutions and are easy used by communities at informal settlements to report a locale area problem and submit requests to access spatial information. Providing effective communication facilities would increase the degree to which the communities and municipal authorities work together, which in turn improve service delivery, social awareness of individual participants and hence improve participation process.

### **1.6 Proposed Methodology and Approach**

For this study, the proposed methodology was adopted from Zhao (2007) research project of “An empirical usability evaluation of a web-based public participation geographic information system and discussion forum”. Similar to Tang (2006) implementation of *GeoDF* prototype as a “proof of concepts”, the methodology incorporated requirements analysis from the potential users of the prototype. HCI principles and usability evaluations techniques from usability engineering literature, as well as recommendations from experienced HCI researchers at the Institute for Information Technology (IIT) of the National Research Canada (NRC) were also incorporated. Figure 1 shows the approach adopted to achieve the objectives.



**Figure 1: Research Methodology (adopted from Zhao, 2007)**

The following approach was adopted to achieve the research objectives, three investigations were performed to fulfill the purpose of the project. The first investigation was conducted with pre-questionnaire survey at the community libraries. The second investigation was conducted through the review of literature of open source software technologies and the design of web-based mapping application was based on the first investigation requirement analysis of the pre-

questionnaire survey and interviews. Finally, the third investigation was conducted with usability experiments of the prototype system at the community libraries. The investigations are outlined below:

### **Investigation 1: Requirements Analysis**

In order to design the prototype system as a “real world” application, the author first needed to determine the functions that will meet users needs and requirements. The pre-questionnaire was designed to inquire about potential users general computer knowledge, its popular usage, familiarity with maps, how often potential users visited the library and general knowledge about PAIA Act. The questions were structured qualitatively and quantitatively to provide basic information for any statistical inferences and towards the implementation of the key components and functions of the prototype system.

#### *Sampling and Data Collection*

The pre-questionnaire survey was completed by 48 participants from 6 different community libraries and they were randomly requested to participate as they walked into the library. Interviews with former City Council Access to Information officer and the current office holder were conducted. The objectives of both the interviews and pre-questionnaire survey were to identify user requirements of the tool to be developed through the use case diagrams and finally draw functional requirements. The interviews also outlined current procedures used for information access requests and guided the prototype development phase.

### **Investigation 2: Prototype System Development**

The selection criteria of the open source software for deploying spatial websites was based on pre-defined criteria defined by Erika Harper (2006) conceptual framework which describes the components of an ideal web-based GIS software solution and other literature reviews.

With regard to the design and implementation of the prototype system, the design of the prototype was based on requirement analysis and the background of the potential users. The approach of developing the prototype system was based on structured system development methodology using best practice method of System Development Life Cycle (SDLC). The

prototype development phase was based on the combination of the available open source components or software instead building a new system.

### **Investigation 3: Usability Experiments and Testing**

The method chosen for investigating usability is similar to Sidlar and Rinner (2006; 2007) combination criteria of usability evaluation techniques through the post questionnaire and post-interview. The prototype usability investigation needed to be considered on two levels, the general aspects of the tool (prototype system) and the specific functions offered.

#### *Sampling and Data Collection*

The post-questionnaire survey was completed by 43 participants for the user satisfactions rating on the Likert Scale. The post-interview for Access to Information Officer was to demonstrate the prototype system to determine whether the information published was accurate and to obtain view points of using web-based GIS to give access.

The usability experiments investigated whether the prototype system was usable and accepted by communities living at the informal settlements to enhance access to spatial information and report locale problems.

### **1.7 Scope**

The scope of the research is limited to the lower-income communities in Cape Town informal settlement areas. The investigations will guide the development of web-based GIS prototype system to be used at the City of Cape Town Smart Cape Access Project at selected community libraries being Langa, Guguletu, Nyanga, Crossroads, Phillip East and Delft South.

The system will be tested at community libraries for usability and functional evaluation by potential users as well as using their input for further research purposes.

The source code of the prototype system is subject to be released to version 2 of the GNU General Public Licence and is also available through the world-wide-web at <http://www.gnu.org/copyleft/gpl.html>.

The thesis is concerned with demonstrating an alternative solution to enhance access to information and report locale problems between communities and the City Council as a feasibility study, it does not incorporate the operations of the City Council and the prototype was not linked to any of the City Council systems or databases but it used the information acquired from the interviews as guidelines for the prototype development and for future research.

### **1.8 Format of Research**

The format of the project is an applied research conducted to investigate access to spatial information and enables online reporting and complaining of public spatial problems by using open source web-based GIS prototype at the communities on peri-urban areas of Cape Town.

### **1.9 Research Structure**

The research is addressed within the following structure:

Chapter 1 introduces the topic of the research followed by the problem statement. It also outlines the objectives of the study and illustrates the detailed approach of research methodology to be used to solve the research questions.

Chapter 2 provided the literature review of public access and accessibility of public spatial information systems. The chapter also discusses issues related to the public spatial information systems and how to address them. It also reviews the relationship between access to information and public participation. The chapter outlines the steps that the City Council uses to give access and it illustrate examples of the existing web-based GIS that enable the public to send access to information requests and submit spatial reports of their concern around their local areas through a participatory process.

Chapter 3 discusses the methodology approach of the research. It details the research framework of the investigation path of the prototype system, the data collection methods applied and the description of the research instruments utilized. It also shows the map of six targeted community libraries of the informal settlements areas of the potential users of the prototype system.

Chapter 4 discusses requirement engineering process of the first investigation and illustrates use case diagrams and its narratives from requirement analysis.

Chapter 5 discusses the techniques used for the implementation the prototype system as a result of the requirement analysis process. The system architecture for the prototype is proposed and outlines how interoperable system components will best utilize existing resources and to obtain maximum performance.

Chapter 6 presents the usability experiments design of this research to test the usability and functionality of the system with the potential users at selected community. The chapter also discusses the usability evaluation methodologies and the reason of choosing the methodology of the prototype test.

Chapter 7 presents the qualitative and quantitative analysis of results based on the information collected during the usability experiment and interviews.

Chapter 8 documents the conclusions, lesson learnt and recommendations of future research studies.

# **CHAPTER 2**

## **LITERATURE REVIEW**

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## **Chapter 2: Literature Review**

### ***2.1 Introduction***

In this chapter, the review of public access and accessibility of public spatial information systems literature is discussed. The issues related to the public spatial information systems and addressing public access is also discussed. The chapter explored the relationship between access and participatory process that can be useful at the informal settlements and looks to answer part of the main question of the study. The chapter also outlined the procedure used by the City Council to give access to the public, it discussed the South African open source adoption policy, open source projects across the country, and SCAP case study. Lastly, the existing web-based GIS examples of public spatial information systems are also discussed.

### ***2.2 Overview of Public Spatial Information Systems***

Accessibility and access to spatial information has to be seen in the broader context of access to electronic information by the public, non profit/profit organizations, and government institutions. Most spatial information is digitized and stored in computer systems, GIS technology is widely used to disseminate such information. Based on the growing demand for public access to this information, there is subsequently a growing need for public accessible web-based GIS applications. In 1998, the convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters was signed by the members of the United Nations Economic Commission for Europe (UN/ECE) to promote access as a means to improve public participation in environmental decision making and awareness of environmental issues (UN/ECE, 1998).

Haklay (2001) discussed the conceptual framework that seems to underlie the current practice in public access to spatial information. The framework is based on six assertions (A-F) taken from

the literature and the history of environmental/spatial information and public access. The set of six assertions are:

- (A) Sound knowledge, reliable information and accurate data are vital for good environmental decision making.
- (B) Within the framework of sustainable development, all stakeholders should take part in the decision making processes. A direct result of this is a call for improved public participation in environmental decision making.
- (C) Spatial information is exceptionally well suited to GIS (and vice versa). GIS development is closely related to developments in environmental research, and GIS output is considered to be highly advantageous in understanding and interpreting spatial data.
- (D) (Based on A and B) To achieve public participation in environmental decision making, the public must gain access to spatial information, data and knowledge.
- (E) (Based on A and C) GIS use and output is essential for good environmental decision making.
- (F) (Based on all others) Public Spatial Information Systems should be based on GIS technologies and user requirements. Such systems are vital for public participation in environmental decision making (Haklay, 2001).

Haklay (2001) emphasise that it is important that each of these, especially the first three basic assertions be viewed within a wider social and institutional context. Assertion A relates to a growing demand for accountability from the public institutions and calls for evidence and criteria-based decision making. Assertion B should be considered within the wider framework of participation in decision making (PGIS), which lead to sustainable development. As for Assertion C, the Author explains that it is important to note that within the practice of spatial information production by environmental scientists and professionals, GIS is not used in alone. However, GIS is the main technology within spatial information systems.

Assertion D is arguably the basis for access to spatial information and it might be the rationale why governments formed Promotion to Access to Information (South Africa, 2000), or Freedom to Information Act (Europe, 1997). The PAIA Act, section 14 of the manual document facilitates

easy access of information to the citizens of South Africa for information held by the state, and by private bodies. The publication of the User Manual document is in line with the Batho-Pele (means Putting People First) principles that articulate the importance of transparency and accountability by the public service to the clients it serves. The Batho-Pele principles three and five provide for the public to have equal access to the services, and the provision of accurate information about the services to which the public are entitled to receive.

The foundations of assertion E are more secure. The increased use of GIS in recent years must be attributed, at least partially to its use as a decision-support tool (Haklay, 2001). Finally, the last assertion is based on all other assertions. It looks at Public Spatial Information Systems (PSIS) that are based on the user requirements and the needs of the public. The assertion F focus on the user requirements implementation, there seems to be a major lack of research on PSIS with regard to usefulness, requirements analysis which is not performed more often by spatial information systems researchers.

### ***2.3 Issues of Public Spatial Information Systems***

Public spatial information systems (PSIS) are built differently from any other spatial information system (SIS). The SIS is designed and built to be used by people who are professionals. In most cases, the designs of the interface are conceived in the same way in which professional documents are published, without customization (Haklay, 2001). The PSIS has empowerment as part of their mission, it makes an effort not only to help people accomplish existing tasks but also build capacity (Rattray, 2006). With regards to this research, people who struggle most to get access to spatial information are the disadvantaged communities or communities at informal settlements. The key challenge is how to develop public spatial information systems that will be easily used by non-professional people at informal settlements. This led Haklay (2001) to suggest that public spatial information systems need special attention from inception to testing phase. They need to be implemented specifically for non-educated users and take into account their needs and user requirements.

The map manipulation functions for the SIS can not be assumed to be same as PSIS, the spatial information system makes assumptions as they are designed in a professional setting. More often, the function tools implemented on the web mapping interface are within assumptions that they share a scientific worldview to other spatially aware professionals and ideally, the professionals are expected to know how to use them, evaluate the quality of the information and how to access it (Haklay, 2001). In contrast to that, the conceptual framework and cognitive thinking of each user of the PSIS is different and it depends on what the user want to perform on the system. In addition to that, the level of knowledge and scientific belief is not known hence designers make mistakes by choosing systems solution that will not benefit anyone (Raskin, 2000). Usability experts have observed that most system users do not often utilize the help function, trial and error is not an option to consider for PSIS users. The situation can be rectified by employing current knowledge in various fields so that it guides development of public spatial information systems (Haklay, 2001). The use of lesson learnt from Human Computer Interaction (HCI), usability engineering process, the development of different views for different users and public understanding of the science studies might help to develop usable systems.

The problem of access to the internet to communities could possibly be solved by providing access terminals in public places such as libraries, schools and community centres. Thompson (2006) of Thompson Research Services compiled a Directory of Free Public Internet Access Points in the Western Cape, an initiative of City of Cape Town Cape Gateway Resources to promote access to the Internet and enhance e-government information and services. During recent years, the City of Cape Town Government has embarked on a number of ICT-related programmes designed to improve its own internal process and increase the availability of ICT to citizens and businesses in the areas it serves, notably: the Smart City Strategy, Smart Cape Access Project, the Ukuntinga ERP project, Business Support Services, Library Business Corner Initiative and others (Bridges.org, 2002). Bridges.org's Real Access/ Real Impact framework (Appendix A) conducted meetings with communities and different organisations to address the status of real access in Cape Town.

## ***2.4 Addressing public access issues***

Onsrud's (2001) summary of proposals to National Science Foundation (NSF) at the meeting of the European Science Foundation/National Science Foundation (ESF/NSF) Workshop on Access to Geographic Information discovered three major strands in addressing issues of "access". The first relates to the role of government at all levels in conceptualizing and implementing access to information. This includes regulatory frameworks such as the Freedom of Information Act (Europe, 1997) or Promotion to Access to Information Act (South Africa, 2000), definition of different structures of information available to users and the development of the infrastructure.

The second strand focuses on access as a basis of wealth and power in a society and addresses societal issues such as equity, ownership and control. Onsrud (2001) emphasise that those active in this research domain argue that the foundation of legal rights of citizens and scientists to access information are being undermined as we move into networked digital data environment. Societal behaviour is the main factor influencing accessibility of information (Craglia, 2002). These societal issues will be further discussed with respect to the Public Participation process which is facilitated by access to spatial information.

Finally, Onsrud's (2001) third strand looks at the impact of increased accessibility to information in respect of the evolving relationship between physical, social and information space. Access to physical space can be replaced or complemented by access to virtual space in which traditional notions of distance, nearness and spatial interaction lose meaning or at least, must be reassessed.

## ***2.5 Public Participation using GIS***

An increase in access will essentially provide exciting opportunities for increasing personal access to virtual and physical resources that are provided by the Internet and enable broader participation in geo-information driven decision making and planning. Geographic information technologies in particular are alternatively seen as "tools" with the potential for empowering communities or "social practices" that advantage some people and organisations while marginalising others (Craglia et al, 2000). To overcome the critique towards GIS, the theory of

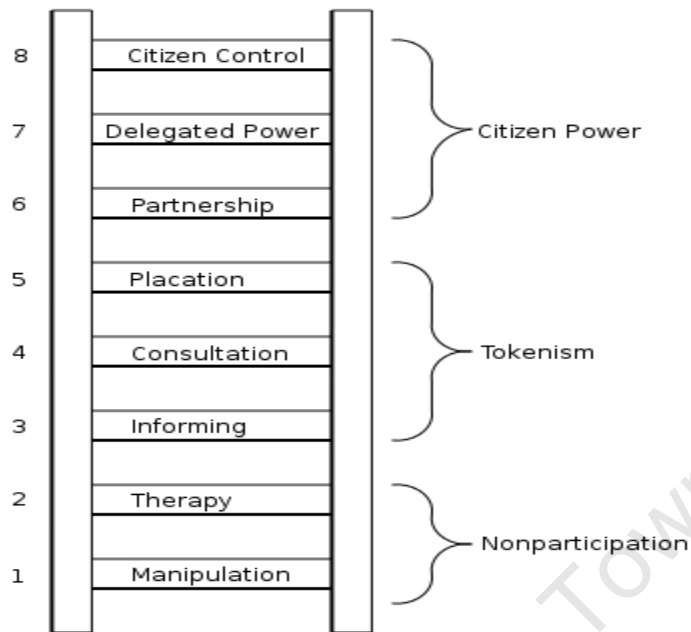
public participation in planning using GIS or more familiar participatory GIS (P-GIS) has emerged as the answer.

Variously labelled as, *inter alia*, participatory GIS (PGIS), Public Participation GIS (PPGIS), and Community integrated GIS, these newer approaches are context and issue-driven rather than technology-led and seek to emphasises community involvement in the production and/or use of geographical information (Dunn, 2007). Sieber (2006) reveal that the term P-GIS originated at the meetings of the National Centre for Geographic Information and Analysing (NCGIA) as attendees struggle to frame the next generation of GIS, or GIS/2 that would ground technical advancements in social and political contexts. This research will utilise PGIS to involve the communities at the informal settlements.

## **2.6 Public Participation Ladder**

“Can good public decisions over issues of broad public concern be made without public involvement? Not if the process is as vital as the result” Onsrud (1998). Proper democratic decision processes take advantage of the concerns and insights of the affected public who are willing and interested in contributing to the public decision-making processes (Onsrud, 1998).

Apart from the vital issue of availability of information, public participation depends also on the interest to be involved and if involved, to what extend people will be involved. Arnstein (1969) claims that citizen involvement in planning represents a redistribution of power from managers to the public. Arnstein developed a ladder of citizen participation (Figure 2). The bottom rungs symbolize no participation at all and the top rungs represent full public control in the decisions made. Arnstein divides the eight levels into three classifications: non-participation, degrees of Tokenism and degrees of Citizen Power. Each ladder represents a level of public decision making.



**Figure 2 : Eight rungs on the ladder of citizen participation (Arnstein, 1969)**

In 1993, Weideman and Femers adjusted Arnstein’s participation ladder based on the rights provided to the citizens. According to Weideman and Femer’s description, public participation increases with the level of access to information as well as the rights the citizens have in the decision making (Sadagopan, 2000). The bottom two rungs of the public participation ladder illustrated in (Figure 3) “the public to know” and “informing the public” reflects a common understanding of access as a form of participation. The bottom of the red line on the ladder provide a foundation of this research web-based GIS prototype implementation while the top guide us towards research test cases and analysis.

- i. Public right to know (*Promotion of Access to Information Act, 2000*).
- ii. Informing the Public (*Public access terminals, i.e. Creating awareness about access to information act to the public*).
- iii. Public right to object (*The ability for the communities to reach informed decision on the given problem, submit this decision directly to City of Cape Town authorities responsible*

for implementing them, and finally, see the results and gain feedback as to the reasons for the final choice)

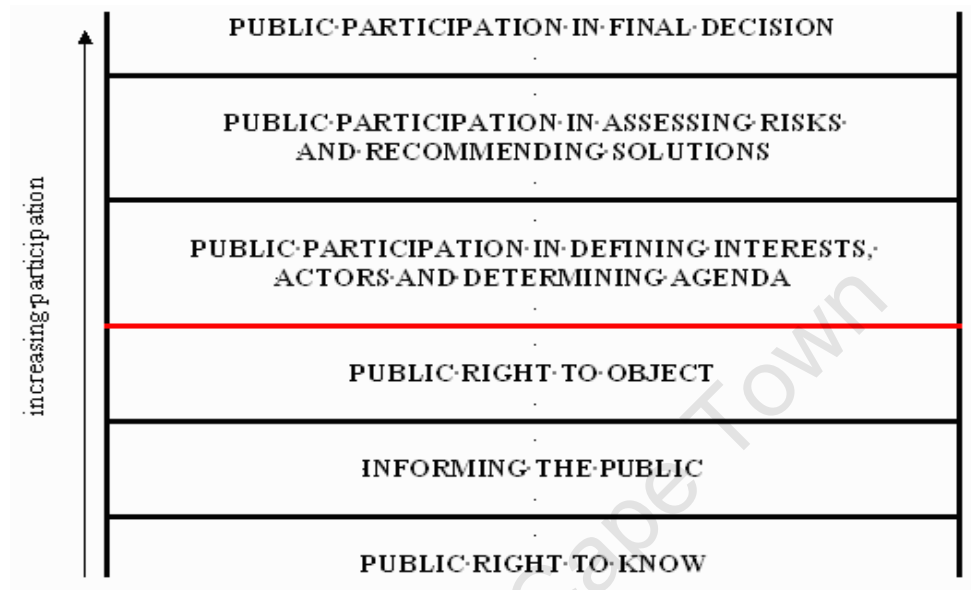


Figure 3 : The Public Participation Ladder (Weidemann and Femers, 1993)

To summarise Weidemann and Femers theoretical approach, public participation increases as the government grants citizens rights at the top of the ladder. The top level of the ladder can be reached only by fulfilling the requirement of the bottom steps in the ladder.

### ***2.7 Relationships between Access to Information and Public Participation.***

From the above two ladders described in the previous section, access be can easily defined based on decision-making processes. This will make access and participation to correspond to each other, but cannot be practically distinguished (Tulloch at el, 2003). Tulloch suggests that public access and participation be treated as occasionally overlapping, often related, but different. With this regard, Tulloch further states that the two concepts should narrowly be used to describe the degrees to which data users might use it or acquire public data from a variety of public and private sources. The author treats access and participation as distinct concepts within the context



of public GIS and offer a new concepts “ladder of data access”, as illustrated by Figure 4, it compliment the more established “ladder of public participation”. The ladder of data access was constructed from responses of the nationwide United States Federal Geographic Data Committee (FGDC) Framework Data Survey and which was detailed by Tulloch and Robinson (2000).

Advertise Data in a Clearinghouse or Catalog (9%)
Allow Unrestricted Redistribution (30%)
Policy on Data Dissemination (40%)
<b>“Casual” Access</b>
Participate in a Coordinating Council (42%)
Allow Redistribution (restricted or not) (75%)
Practice Data Sharing (88%)

Figure 4 : The ladder of public access as constructed from responses to the FGDC Framework Data Survey. Each rung of the ladder is labelled with the percentage of local governments reported to be engaged in the different levels of access (Tulloch 2001).

The FGDC Framework Data Survey asked data producers questions about several different ways in which they allow access to data (Tulloch and Fuld, 2001). The responses indicated a progression spectrum of access activities. Tulloch analysis revealed that the vast majority of producers allowed data sharing, very few producers actively advertised their data in data clearinghouses, catalogs and GIS web-based portal. The top three rungs of the ladder often require minimal effort on the part of the data producer and they were grouped as “casual” access practices while the bottom three rungs demonstrated a greater commitment to access, since they are perceived to require more work and can involve additional exposure (Tulloch and Shapiro, 2003).

Relationships between Access to Information and Public Participation are part of the same field. There is an understanding that access is a key prerequisite to participation, with the general assumption that GIS use will be unsuccessful when access and participation are denied and will be successful when they are both present at high level (Tulloch and Shapiro, 2003). Onsrud (1998) state that further research is needed on the role of government in the information society, with regard to access to information. This needs to involve an idea of participation in this process and what underlying expectations the actors have.

## ***2.8 Access to Information held by the City of Cape Town***

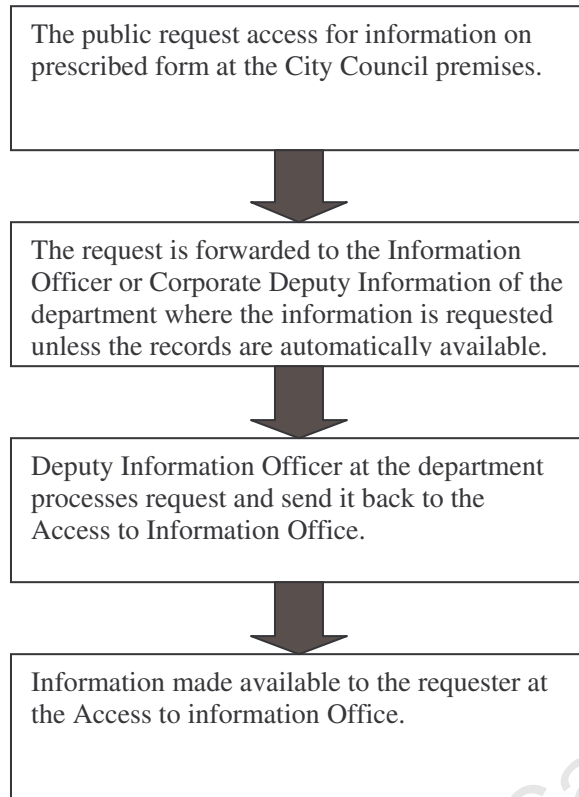
The City of Cape Town gives access to its information with the guidance of section 10 of the Act<sup>1</sup>, the Act is in terms of bill of rights and the Access to information is a basic right to public. The City of Cape Town section 14 (Appendix B) manual document states that South African Human Rights Commission (SAHRC) is responsible of compiling a guide containing such information as it may reasonably be required by a person who wishes to exercise any right contemplated in the Act.

Having interviewed City of Cape Town Information Officers (Appendix C.2 and C.3), Persona A<sup>2</sup> who previously worked at the Access to Information Office indicated that there are certain documents that are freely, voluntarily, and automatically available to the members of the public without a person having to request access in terms of the Act or the process of the requesting access to information without being followed, but where appropriate, remain subject to be reviewed by the Information Officer in terms of section 15 (4) of the Act. Figure 5 shows the flow chart of formal request for access to information held by the City of Cape Town.

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<sup>1</sup> Act means Promotion of Access to Information Act (2000)

<sup>2</sup> Pseudonyms Persona A,B ...Z will be used to identify City of Cape Town Information Officers as per an agreement that was signed by the Author and the City of Cape Town



**Figure 5 : Formal request for access to information held by the City Council (City of Cape Town Section 14 Manual, 2006)**

In summary of the flow chart, the request must be made in writing on the prescribed form and be forwarded to the Information Officer or the Corporate Deputy Information Officer at the Access to Information Office premises and the application has to be accompanied by the prescribed request fee of R35. Usually, two types of fees are required to be paid, namely requester fee and the access fee. A requester, who seeks access to a record/information containing personal information about that requester, is not required to pay the request fee. Every requester must pay the relevant request fee (City of Cape Town Section 14 Manual, 2006). Information Officer/Deputy Information Officer will take a duration of thirty (30) days to process the request unless the period has been extended hence the requester will be notified on every step of the process (City of Cape Town Section 14 Manual, 2006).

## **2.9 Open Source Software**

Open source software is software for which the human-readable source code is made available to the user of the software, who can then modify the code in order to fit the software to the users needs. The source code is the set of written instructions that define a program in its original form, and when it's made fully accessible, programmers can read it, modify it, and redistribute it, thereby improving and adapting the software. In this manner the software evolves at a rate unmatched by traditional proprietary software. The definition provided by the Open Source Initiative (OSI)<sup>3</sup> contains the following rights and obligations:

- No royalty or other fee imposed upon redistribution,
- Availability of the source code,
- Right to create modifications and derivative works,
- May require modified versions to be distributed as the original version plus patches,
- No discrimination against persons or groups,
- No discrimination against fields of endeavour,
- All rights granted must flow through to and with redistributed versions,
- The license applies to the program as a whole and each of its components,
- The license must not restrict other software, thus permitting the distribution of open source and closed source software together.

The National Advisory Council on Innovation's Open Source Working Group (NACI) has adopted the acronym FLOSS, referring to Free/Libre and Open source Software or the equivalent meaning term FOSS that refers to Free and Open Source Software. For the past few years free/open source software has been gaining momentum. It is now unsettling the large proprietary software corporations as they finding themselves competing against commercially available open source software.

## **2.10 Open Source software in South African society**

In 2002 and 2003, The South Africa cabinet noted and adopted policy recommendations from the Government IT Officer's Council (GITOC) pertaining to Free/Libre and Open Source Software

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<sup>3</sup> The Open Source Initiative is a non-profit corporation dedicated to managing and promoting the Open Source Definition for the good of the community.

(FOSS). In putting forth these policies, the issues of technical performance, capability, security, cost and others pertaining to the selection, implementation, support and enhancement of FOSS IT systems were addressed, and it was predominantly on the basis of these direct cost/performance issues that policies supportive of FOSS were adopted (Department of Public Service & Administration, 2006). The South African government has recently formulated an open source software policy document. The document is available at <http://www.oss.gov.za>. The policy enforces the use of software that complies with open standards, it also suggests that government should investigate open source software before considering proprietary solutions.

In April 1999, the South African government established the State Information Technology Agency (SITA) in accordance of section 3 of the Act of the Parliament, Act No 88 of 1998. SITA was born from the merger between Infoplan (IT organisation of Department of Defence or DoD), IT Division of South African Police Service (SAPS); and Central Computer Services (CCS) Division of Department of State Expenditure. SITA general mandate is to

- improve service delivery to the public through the provision of information technology, information systems and related services in a maintained information systems security environment to departments and public bodies; and,
- To promote the efficiencies of departments and public bodies through the use of information technology.

SITA drives government open source software recent policy through the following criteria:

Choose FOSS:

Implement FOSS unless proprietary software is demonstrated to be significantly superior.

Migrate to FOSS:

Migrate current proprietary software to FOSS whenever comparable software exists.

Develop in FOSS:

All new software developed for or by the South African Government will be based on open standards, adherent to FOSS principles, and licensed using a FOSS license where possible.

Use FOSS/Open Content licensing:

Ensure all Government content and is made Open Content.

Promote FOSS in South Africa:

Encourage the use of Open Content and Open Standards within South Africa.

### ***2.11 Open Source software Projects in South Africa***

The true value of open source software is being felt through projects across the country where OSS is being used to roll out affordable community access points, build new business initiatives and develop Information Technology (IT) literacy skills.

In schools across the country, students are getting hands on OSS through projects run by organisations such as the Shuttleworth Foundation tuXlabs project, Netday's computer laboratories programme and DireqLearn. tuXlabs volunteers and teachers come together and install second hand refurbished personal computers (PC) with open source Linux Operating System. The advantage of Linux Operating System is that there are no associated licensing costs; eliminate the need for costly and renewable licence fees which would be a significant stumbling block for disadvantaged schools to have technology access (go-opensource.org, 2005).

Open source software has also impacted profoundly on public health care. The use of OSS in public health is an established practice in South Africa by few non-profit organisations. It is a useful monitoring tool to improve the timeliness, quality, access and use of Health Management information. The web and mobile enabled OSS GIS facilitate decision making at the strategic, tactical, and operational levels, support for performance of administrative operations, and serve as a gateway for decision-makers and general users to access the system conveniently and effectively. One of the organisation which does that is Cell-Life, Cell-Life is a non-profit organisation, it merges mobile phone technology with the Internet and Database systems, it has developed a range of systems to support the management of HIV/AIDS treatment. In addition to the cell phone solution, a simple but effective ARV drug supply chain management system has been developed (iDART, or Intelligent Dispensing of ARV treatment). Open Source GIS is one

of the current innovative areas of development they are focusing on. They look to expand the existing database to incorporate spatial information about patients, and regional resources. Collectively, this information will form a powerful spatial GIS database that allows further research, analysis of information and more efficient support within affected communities (Cell-Life, 2006).

Transalate.org.za is a non-profit organization which has over last couple of years translated open source software into local languages such as OpenOffice.org in Zulu, Northern Sotho and Afrikaans, and Mozilla Firefox in Xhosa, Zulu, Sotho, Northern Sotho and Afrikaans. The organization says that translation intervenes wherever computers fail their users, for their latest innovative project, they have created fonts for Venda and a South African keyboard on top of our localisations of GNOME, KDE, OpenOffice.org, Firefox and Thunderbird. Community users who are learning computers for the first time, however, benefit of being able to interact with the PC in their home language (go-opensource.org, 2005).

### **2.11.1 Case Study: Smart Cape Access Project**

In 2002, the City of Cape Town launched the Smart Cape Access Project as a pilot project at six libraries: Wesfleur, Brooklyn, Delft, Grassy Park, Guguletu and Lwandle with the objective of giving everyone access to basic information and communication technologies (Smart Cape Access Project, 2003). It involved provision of computers with free internet at the disadvantaged community libraries. The Smart Cape access workstations use a Linux-based operating system as opposed to proprietary software.

The Smart Cape project's three primary goals are:

- To provide free public access to computers and the Internet;
- To prove that open source software is affordable, appropriate technology for a public service digital divide initiative;
- To increase opportunities for members of disadvantaged communities.

**a****b**

**Figure 6 : (a) Smart Cape Access Truck – a pilot project designed to bring connectivity to those marginalized areas that do not currently have Internet access. (b) Smart Cape workstations at the community libraries provide free public access to computer usage and internet.**

Figure 6 (a) shows a Smart Cape Access Truck, a mobile unit that is first of its kind in the City to give access to basic computing infrastructure and the internet. The truck operates on a rotating basis across where Internet infrastructure is not connected, providing wireless connectivity and also present various needed services to the communities that are beyond the reach of infrastructure. Connectivity is being sponsored by Vodacom South Africa, a cellular network company. Figure 6 (b) shows community libraries users using computers for a variety of tasks. According to the Manager of E-Governance for the City of Cape Town, people use the facilities not just to surf the web but they also prepare curriculum vitae (CV), find employment, improve business practices, do research for school project and other computer literacy things. All users are given a “@smartcape.org.za” email address and with the same smart cape login details, they can access Internet at any community library.



## **2.12 Existing Web-based GIS examples of Public Spatial Information Systems**

### **2.12.1 “Planning for Real”, an exercise at the local community in village Slaithwaite (European Case Study)**

In 1998, Colne Valley Trust (CVT) organized a process of involving local people more closely in local environmental planning problems through active participation and decision making. The public spatial information system was developed explicitly for non-professionals. Kirklees Metropolitan Council's (KMC) Environment Unit were consulted to help identify the planning for real (PFR) exercise as an ideal opportunity to compare traditional methods of public participation in environmental decision making with new techniques being developed in the research project at the University of Leeds.

The study conducted usability experiments by using the web-based decision making prototype system. This experiment was used to collect citizen's ideas and comments on the development of the 3-D Slaithwaite village model. The community was given the opportunity to show their ideas by placing comments on flags in certain locations of the 3-D model (Figure 7) of the village (Evans *et al*, 1999). The analysis of user response and evaluation of the decision making process contributed to the new theory in participatory environmental decision making. The 3-D model was converted in 2-D model (Figure 8) which can be browser from the internet and the map viewer has zoom, pan and full view functions to be used to navigate the village map area. The application was developed using open source software such as Geotools and Netscape Navigator. Geo tools is a Java map application and the map applet was browsed in Netscape Navigator (nowadays knows as Mozilla Firefox).



Figure 7: Slaithwaite 3-D models of the village

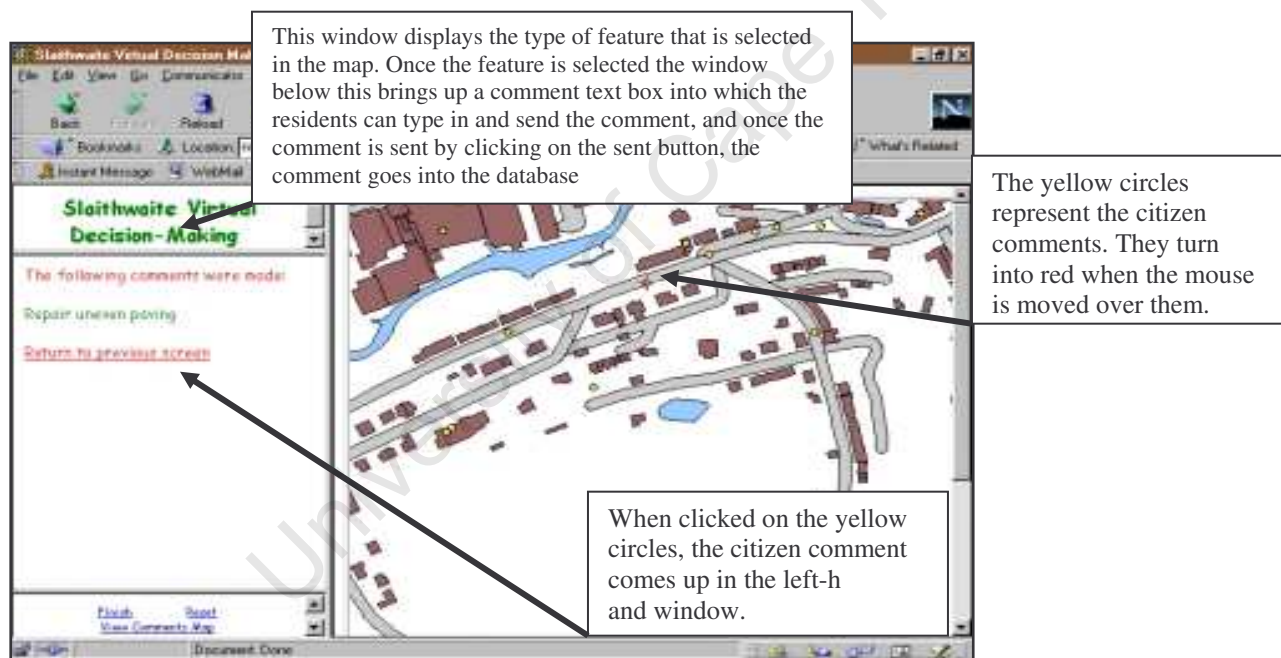


Figure 8: Slaithwaite 2-D model of the village named Virtual Slaithwaite (Sadagopan, 2000).

<http://www.ccg.leeds.ac.uk/slaithwaite/>

### **2.12.2 *mySociety.org*, citizens online democracy website (UK)**

Mysociety was founded in September 2003 and is a non-profit organization based on a charity donations, it also involves community of volunteers and (paid) open source developers. Its formation started from a widely shared thoughts and concerns about the problems facing democracy, government and technology in the UK. My society develops a couple of projects that includes web-based GIS solutions to make the communication with the public easier through navigation of maps and the usage of postal code, it also gives the ability to communicate with the local government via the Internet.

Mysociety first mission is to be a charitable project which builds websites that give people simple, tangible benefits in the civic and community aspects of their lives. The second is to teach the public and voluntary sectors, through demonstration, how to use the internet most efficiently to improve lives. The organization runs most of the best-known democracy and transparency websites in the UK, websites like WriteToThem.com, FixMyStreet.com, WhatTheyKnow.com, PledgeBank.com, HearFromYourMP.com, GroupsNearYou.com and Travel maps. Discussing the first three projects that are of interest to this study,

- WriteToThem.com is the award winning successor to FaxYourMP.com. It is the only website in the UK at which a UK citizen can identify and contact any of their elected representatives, no matter they are local councillors or Members of Parliament.
- FixMyStreet.com enables reporting and complaining of spatial problems like broken paving slabs, street lighting and other public spatial problems. The previous procedure was a private process between complainer and council, this was a drawback when the problems themselves are public, and affected many people.
- WhatDoTheyKnow.com is a Freedom of Information site that helps the public to make Freedom of Information requests and its an archive of requests and responses made by other people, so you can search for information other people have found, or even set up email or RSS alerts to get notified when request that you are interested in

are posted. WhatTheyKnow.com has been built to help the public to get information out of government departments and agencies.

Each project website use open source software. The software code is downloaded from the CVS repository with its server configurations. Figure 9 shows mySociety.org website and three listed projects that were discussed.



Figure 9: Mysociety.org online democracy website. (<http://www.mysociety.org>)

## **2.13 Conclusion**

The literature that was discussed in this chapter gave a brief background on the development of prototype system that can be used to give public access and it helped to identify the important issues of giving public access that need to be considered during the research life.

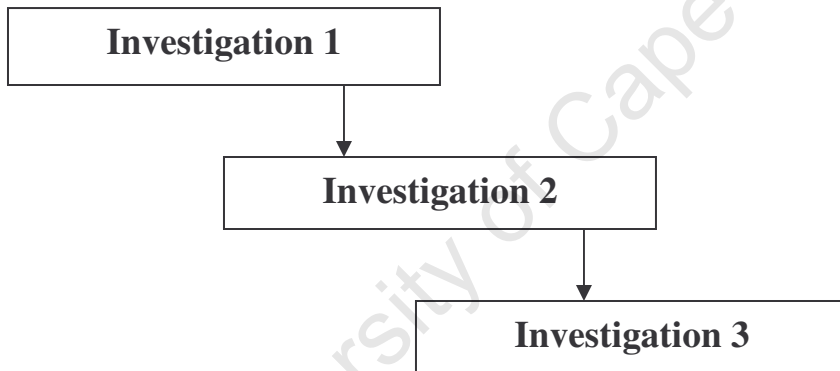
The chapter also showed the existing examples of web-based GIS public spatial information systems that involved public involvement to help communication with the public to be easier to their local government/municipalities via the Internet so that they can report issues of concern and make access to information requests. This examples answered part of the main question “*Can web-based open source GIS software be used to access spatial information at informal settlements?*”. The literature in this chapter also helped the research to set the scope and direction for the questions of the pre-questionnaire survey that was conducted as a first step of the investigation to elicit user requirements in order to develop an easy and usable prototype.

In a similar manner, this research is guided by the conceptual framework assertions and is implementing a prototype system that will help communities residing at informal settlements to access information from the City Council rather using the manual procedure. The methodology approach of the research is discussed in the next chapter. The research framework investigations are conducted from Chapter 4 consecutively.

# CHAPTER 3

## RESEARCH METHODOLOGY

Investigation steps to be undertaken by this research.



## **Chapter 3: Research Method**

### ***3.1 Introduction***

This chapter provides a description of the research investigations and data collection methods applied, description of the research instruments as well as the rationale behind the use of it. The key goal of the chapter however, is to explain and clarify the research path that this study takes.

### ***3.2 Research Methodology***

#### **3.2.1 Purpose of the research**

The purpose of this project is to assess if there is a possibility of using a prototype for access to spatial information to the communities. It should be easy to learn, use and affordable by using free web-based open source GIS technology. The only way to provide the communities with that GIS technology solution is to deliver it in the form of a regular website that can be accessed from virtually any computer over any Internet connection, even the slowest dial-up connection.

#### **3.2.2 Research Framework**

Three investigations are conducted in order to fulfill the purpose of the research. The investigations was primarily conducted with pre-questionnaire, then prototype development and finally testing the usability of prototype with potential users. Figure 10 outlines the path of the investigations that was performed during the course of the research.

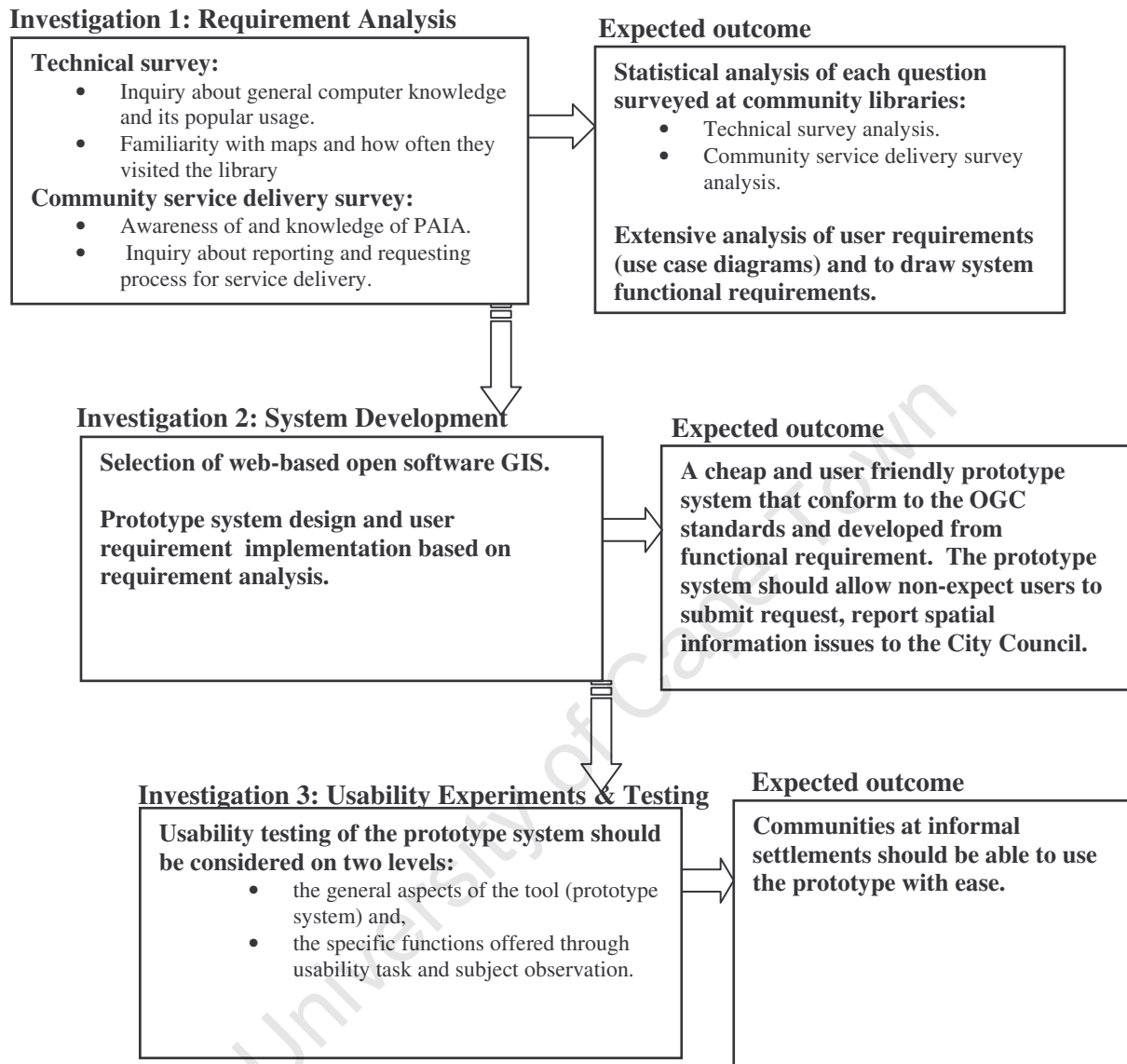


Figure 10 : Research framework path of the study

### 3.2.3 Investigations of research framework and Data Processing

The pre-questionnaire and post-questionnaire survey data processed in these investigations provided basic information for statistical inferences. The interviews helped to identify the current procedures used to give access to information by the City Council and guided the implementation of better technological solutions. The system development was based on



extensive literature review of the current prototype best design practices and web-based open source GIS software.

### **3.2.4 Investigation 1: Requirement Analysis**

The first part of the investigation used a pre-questionnaire and interviews in order to obtain user requirements functionalities. A power point presentation and paper prototyping was used to demonstrate and to help participants at community libraries to visualize the context of the study. The conclusion derived from the investigation assisted to understand the functions that are important to meet users needs and functional requirements. This investigation included Information Officers interviews and a pre-questionnaire survey (Appendix C.1) which is categorized in technical questions as part 1 and community service delivery questions as part 2.

Pre-questionnaire design structure:

#### Part 1: Technical questions

The technical questions were designed to inquire about potential users general computer knowledge, potential users popular computer usage, familiarity with maps, how often potential users visited the library.

#### Part 2: Community service delivery question

The second part of the questionnaire inquired about service delivery issues from the communities. It also inquired about the general knowledge and awareness of the PAIA Act.

#### Information Officer Interviews

The investigation conducted interviews to the former City Council access to information officer and the current officer. The interviews were formal in order to elicit different views on information access, better alternatives that can be done in future to give access and existing systems in place.

### **Data Processing**

The questions were structured with mostly close ended *yes/no* questions for both questionnaire parts and few open end questions which required participants to fill up the answers with their own hand writing.

The answered questionnaire results were collected and captured in Microsoft Excel spreadsheet. The collected results were organised according to each question frequency, the registered answers was tabulated and presented on a bar graph (Figure 13-14).

1. The closed ended technical questions Q 1.2 – Q 1.6 depicted the participants computer literacy in terms of technical experience and it was presented in a horizontal bar chart with *Yes* and *No* indicator.
2. The part 2 question Q 2.1 – Q 2.7 for community service delivery and awareness of PAIA Act was also coded with the Yes/No indicators.
3. The open ended questions provided an opportunity for participants to express their opinions and their answers were transcribed (see Appendix C.4).
4. The Information Officer interviews which shed light of current and previous access procedures used by the City Council were recorded using a Dictaphone and were also transcribed (see Appendix C.2 and C.3)

The indicators mentioned in this investigation were applied because the Author thought it would easily differentiate the needs and what the participants require. The frequency of the indicators and other statistics methods were used to make user requirement analysis. Further details about users requirement analysis will be discussed in the next chapter.

### **3.2.5 Investigation 2: System Development**

This second investigation is focused on selection of web-based open software GIS and prototype system design. User requirements implementation was based on requirements analysis of the first investigation.

#### **Selection of web-based open software GIS**

The selection criteria of the open source GIS software for deploying spatial websites was based on pre-defined criteria defined by Erika Harper (2006) conceptual framework which describe the components of an ideal web-based GIS software solution. The selection criteria of this study considered basic GIS functionality that is most common and important to any GIS system implementation. The selection criteria points were:

- The web application software must conform to industry-accepted data and protocol standards, such as applicable OGC standards and W3C standards.
- The software should be able to run on common system platforms, such as Windows and Linux and be supported in common browser products such as Internet Explorer and Mozilla Firefox.
- The software should make as much use of server-side processing as possible to provide a rich experience to thin clients.
- The database server must support a Relational Database Management System (RDBMS) or data file structure that enforces data integrity, security and reliability, provides adequate support and documentation, allows for storage of industry-standard spatial data formats and/or conforms to industry-standards.
- Web server software must provide for efficient process and memory management for responding to HTTP requests, ease of setup and configuration, reliable security and have adequate support and documentation.
- Application server software must provide support for common high level programming and/or scripting languages for extensibility and customization, efficient compilation/interpretation of program code, provide adequate documentation and be able to communicate efficiently between the web server and the database server (if any).
- The map server software should provide quality output, including clean raster and vector graphics, labeling/annotation, feature identification/querying, support for industry-standard map projections and coordinate systems, basic viewing functionality (zooming, panning), multiple data layer support, basic spatial analysis functionality between layers (overlay, etc.), allow for extensibility and customization through programming/scripting languages, easy to learn, setup and maintain, support for common spatial data formats

and able to communicate efficiently with other middleware software (e.g. backend DBMS, application server, web server).

The selected open source GIS software used to develop the prototype system will be discussed in chapter 5.

### **Prototype system design and user requirements implementation**

The approach of developing the prototype system was based on structured system development methodology using System Development Life Cycle (SDLC). The waterfall model defines the pieces or components phases and activities that one finds in a typical system development project. The developer can review and modify any components as the system goes through the phases. It allows the developer the ability to go back to previous phases if needed (APG3011F lecture notes, 2006).

Figure 11 illustrates the waterfall model that summarizes the development of a web-based GIS mapping interface using web map server MS4W (Mapserver for Windows) open source software and FIST application. The research path investigations are merged into the waterfall model stages and it also shows the different stages of each software usage. Each stage of the waterfall model is considered separate from the rest of the development process and stages are mutually independent from each other.

The advantage of this approach is that the development remains highly structured, ensuring that the system is robust and easily maintainable (Sommerville, 1995). There are deliverables at the end of each development stage that determines the project life,

The drawbacks of the waterfall model are that it does not allow incremental development. The waterfall model has inflexible partitioning of the project into distinct stages that does not allow for the dynamic state of the user requirements.

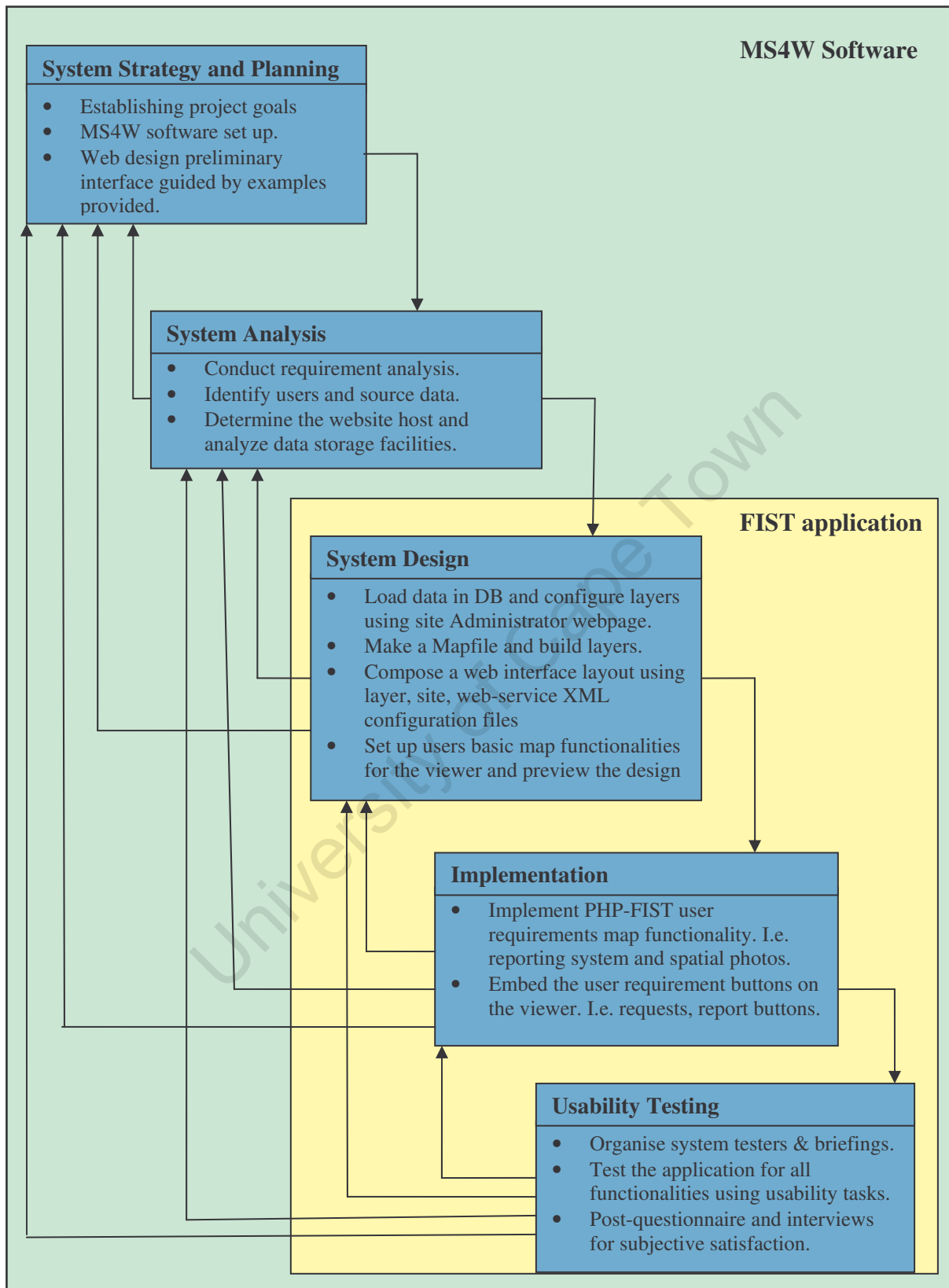


Figure 11 : The waterfall model for UCT CSIS prototype system using MS4W and FIST application.

### 3.2.6 Investigation 3: Usability Experiments & Testing

The final investigation was to determine if the prototype system is usable and acceptable by potential users at the informal settlements. The usability testing involved recording potential users performance on three different tasks in a controlled set-up. The performance task times and participants activities were recorded during the course of the experiment to help explain why the users did what they did. User satisfaction questionnaires and interviews were used to elicit users opinions. The post-questionnaire survey (Appendix C.1) was divided in to (5) five sections, section 1 of the questionnaire inquired about the background information of the participants, section 2-4 dealt with usability tasks and section 5 was short answer questions.

#### **Post-questionnaire design structure:**

##### Section 1: Background information

The section 1 of the questionnaire inquired about the experiences of the participants on using web-mapping applications and their knowledge of geography or geographical information systems. It also enquired out if participants were aware of the presence of the City Council Access to Information Office which processes public requests.

##### Section 2: Task 1 (Landmark Searching)

The section wanted to find out if participants will be able to find out a location of the landmark they are familiar with on the web-based mapping interface. The selected areas and other features were common to participants map orientation (i.e Airport, N2 freeway and other features (see Figure 10). The participants could navigate the map window by using other visualization tools from the tool bar.

##### Section 3: Task 2 (Reporting problems)

Participants were required to use the prototype system to report problems around their area. The task was to find out how empowered participants felt after using the system and also determined how easy it was to make a report using the prototype system. It also determined the usefulness of the information provided by the system and finally to visualize geo-referenced community library photos for map orientation.

#### Sections 4: Task 3 (Requesting spatial information)

The section was to find out if participants can make access spatial information requests in public by using prototype system e-register board. The task was to determine whether participants understood the purpose of the tool and recognized whether it was useful to be used. It was also to find out if users have learnt how the City Council Directorates/Departments are related and how they serve the public. The last question of the task determined the subjective user satisfaction from participants after using the e-register board for making requests.

#### Section 5: Short answer questions

The last section was to get users written opinions from the performed tasks after using the prototype, the section inquired about frustrations they encountered while using the prototype, user implemented functions that interest them, what other improvements or enhancements they would have liked to see in future. The section also inquired about participants preferable source for spatial information access and finally solicited comments about the prototype system in general because this option might have not been covered by the questions from the previous sections.

#### **Post Information Officer Interview**

The interview was to demonstrate the developed prototype system to the current Access to Information Office holder to inquire whether it was in the pipeline to what they are planning to implement and inquired what other improvements they would have liked for the development of the full system. It was also to crosscheck if the information published on the site is accurate and would not mislead participants with regards to access to information requests.

## **Data Processing**

The answered post-questionnaire results were collected and then coded to be processed using the Civil Engineering student's course evaluation software, for the raw data and the results, refer to Appendix D.4.

Section 1- 4 had closed ended questions that require users to complete the answers on a Likert scale being rated from 1 to 5, with 1 being strongly disagree, 3 is if the user is neutral/impartial and 5 being strongly agree.

The open ended questions in section 5 provided an opportunity for participants to express their opinions and they registered answers on their own hand writing (see Appendix C.4).

With regard to the Observation evaluation, the participants were silently observed and no comments or questions were asked during the testing process so as to factor out any bias effects. The facilitator completed the subject evaluation form (see Appendix D5) as the participant was busy with the test. The task time was also recorded in the process (see Appendix D6).

The Information Officer current office holder interview was recorded using a Dictaphone and transcribed (see Appendix G.4)

The Likert scale method was applied this investigation because it was easy to compute and code the answers using the Civil Engineering student's course evaluation software. The software produced an easy and understandable statistics that was used in the Results and Analysis chapter.



### 3.2.6 Study Area

As outlined in the research scope, this research is concerned about communities living at the informal settlements. The chosen informal settlements lie along the major N2 freeway and on the proximity of the airport which became easy to traverse between them as they are close to each other. The prototype used the City Council Smart Cape Access Project at six community libraries being Langa, Guguletu, Nyanga, Crossroads, Philippi and Delft as shown by Figure 12.

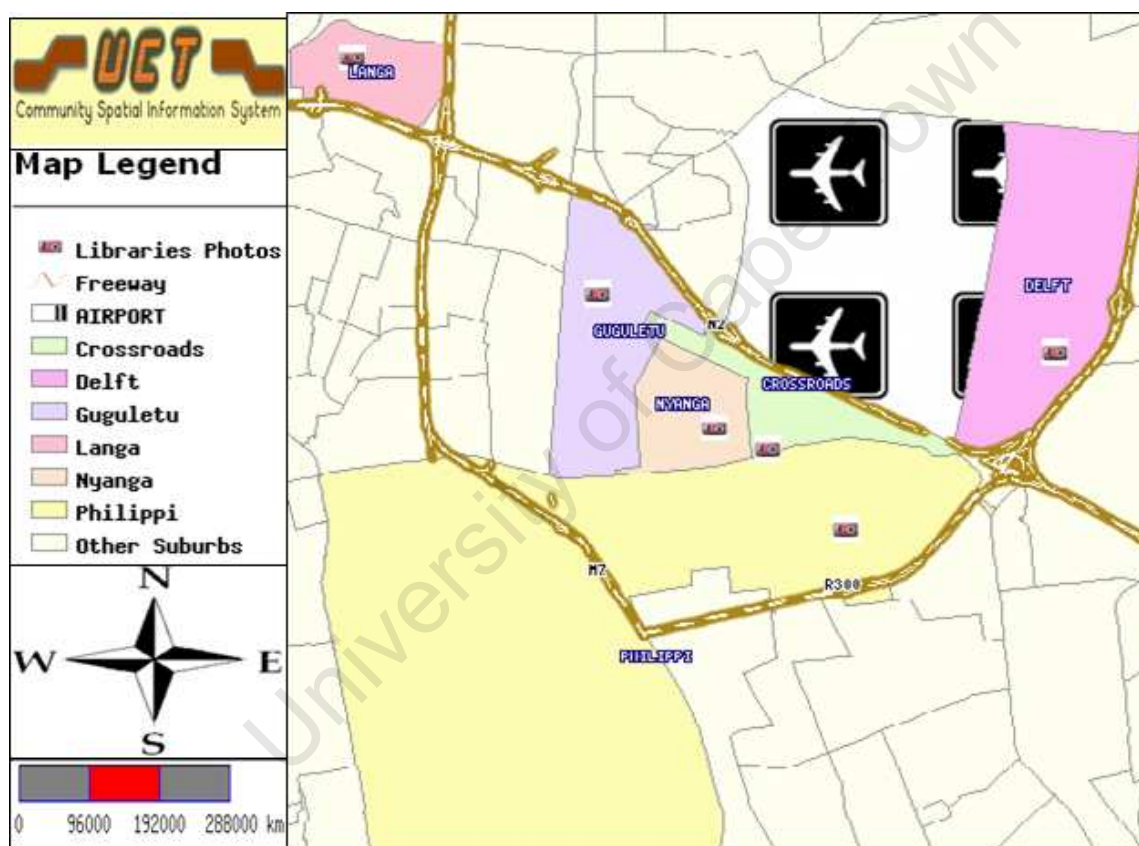


Figure 12: UCT CSIS research target areas.

### 3.2.7 Conclusion

This chapter presented the methodology used by this research, it outlined the research framework that expand on the proposed research methodology which was described on chapter 1 and the path of the investigations to be performed in order to fulfill the purpose of the research. The

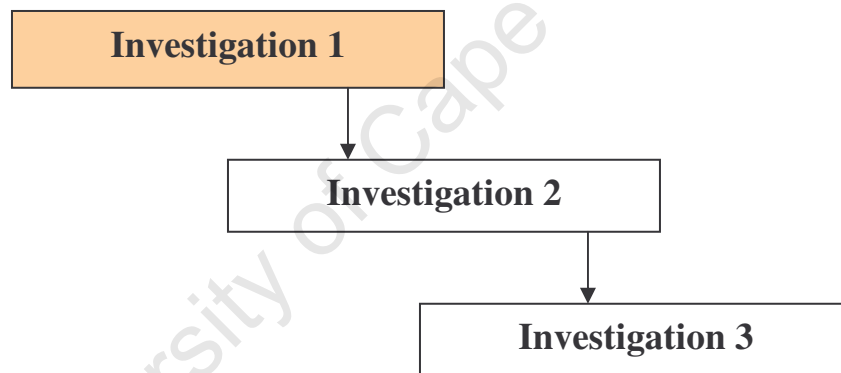
chapter discussed the instruments used, data collection methods applied and it also discussed their rational.

Ethical concerns regarding human subjects were considered during both questionnaire designs and the interviews. The Assessment of Ethics in Research Projects form from the Engineering and Build Environment Ethics Committee had to be completed and submitted for approval before any commencement of the survey. The chapter finally outlined the research study area. The first investigation of the research framework which consists of the data collection and requirements analysis is discussed in the next chapter.

University of Cape Town

# CHAPTER 4

## DATA COLLECTION AND REQUIREMENTS ANALYSIS



## **Chapter 4: Data Collection and Requirements Analysis**

### ***4.1 Introduction***

The research objectives, as described in Chapter 1, state that this research looks to investigate the procedure that is used to give access by the City Council and determine user requirements of spatial information access from the communities. This Chapter takes the first step to achieve one of the research objectives and complete the first investigation of the research path.

This Chapter also offers an analysis of the data collected as the starting block of the requirement analysis process through the use of community pre-questionnaire and Access to Information Officers interviews. The data analysis will be primarily interpretative and requirement engineering process will be discussed, this will be followed by the design of the use case diagrams in order to draw the prototype functional requirements.

### ***4.2 Investigation 1: Requirements Analysis***

The pre-questionnaire results were divided in two parts as structured in its design. The survey results depicted the participants computer literacy in terms of technical experience (part 1) and their awareness and knowledge about promotion to access to information with regard to community service delivery (part 2). The pre-questionnaire survey was completed by 48 participants from 6 libraries and they were randomly requested if they would like to participate in the usability experiment. The numbers of participants are not even for each library, three libraries had 7 participants surveyed while the other three libraries had 8,9,10 participants accordingly.

### 4.2.1 Part 1: Technical Findings

The technical findings result were categorized qualitatively and quantitatively, Figure 13 shows the closed ended questions from question 1.2 – 1.6 while question 1.1 and 1.7 were open ended questions and their results are presented on Appendix C4. The answers given by 48 participants are presented on a bar graph.

#### Closed Ended Questions

Question 1.2: “Do you know how to use a Computer mouse?”

Most of the answers for this question indicated that the participants are generally computer literate. Almost 90% and above indicated that they knew how to use a computer mouse, this might be because the participants might have been using the Smart Cape Access Project computer facilities since its launch.

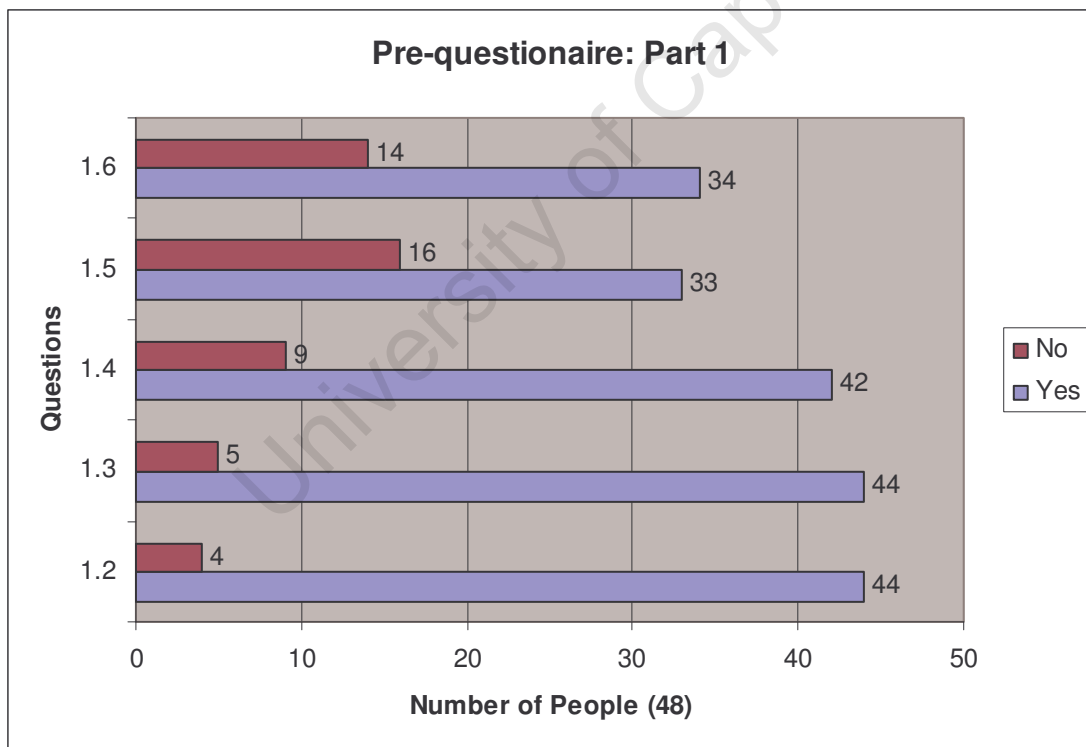


Figure 13: Summary of the user computer literacy questions from community libraries.

Question 1.3: “Do you know how to use a Computer keyboard?”

This question also indicated that a significant number of participants knew how to operate a computer with a keyboard, the answers nearly matched question 1.2 answers but its 1% lower.

Question 1.4: “Do you know how to use internet web browser?”

The workstations at the community libraries offer free internet to all Smart Cape Access Project users, this question indicated that most participants access Internet through the usage of the Mozilla Firefox web browser as it was observed at the community libraries. This question is backed by question 1.7 which showed what participants prefer to access email compared to others.

Question 1.5: “Can you upload multimedia information (documents, pictures and video clips) on the internet?”

A significance of learning internet applications was shown by questions 1.5 as 67% of the participants answered *Yes* from the sample population. This question is related to question 1.4, it showed that a fair number of people do interact with internet application and upload contents on the web by using application like facebook.

Question 1.6: Do you know how to read a map?

Almost 50% of the survey respondents indicated that they knew how to read a map while the other 50% did not. Some verbally said they are comfortable with a paper map printouts and some said they have not experienced with web-map on the computer before. They were not, however, as familiar with map reading as they were with using the Internet web browser and uploading multimedia information.

### **Open Ended Questions**

Question 1.1 “How often do you visit the computers at the library?”

The participants showed (Appendix C.4) that they were regular community library users because majority of the subjects indicated that on average, they visited the libraries almost everyday. In order to use the Smart Cape Access Project, participants are required to register using their library card and National Identity documents, they are given an

email and they can access internet or use the workstation for a period of 45 minutes session for a day on every City of Cape Town libraries, from this, this study assumes that participants has access to use internet.

Question 1.7 “What do you mostly use a computer for? (CV, e-mail, games, facebook or news)”

The results of this question shows a cumulative frequency (see Appendix C.4) of all participants surveyed, their number one priority for using the computer at the community libraries is to access e-mail, and then followed by creating CV for jobs and then read online news. There is an evidence that some do research by using internet as it is indicated by the others category. Few participants use the computer to access facebook and games.

The survey results helped to better understand technical requirements of different types and levels of potential users of the prototype system. The Part 1 questions helped to answer questions like: do they use internet at all, for what reasons do they use internet or the computer for? What is their technical experience? Is there any difference in functionality requirements between different levels of users?

#### **4.2.2 Part 2: Community service delivery findings**

Similar to part 1, the community service delivery results were categorized qualitatively and quantitatively, Figure 14 shows the closed ended questions from question 2.1 – 2.7. The only question that was open ended was question 2.8, the result were presented on Appendix C4.

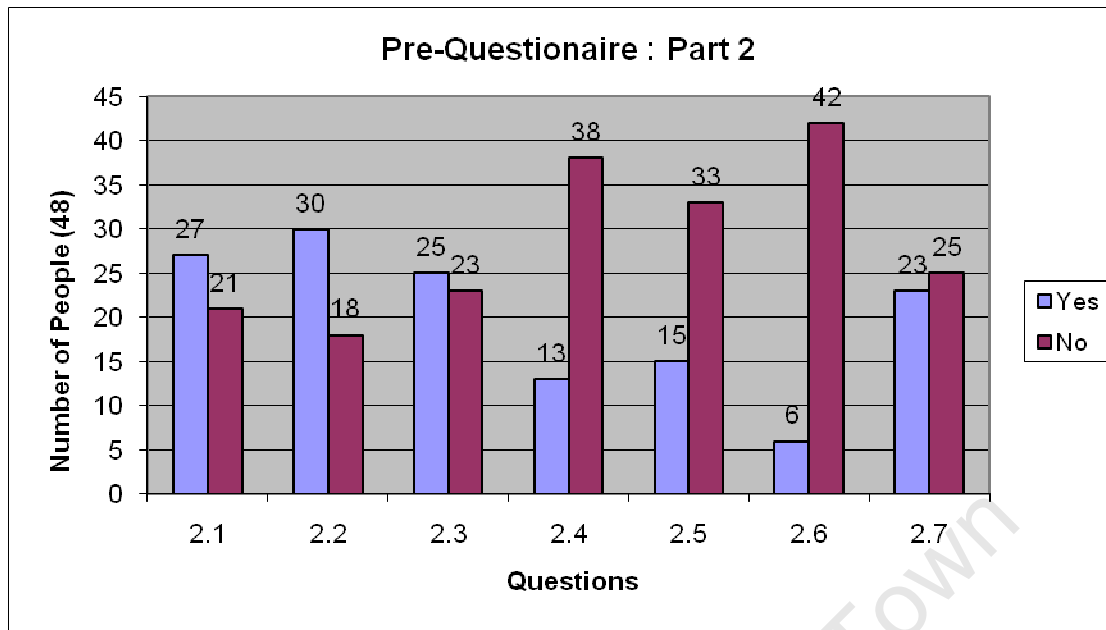


Figure 14: Summary of the community service delivery questions.

### Open Ended Questions

Question 2.1-2.2 “Do you know who to contact and where to report environmental problems”

Figure 14 showed that a significant number of participants knew who to contact by calling telephone numbers given at the libraries for any community issues, the same telephone numbers are used to report environmental problems around their community. The environmental problems examples given ranged from burst water pipes, an overflowing stormwater drain, loose power cables or fallen poles around their communities. The number of participants who registered *NO*'s for both questions were slightly lower compare to *YES* answers, this indicates that above 56 percentile of participants who were surveyed knew who to contact and where to report environmental problems and others did not.

Question 2.3 “Do you know where to go (City of Cape Town Offices) to report the situation in 2.1 and 2.2?”

Almost equivalent number of participants either knew the location of the City Council premises to report the environmental problems. This situation might be due to the location of the Informal Settlement as discussed in the study area (section 3.2.6). The



selected informal settlements are located on the outskirts of the City of Cape Town hence participants seldomly visit the city center where the offices are located.

Question 2.4 “Have you ever used the City of Cape Town website to get information about your community or municipality?”

The results of this question indicated that a lot of participants (75%) do not use the City Council website to find information with regard to their communities. Some participants verbally said they relied on their ward councilors or neighbours for information. In contrast, the Information Officer (Appendix C.2) revealed on question 19 that “*We have internet link on the main website (quick links of the left), some people phone and email us; they can also fill the form online*”, despite the effort to reach out to the communities, this is evident that participants who took the survey do not use those links but 25 % of the participants do use them.

Question 2.5- 2.6 “Have you heard of the Access to Information act and have you seen any form of promotion to access to information around your community as a means of creating awareness?”

The greatest proportion of survey respondents showed that 69% of the participants from the survey population have not heard about the Act, in addition to that 86% of participants have not seen any form of promotion to access to information act (PAIA) around their communities as a means of creating awareness. Question 8-12 of (Appendix C.2) interview of the current office holder indicated that the City Council do visit the communities once in a while to promote access to information, at the time of the interview, the officer had two years in the office and during the interview, it was indicated that the visit to the communities happened once since resuming to work at the City Council.

The previous office holder interview (Appendix C.3), question 5-6 indicated that it is difficult to say that communities at informal settlements knew about Access to Information Office, with regard to the community visits (Q6), the officer said “*Unfortunately NO, we didn't go to the communities. Corporate office arranged training*

*and we either did ourselves or a service provider was used and then we will get a chairperson or sub-councillor who has contacts with the communities to distribute leaflets or flyers. We did had a local government week where we distributed flyers in Civic Centre (City Centre) but not at communities.”*

Question 2.7 “Have you ever been informed that you can find the information about Cape Town, Government Structures and Service delivery on the internet?”

Approximately 53% of the participants indicated that they have not been informed to look up for information about the Cape Town, Government structures and service delivery on the internet while 47% knew about it.

### **Open Ended Questions**

Question 2.8 “What improvements do you like to see with regard to promotion to access spatial information around your community?”

The question results were transcribed on Appendix C.4, participants were able to record their opinions, the answers varied from upgrading of computers facilities (more workstations and high speed internet) at the community libraries, training people how to use the computers effectively, to have a door to door flyer’s papers delivery to community so that people are aware of the procedures required and more media publicity.

### **Summary of the Information Officers Interviews**

The previous officer (Appendix C.3) described how they previously used to provide information to the requesters. The officer indicated that all the guidelines are stated in the City Council section 14 manual documents (Appendix B) and they had to follow it. The officer further emphasized that apart from the procedure to be followed, there were a list of records which were automatically available which did not require a specific procedure to be followed. The previous office holder also indicated that if there was a system to have been used during her time, a system that use internet could have been preferred or networked computer facilities as they reach wider audience.

The current officer (Appendix C.2) elaborated on what currently is done to provide access to information and the structures of the City Council involved in the process. The officer also emphasized that the information lies with different directorates/departments. What they do is to request it from Deputy Information Officer from those directorates/departments and hand it over to the requester with reference to the Act. With regard to what better alternative can be used to provide access to information, the Officer pointed out that as many people are aware how to follow the process, it would best for each directorate/department to have their own Section 14 manual rather than to centralise it at Access to Information Office so that it shorten the time for requesters to receive information. With regard to the computer systems in place for information access, the officer said that they have Internet links on the main City Council website for people to know about their office, contact them or fill an online electronic form that is provided, The Officer indicated that there is no systems in place that are advanced in the City Council that promote access to information but rather they do it manual where the public comes forward to their premises with their requests.

### ***4.3 Requirements Engineering Process***

A comprehensive requirement engineering process was undertaken in order to develop the requirement specification document (Appendix F.1). There is a need for good requirements engineering, and the consequences of a lack of it, are most apparent in systems that are all or mostly software. Requirements engineering approaches are closely tied to the system development life cycle (Figure 11). A distinction is made between requirements engineering at the system level and at lower levels, the process put people first rather than the systems, developers tend to spend much of their time and effort to find out certain functionality for the implementation of their preferred style without considering the potential users. The complete requirements engineering process can be seen in the next following sections. The fundamentals of requirements engineering are defined and presented by inception, elicitation, elaboration and negotiation phase.

### 4.3.1 Inception Phase

The topic of the study attests to the Author long-established interest in the use of web-based and networked technologies on open source GIS applications that offer geo-information driven decision making and planning and improve service delivery to disadvantaged communities. Since the South African Government has embarked on “Open Source” drive and Promotion of Access to Information Act of 2000, this research forms part of the investigations and hopes to contribute to the knowledge base for system development at grassroots level to combine GIS and the Act..

It was understood that the aim of the project was to implementation of user-friendly open source web-based GIS prototype system for the access to spatial information. The project also seeks to test the functionality and usability of the system with the potential users at selected community libraries. The key stakeholders were established at this phase of requirement engineering process.

i. Stakeholders

The communities living at informal settlements and the City Council Access to Information Office.

ii. Outcomes and Deliverables

At this stage, the preliminary understanding of the problem was achieved; the project scope and the various stakeholders were identified.

### 4.3.2 Elicitation Phase

Initial meetings were held with geographical information sector at the City of Cape Town’s being: Environmental Information System Manager (Appendix E.1), Corporate GIS team (Appendix E.2) and Strategic Information Services (Appendix E.3). The meetings were part of the fact finding mission to identify how GIS technology can be used to promote access to

information and support interaction between municipality level and the people its serves. Several requirements were established and agreed upon at this phase, these requirements was changed in later phases as the project investigations moved to the communities to investigate the reality of access to information by the communities concerned.

i. Points noted from the interviews in this stage.

- People walk-in to the City Council department to request information.
- Currently, there is no web-based system to disseminate spatial information, the City is going to be implemented on the ISIS project.
- Broadband fiber optic network cables are still being connected throughout the City to upgrade Smart Cape Access Project facilities.
- The City Council Corporate GIS is creating a clearing house to serve data to the external and internal requests,
- The City is creating awareness to the societies, at the present moment it has been through schools “adopt a school concept” but not necessarily approaching households or communities.
- Informal Settlement Growth Monitoring System project target informal settlement, it takes the aerial image of informal settlements and then it takes in all other surveys from water quality, housing settlement, police and others. It aggregates the information so that people can get visual maps of informal settlement and the associated data.
- The city has invested into proprietary software, to move away from it overnight will be difficult. They do look at other software but not at a larger scale.
- The City Council conduct research on open source software, they know that that open source work, but the main concern is capacity.
- None of the City Council raw data is accessible to the public. There are legal implications poised to it.
- The City performs households survey through survey consultants and sub-contracts market research companies for metropolitan statistics. They usually conduct the small household surveys.

- Majority of the people interviewed at the informal settlements libraries do not know some of the City Council department.
- The City Council is intending to develop a map shop for all city maps and data.
- There is a *list of records automatically available* from the Access to Information Office that does not need the procedure of giving access.

ii. Outcomes and Deliverables

At this stage, a strong understanding of the problem and initial needs to distribute spatial information were gathered from the City Council departments.

### 4.3.3 Elaboration Phase

The Access to Information Act Officers (Appendix C.2-C.3) and Community pre-questionnaire survey at informal settlements libraries were treated as the priority to identify the needs and requirements for the potential users of the prototype. Several requirements from other interviews were considered.

The pre-questionnaire survey and interviews (section 4.2) were analyzed and the following needs were identified.

i. Community desires to :

- have access to spatial information presented by online systems, read instructions, read reporting tutorial and system help. Section 4.2.1, Question 2.4 outline that few participants use the internet to access information about the community or municipality.
- be able to use basic map functionality tools (zoom, pan, query and select), edit and navigate through features by simply using the keyboard and mouse as indicate by Question 1.2-1.3 analysis.
- be able to reach informed decision on submitted problems and receive feedback on requested information as they indicate in question 2.1-2.2.

- be able to produce or digitize map sessions after examining “what if” scenarios that suit their opinions as indicated by question 2.8.
  - be familiar with map orientation and have the ability to view library sites at the location of the informal settlements, question 3.4.
  - be able to visually see results graphically and in tabular format.
- ii. Information Officer wishes to
- use an internet system to provide access rather than the current manual system where people come to their premises (Appendice C.2, question 19).
  - be able to receive requests online as a first step in order to give access (see Section 2.8) rather than having queues at their premises.
  - be able to send an immediate feedback on information that is automatically available, officers outlined that they follow section 14 manual procedure to give access if the information is not automatically available from their office.
  - be able to update announcement to inform communities about promotion to access to information activities, this needed to create awareness as City Council Access to Information Office rarely visit the communities.
- iii. Outcomes and Deliverables
- From the pre-questionnaire analysis and Access to Information interviews, the user needs were identified. It was very useful to group some of the identified needs together as they meant the same thing.

#### **4.3.4 Negotiation Phase**

Many requirements were collected during the previous three phases, with many not being realistic for the scope of this project. With a review of web GIS implementation literature, software engineering principles and the usability engineering specifications, the identified requirements will be implemented in the next chapter, the next section discusses the use case diagrams and use case narratives.

#### **4.4 Use Case Overview Diagrams**

Use case diagrams describe the behaviour of the system when one of the actors sends one particular stimulus or action. They separate the system into actors and use cases. Actors represent roles that can, are played by users of the system. Those users can be humans to humans (Peer 2 Peer or P2P), humans to applications (Peer 2 Applications or P2A), and applications to applications (A2A). The only criterion is that they must be external to the part of the system being partitioned into use cases. They must apply stimuli to that part of the system, and they must receive outputs from it. They are purely functional descriptions written in a format that is completely separate from software design.

This section represents use case diagrams and narratives describing how Communities and Information Officers might interact with the proposed prototype system to fulfill their spatial information needs.

Community User Use case diagram



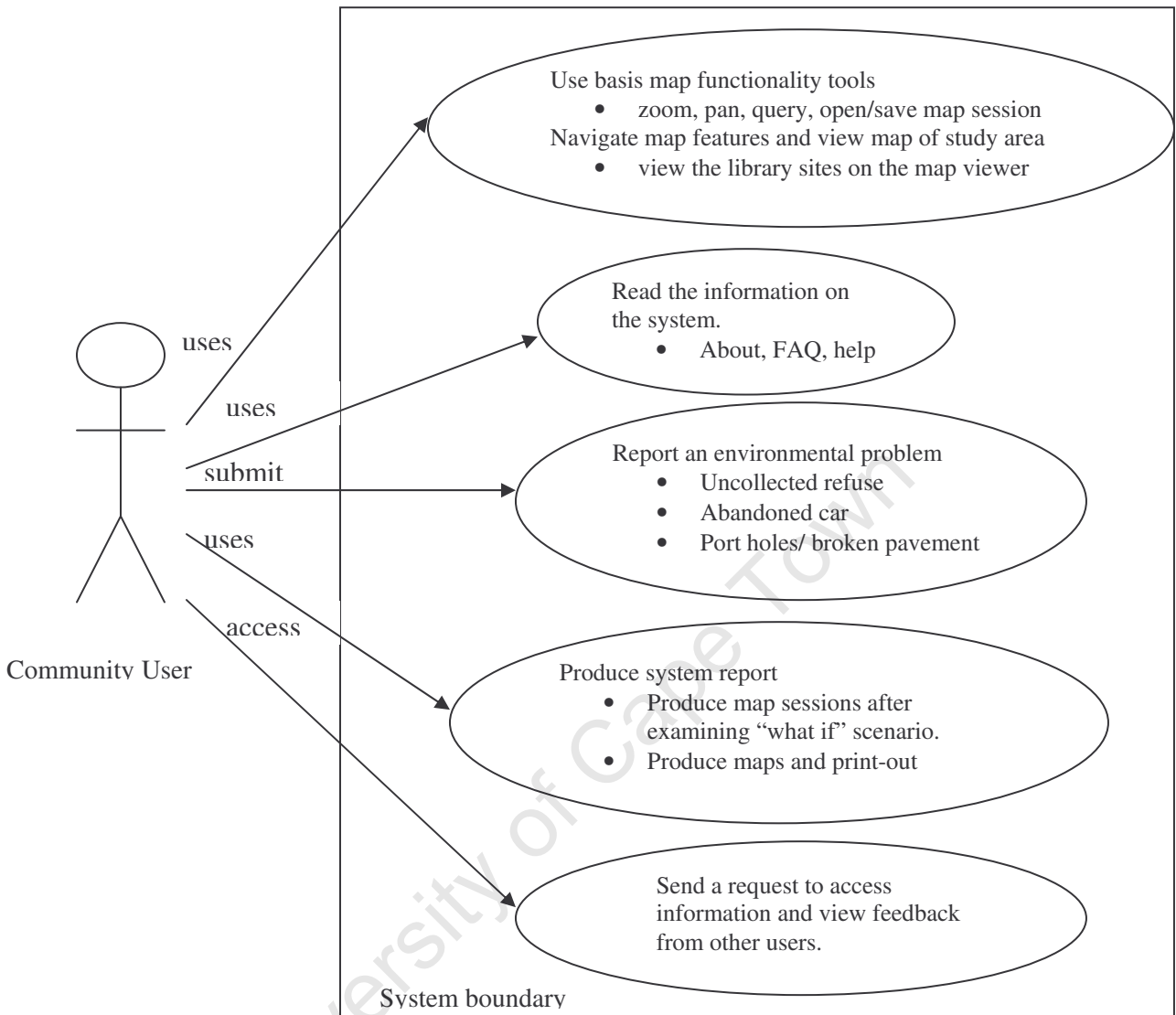


Figure 15: Community users use case diagram

## Information Officer Use case diagram

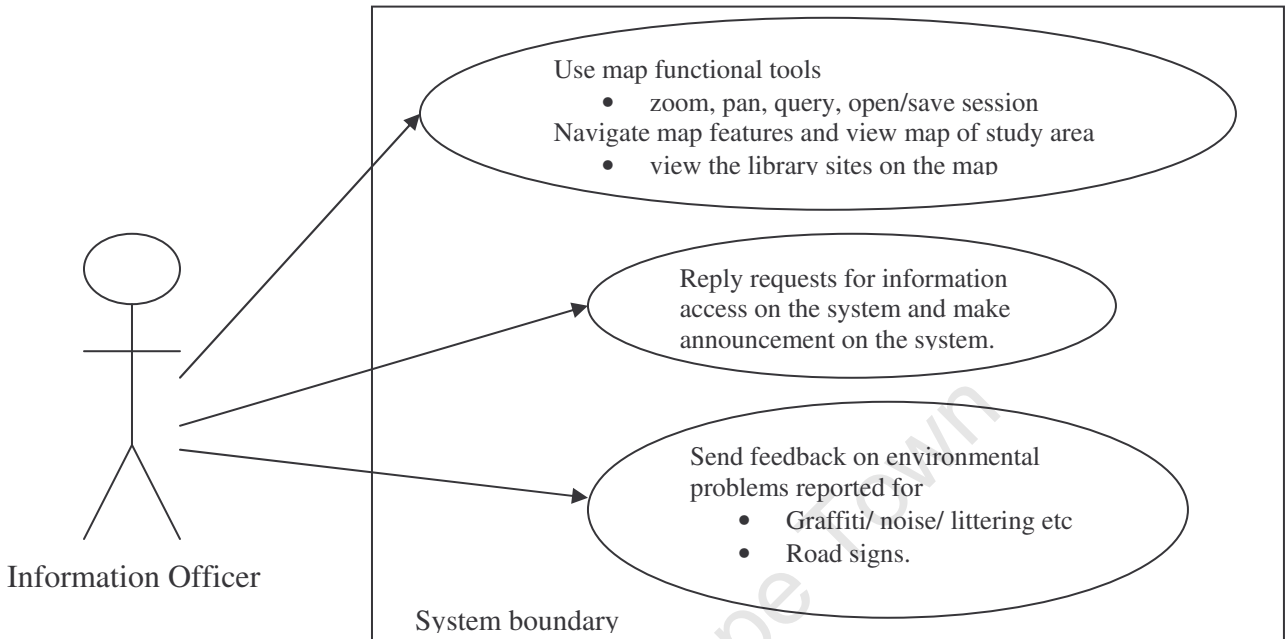


Figure 16 : Information Officer use case diagram

### 4.5 Use case Narratives

The use case narratives of the system describe all the possible scenarios, conditions and process that are involved when the operation is performed. Following the discussion on section 4.3, the scenarios can either be the system scenarios, conditions or user scenarios.

Refer to Appendix F.2 for individual use case narrative, the use case narratives denoted with (\*) on the primary actor attribute means that they can be used by one or more actor.

### 4.6 Functional requirements

Functional requirements are analyzed by decomposing use case diagrams functions that were identified through requirements analysis into lower-level functions. For functional requirements, refer to the requirement specification document on Appendix F.1.

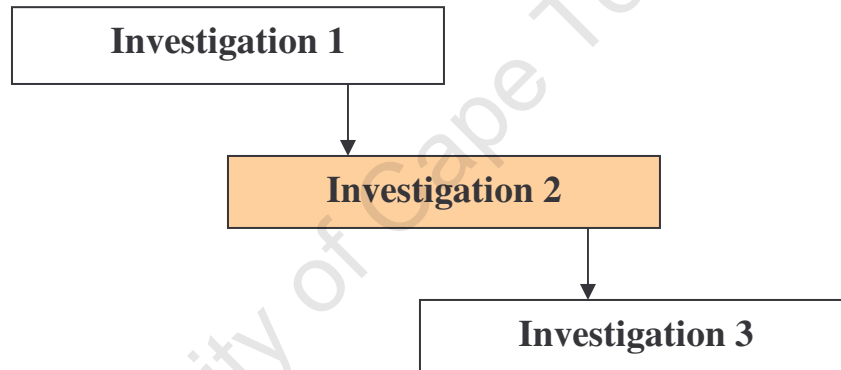
## **4.7 Conclusion**

This chapter analyzed data collected through ethical community pre-questionnaire and interviews. A good response rate was achieved with the community library survey and a total of four interviews with City Council departments were conducted. The community libraries response rate means this study cannot make any inferences about the population of the communities at the informal settlements as this study conducted the surveys only at the selected public libraries. The community survey and Access to Information Officers interview were treated as main direction of which this study will investigate access to spatial information, this is due to the fact that public requests are processed by the Access to Information Office. Nevertheless, this study obtained valuable input from interviews of other City Council departments.

The requirement engineering process methodology was applied to the analyzed results. This allowed the study to produce the requirement specification document, use case diagrams and use case narratives. The functional requirements outlined in the document will be implemented in the next chapter.

# CHAPTER 5

## PROTOTYPE DESIGN



## **Chapter 5: Prototype Design**

### ***5.1 Introduction***

This chapter discusses the techniques used for the implementation the prototype system user requirement as a result of the requirement analysis. The system architecture for the prototype is proposed in this chapter. The chapter discusses the selected open source GIS software used, data structures and programming techniques utilized.

### ***5.2 Investigation 2: System Development***

The prototype system named UCT CSIS was developed using the web mapping interface the FIST. The web mapping interface made it easy to modify the website appearance, add/remove map tools and add/remove map layers. The map tools enabled the developers to also implement extra functionality in relation to their user requirement.

### ***5.3 Selecting open source GIS software***

The section process was based on the discussed criteria outlined in section 3.2.4. The selected open source software for this study were:

- PostgreSQL/PostGIS database,
- Hypersilence board,
- Sitemeter for online statistics,
- Mapserver for Windows (MS4W) and,
- Flexible Internet Spatial Template (FIST)

#### **5.3.1 PostgreSQL/PostGIS database**

PostgreSQL was chosen because it is a popular open source relational database management system (RDBMS). It has been in development for the past 15 years and can run on multiple

platforms including Linux and Windows. PostgreSQL is a RDBMS similar to Microsoft SQL Server 2008 (RC0), MySQL and Oracle but the only difference is that it has PostGIS extension. PostGIS is a spatial extension module that allows mapping data to be stored inside of a PostgreSQL database. This extension to PostgreSQL is similar to Oracle Spatial and can function similar to ArcSDE. Points, lines, polygons, and text attributes can thus be represented in a PostGIS layer just like they can in a Shapefile (Koning *et al*,2006). This research used both Shapefile and PostgreSQL/PostGIS as the backend database to feed the data to UMN Mapserver.

### **5.3.2 Hypersilence board**

Hypersilence board was chosen because is unlike most other PHP message boards, for the simple fact that it uses no databases at all. The board use flat text files to store requests and user information. This makes the hypersilence board fast and ideal for anyone whose host has limited or no database abilities. The board requires no installation at all, it is extracted on the web directory folder (htdocs) and edited manually. The other reason why it was chosen is that the board is built-in with an intelligent system of including banned words and censored words, censored words will be automatically detected by the board while banned word will lead to a user to be warned or suspended by the Administrator from using the board. This is a useful functionality for sending online information request.

### **5.3.3 Sitemeter**

Sitemeter is a comprehensive real time website tracking and counter tools to give users access to vital information and data about their websites audience. The sitemeter statistics is hosted by the sitemeter.com server. It was chosen to record the statistics of the web-based prototype system activities as it is used by communities at the informal settlements.

### **5.3.4 Mapserver for Windows (MS4W)**

Song *et al* (2004) compared three open source web map servers that have broad deployment and functionality, the web map servers are Minnesota Mapserver, Geoserver and Deegree. From the

chosen three servers, all of them offered everything for a novice GIS developer to more advanced developers and are able to be viable alternative to proprietary map servers.

Minnesota Mapserver is built upon other open source projects and has the advantage on various platforms where most commercial system would not or can not work properly. Geoserver is a java based open source server that connects the information to the geospatial web and its administration is performed through a web interface. Finally, Deegree is also java based open source software framework for the implementation of Spatial Data Infrastructures (SDI). It contains the services needed for SDI as well as portal components, mechanisms for handling security and access control issues and storage or visualization of 3D geodata.

Song et al (2004) concludes the comparison by specifying that according to the declaration of supporting OGC WFS/WMS specification, all of three map servers are compatible with OGC WMS interface, the Mapserver only supports basic WFS function, while Geoserver and degree fully implement OGC WFS interface, supporting additional transaction operation of GIS database- insert, update and delete. Table 2 shows the comparison of the three map servers and their support for OGC Web services.

OGC Web Service	UMN Mapserver	Geoserver	Deegree
WMS	✓	✓	✓
WFS	✓	✓	✓
WFS-T	✗	✓	✓
KML/KMZ	✗	✓	✗

**Table 1: Web map server comparisons (Song et al, 2004)**

From the selection criteria points discussed on section 3.2.4, Mapserver (Mapserver on Microsoft Windows or MS4W) web map server was chosen for this research project because it supports a lot of easy customizable applications like FIST, Mapbender, gMap and others that are used to create web-based mapping interfaces . Unlike the previous versions where developers had to read instructions and extract the software to the local drive (C drive as the default), MS4W 2.2.7 installer set up MapServer on Microsoft Windows platforms. The purpose of this package is to

allow all levels of Mapserver users to quickly install a working environment for Mapserver development on Windows.

MS4W configuration utilise Apache HTTP Server, PHP, MapServer and employed shapefiles for the data. MS4W can access the same data from the shapefiles stored in the backend relational database system PostgreSQL, utilizing the PostGIS extension. MS4W can use both Mozilla Firefox 1.5 or greater versions and Internet Explorer to launch the web mapping applications.

### **5.3.5 Flexible Internet Spatial Template (FIST)**

With regard to the selection of application that runs on top of MS4W, Flexible Internet Spatial Template Application (FIST) was chosen because it is utilized by a number of people as a low cost option for information sharing. The FIST is Pre-Hypertext Processor (PHP) object based application that is used to rapidly deploy internet mapping web sites. It provides a code base with built-in functionality for common and basic internet mapping tasks as well as the ability to extend the mapping site with custom functions. The application is not specific to any one dataset and also features a map server abstraction layer that separates the mapping requests from any specific map server (FIST Administration Manual, 2006).

### **5.4 User requirements implementation**

FIST tools arguably represent an easier method of building custom tools than the map widgets method. For example, FIST tools do not require a specific programming language and can use any web pages that have been setup to utilize HTTP GET variables (i.e URL argument). The web page could be a simple page with one line of JavaScript to print the coordinates or a complex Java Server Page (JSP) web page that requires a variety of spatial databases for features before passing them on to an external submission system. The following user requirements are implemented:



### 5.4.1 Spatial referenced community library photos

One of the requirements derived from the previous chapter was a need for users to have good orientation for community libraries. Users should be able to navigate the map area and view the photos of the community public library that they wish to visit. Spatial referenced community library photos function was implemented. The photos tool use FIST PHP functions, it uses two web pages with PHP code and a FIST tool definition. Figure 17 shows the spatially referenced community library photos.

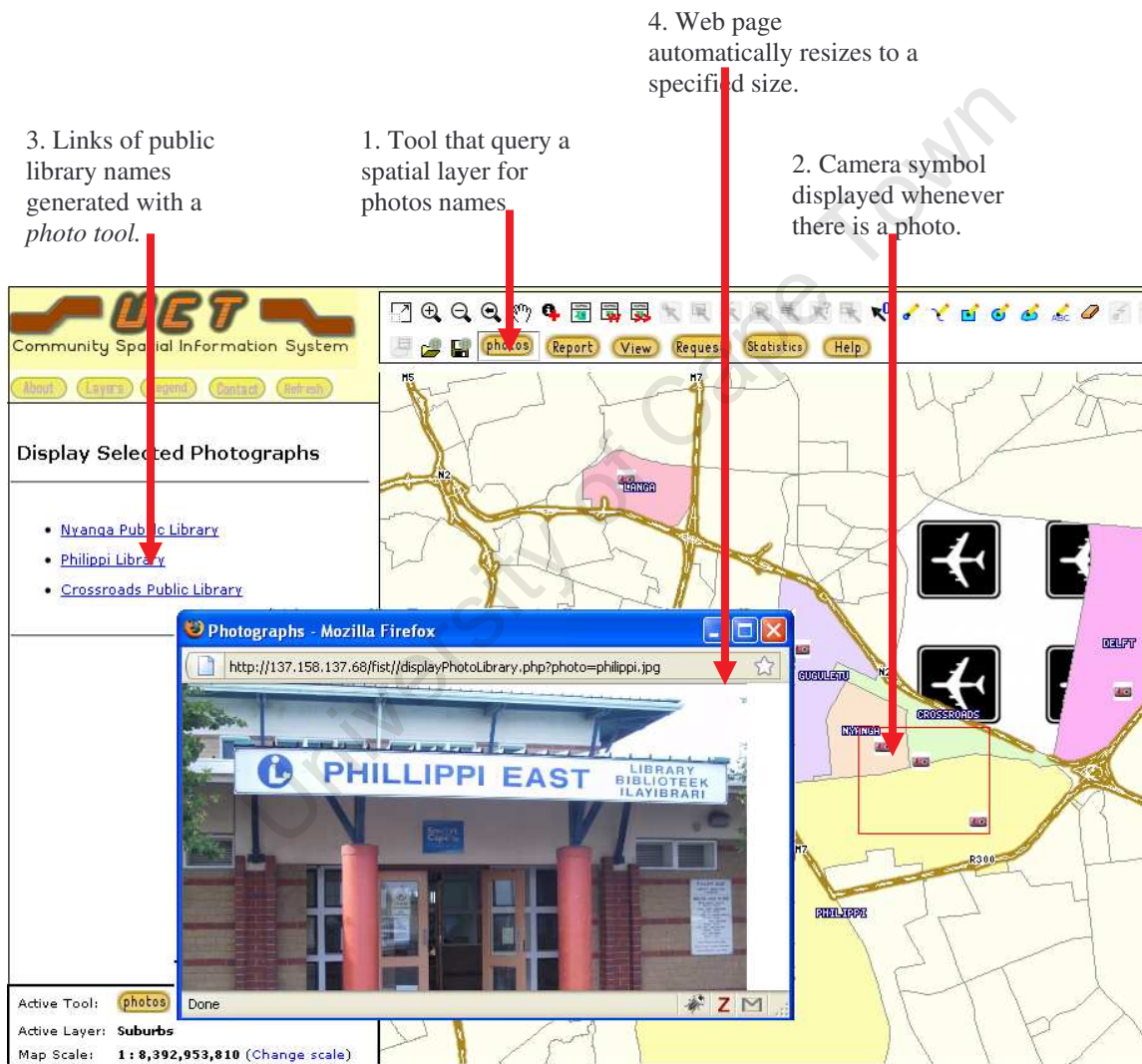
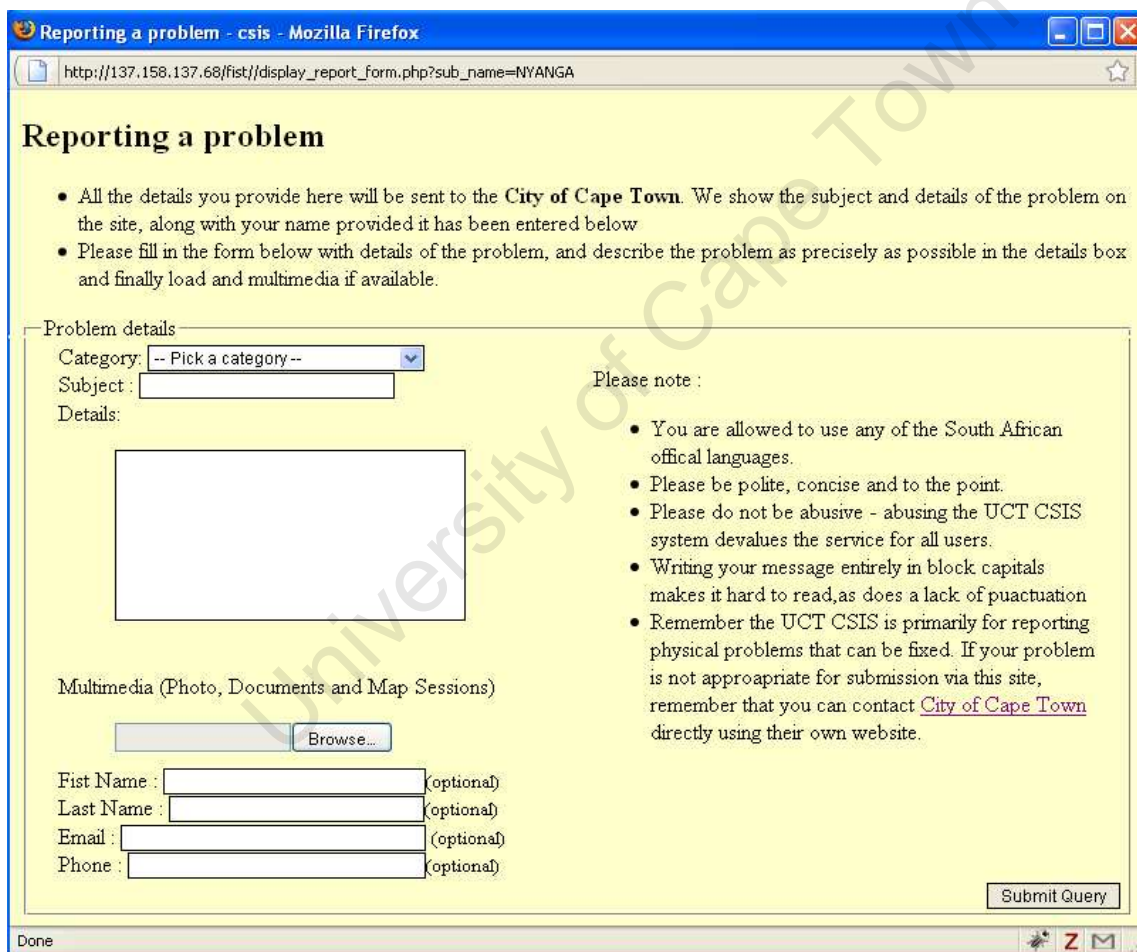


Figure 17 : Spatial library photo illustrated by UCT CSIS prototype system.

## 5.4.2 Reporting tool

The users of the prototype need to be able to report environmental problems around their area by using the prototype, describing it in details and uploading any documents or multimedia (photos only) files to support it. The reporting tool uses that same mechanism as the photos tool but it utilizes three web pages instead of two, it uses coordinates from the selected map area and it populate the list of suburb names which are extracted from the PostgreSQL/PostGIS database, when the user clicks the link, the reporting form pop-up as indicated in Figure 18, the user is required to fill all fields except the optional ones before submitting the form.



**Reporting a problem**

- All the details you provide here will be sent to the **City of Cape Town**. We show the subject and details of the problem on the site, along with your name provided it has been entered below
- Please fill in the form below with details of the problem, and describe the problem as precisely as possible in the details box and finally load and multimedia if available.

Problem details

Category:

Subject:

Details:

Multimedia (Photo, Documents and Map Sessions)

First Name:  (optional)

Last Name:  (optional)

Email:  (optional)

Phone:  (optional)

Please note :

- You are allowed to use any of the South African official languages.
- Please be polite, concise and to the point.
- Please do not be abusive - abusing the UCT CSIS system devalues the service for all users.
- Writing your message entirely in block capitals makes it hard to read, as does a lack of punctuation.
- Remember the UCT CSIS is primarily for reporting physical problems that can be fixed. If your problem is not appropriate for submission via this site, remember that you can contact [City of Cape Town](#) directly using their own website.

Figure 18 : The reporting a problem form that the user have to fill in order to report a problem.

The reporting tool implementation workflow had to be tuned on the Apache web server file (php.ini file) because it is meant to upload large files such as PDF files, Microsoft word files,

other image formats files and map session files. There were few additional steps that were required:

- The memory limit of a PHP script should be greater than the maximum file size. The *memory\_limit* parameter was adjusted in the apache web server php.ini file.
- The maximum file upload size was set by modifying *upload\_max\_filesize* parameter to 350M in the php.ini file.
- The maximum POST size was set to be greater than maximum file size by modifying *post\_max\_size* parameter in the php.ini file.
- The maximum execution time for a PHP script was set to 120 seconds to allow the upload to complete. The default value is 30 seconds but considering that the internet connection is slow in South Africa, 120 seconds was set. The parameter modified in the php.ini file was *max\_execution\_time*.

The parameter configurations were made to avoid the web server to crash in case of a slow internet connections at the community public libraries.

### **5.4.3 Requesting tool (e-Register board)**

The main function of the prototype is to be able to allow users to post new access to spatial information requests and share feedback of previous requests. The system should allow guest users to view, post and reply requests. This is achieved by the user choosing a relevant directorate and within the directory, the user can choose a department to request information and post a request. The results must then be published publicly on the board so that other users can view. Users should have the ability to reply other post if they want to share the information to avoid the waiting period from the administrator in case they know the answer. Figure 19 illustrate access to information e-register board for the prototype.

Register link for the e-Register board.

City of Cape Town Department

City of Cape Town Directorates

Topics and post update statistics

Access to information request posted to a department

Board	Topics	Posts	Last Post
<b>Safety and Security</b>			
<b>Emergency Services</b>	0	0	<b>There are no topics.</b>
<b>Traffic and Metro Police</b>	1	2	August 01, 2008 / 06:47:47am <b>Speed camera</b> by Admin
<b>VIP Security</b>	0	0	<b>There are no topics.</b>
<b>Utility Services</b>			
<b>Water</b>	1	2	October 30, 2008 / 06:26:35am <b>water leakages</b> by Timothy
<b>Electricity</b>	2	3	November 04, 2008 / 08:10:09am <b>Electric box</b> by arlene
<b>Solid Waste</b>	0	0	<b>There are no topics.</b>

Figure 19: UCT CSIS Access to Information e-Register board.

The requesting tool was implemented using the Hypersilence board discussed on section 5.3.2, The important part of the board is for users to read the *about page* of the board derived from the City Council section 14 manual guidelines, *frequently asked questions (FAQs)* and *Terms of Services* of the board. It is also advisable for the users to register on the board rather being guest so that they can utilize other functions like search and view top 25 users of the board. In addition to that, users earn points after registering and they can qualify to be moderators or administrators depending on the way the use the board (post topics, view topics and reply topics).

### 5.4.4 Statistics webpage

The statistics webpage (Figure 20) presented the statistics numerically and graphical chart, it displayed newly reported problems in the past week, fixed problems in the past month, pending problems in the past month and a total of all the problems. The prototype also allowed users to view all reported problems from the study area statistics internet link and site statistics internet link. The study area statistics showed each area statistics, for instance, Nyanga area statistics of reported problems shown on Appendix G.1. The site meter internet link statistics (Appendix D.7) is a free, fast, and easy online statistics. Not only can it display the number of visitors to the web site, it also keeps statistics on the number of visits each hour and every day in real time. The other use of the statistics webpage is to update the reported problems to indicate if they are fixed or still pending.

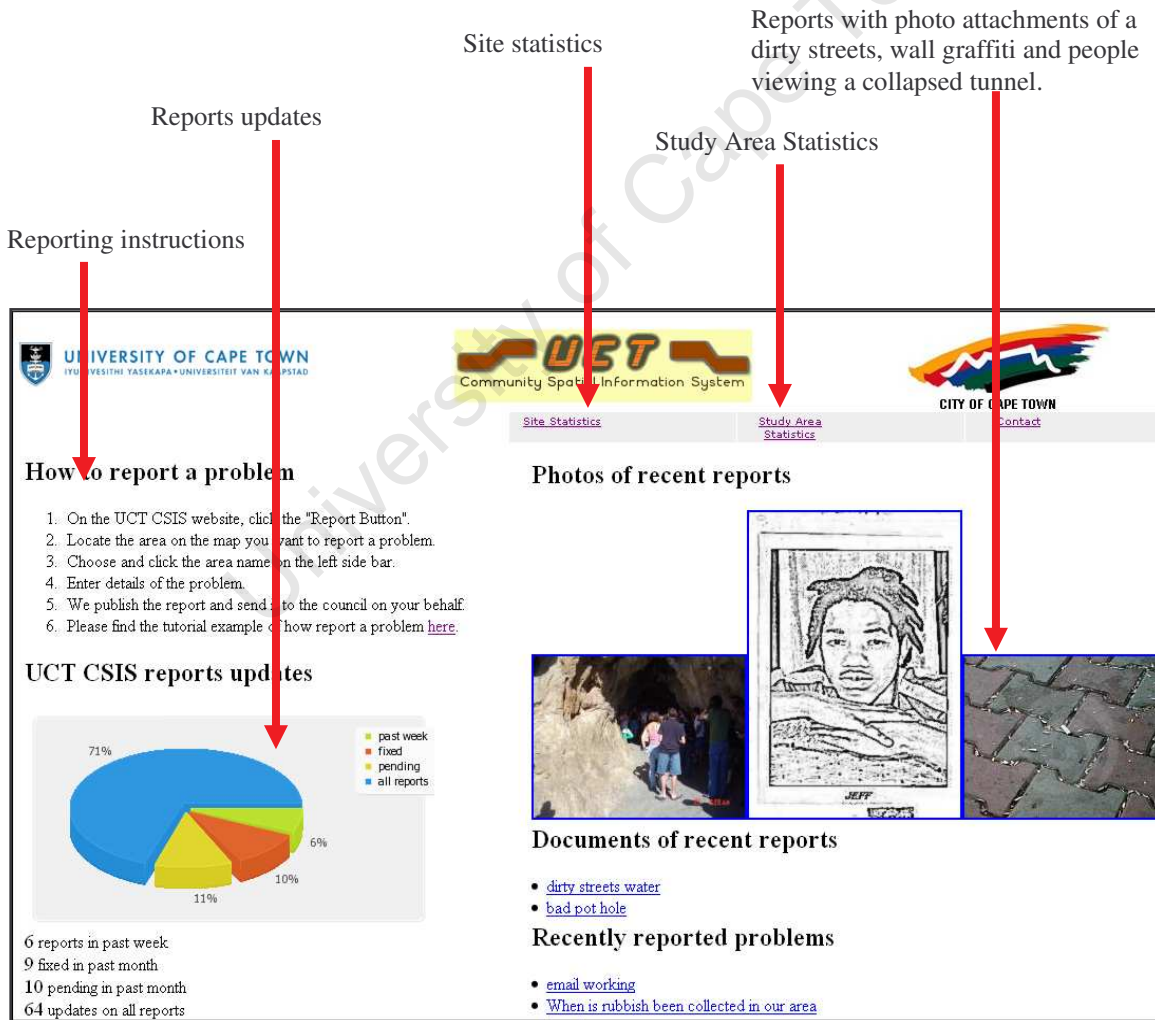


Figure 20 : Statistics webpage displays statistics reports from the database.

## **5.5 Prototype Design**

The system architecture for the prototype is proposed in this section. The main idea is to translate the work flow of users action as indicated by the use case diagrams into geographic database operations as the users manipulation the interface, transforming the information coming from the database to allow for visualization on the viewer within an optimum time.

### **5.5.1 System architecture**

The architecture of the prototype system aims to provide a web-based open source software platform for collaboration and communication to interoperable system components to best utilize existing resources and obtain maximum performance. Web applications enable different users to access information from diverse locations with different tools and this possibility is due to the relationship between client and server components. Most of the time there is a need for additional web-based application to provide a web mapping interface, either at just the server-side or at both the client-side and server-side, for example, QGIS or GRASS is mostly used to prepare data to be published by the map server. Haronot *at el* (2002) emphasis that the web server itself is not able to do any geo-processing, the Author point out that it has to pass on requests from the clients to map server (i.e. MS4W) for geo-processing. They are several standard interfaces such as the Common Gateway Interface (CGI) and server Application Programming Interface (API) to enable the communication between web server and map server. The diagram on Figure 21 illustrates open source web-based mapping system architecture.

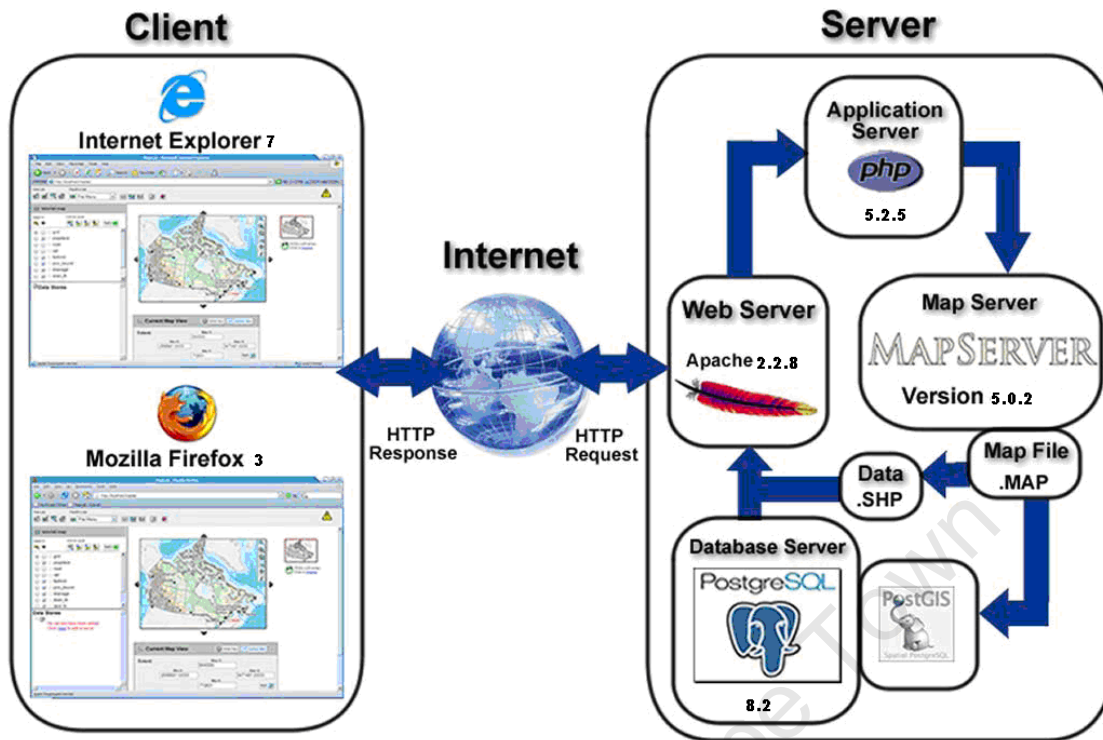


Figure 21 : Web-based mapping system architecture (Adopted from Erika Harper, 2006)

The client applications of web-based mapping system send a request to the server-side, a server-side application communicates with the map server to provide the request information. The updated map is returned to the browser embedded in the HTML page or applet (Haronot *at el*, 2002). The design of the system architecture and components configurations (as mentioned in section 5.4.2) determines optimum performance of a web-based.

The processing is the core matter that is traded off in the various systems, hence a server-side oriented system puts more load on the server “thin client” (Figure 22 a) while a client-side oriented system distributes the personalized processing load among the clients “thick or fat client” (Figure 22 b) (Berry, 2004).

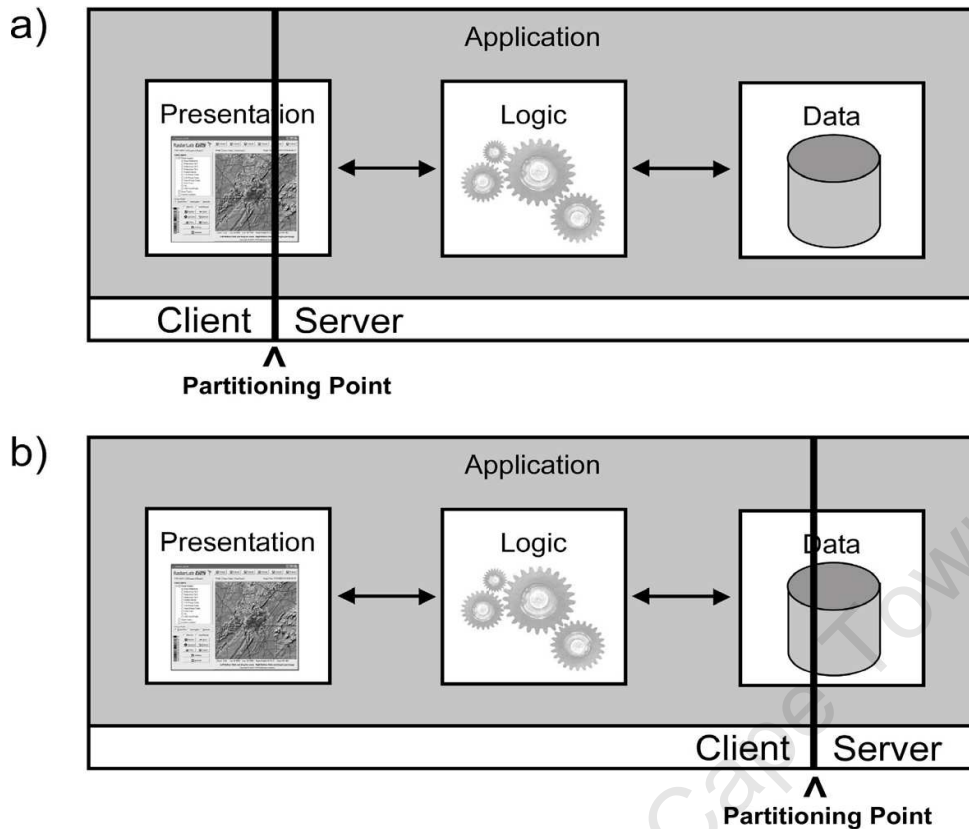


Figure 22 : The partitioning point differentiates between thin client (a) and thick client (b) or any position in between. (Keßler, 2004).

Since this research is oriented towards the communities at informal settlements, the former design was chosen with the main idea of minimizing the client processing and maximize server load and accessibility. This concept would facilitate maximum usability or in the other words, the system would be technically as ‘easy access system and fast in terms of performance’ (Peng and Tsou, 2003). In order to access the spatial information, the community user needs only to have a web browser and access to the internet. The user does not need to download any client’s plug-gins or applications, in addition to that, login is only needed for the Administrator interface but not the user interface. An outline of the UCT CSIS prototype system architecture is shown in Figure 23 and it present an overview of the ongoing efforts to improve the interoperability and compliance with the OGC. The system architecture combines open source software *FIST*, *Hypersilence* for E-register board and *site meter* for all online access statistics. Note the integration of a web server, map server, web mapping interface application, database server and web browser.



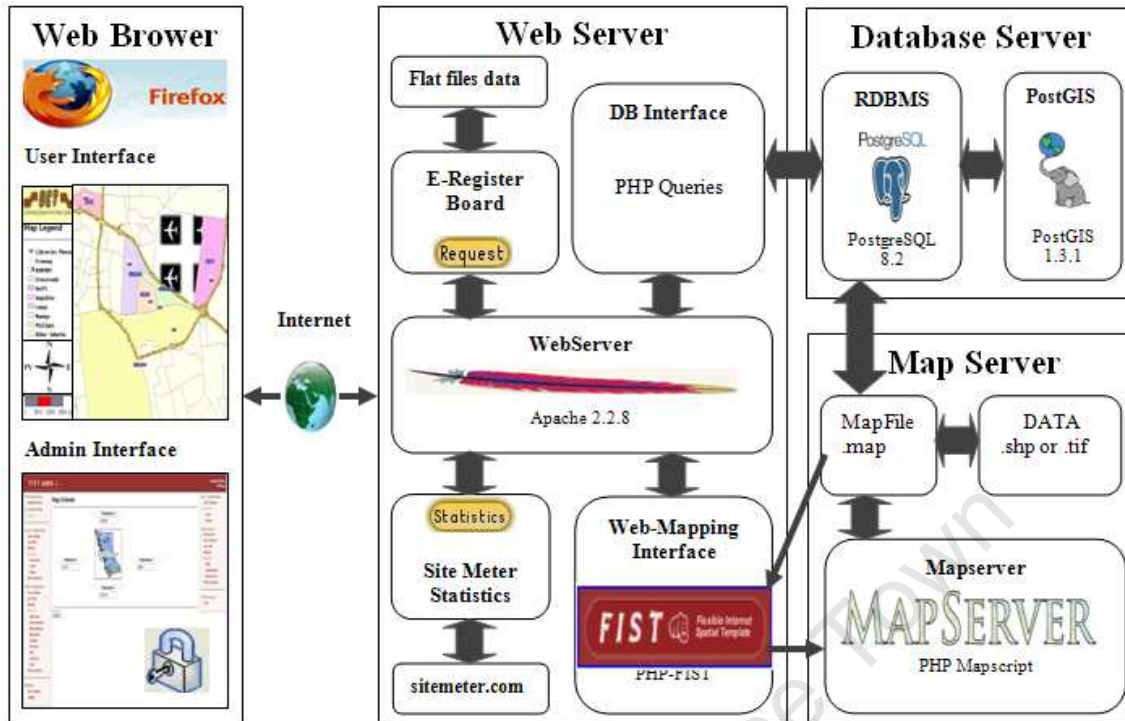


Figure 23 : UCT CSIS Prototype System Architecture, the thin client renders the web pages while the server processes and stores the data. E-register board and site-meter statistics connect only to Apache web server.

### 5.5.2 Database design structure

The database design structure is a main component that is associated with the prototype. The storage of spatial data such as roads, clinics, community libraries, reported problems and the support of their one-to-many or many-to-many relationships had to be mapped on the prototype. The user can manipulate (edit, delete or digitize spatial objects) the data published on the mapping interface without any worry of destroying it, this is because the data is connected to the relational databases and after every users session, the database server automatically refreshes itself.

The reporting tool stores the reports in a relational database. The report consists of fields shown in section 5.4.2 of the reporting form and additional database attributes that are automatically extracted from the submitted information. The data is entered by the user and once the submit button is clicked, the data is inserted into different tables shown by Figure 24. The table's

relationship enables the direct mapping of one-to-many relationships to the data structure, as well as the use of spatial attributes from spatial data types discussed in Appendix G.2.

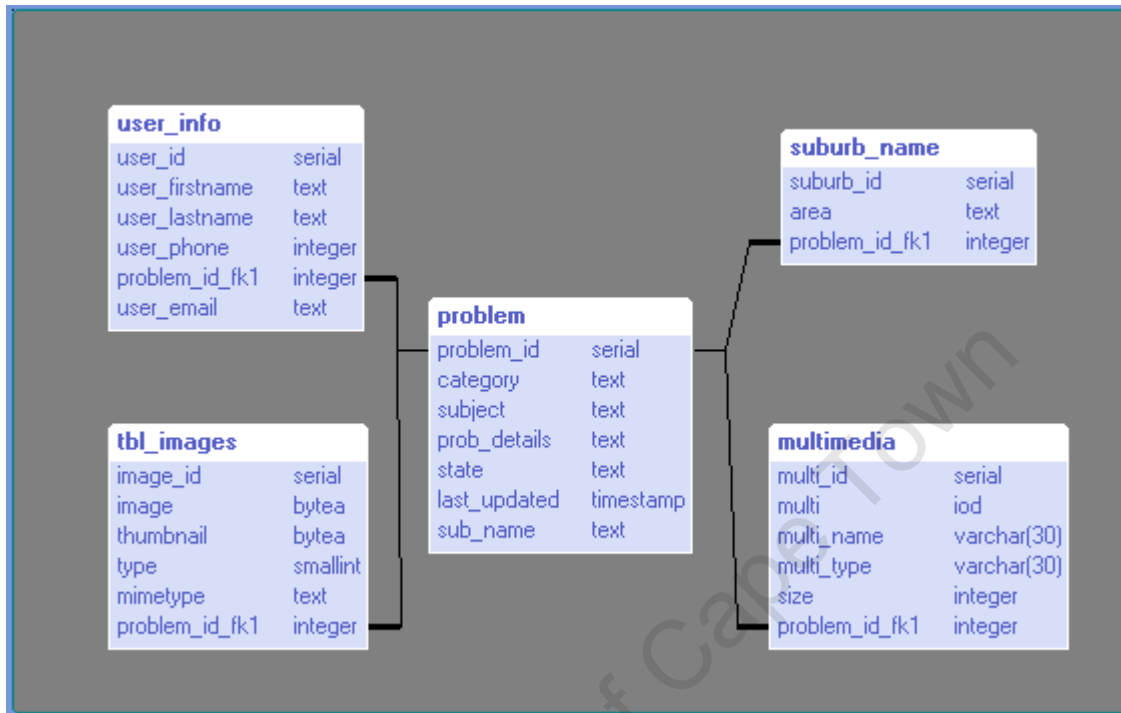


Figure 24 : Reporting tool database relations

### 5.5.3 Data and Hardware

The data used for the project is obtained from University of Cape Town GIS Research Lab. Refer to Appendix G.2 for spatial data and hardware specification that the prototype uses to run. The data used for the prototype was chosen with regard to users familiar map orientation and landmarks such as clinics, police stations and others features that they can locate very well when displayed on the map.

### 5.5.4 Conclusion

The main objective of this research was to implementation of user-friendly open source web-based GIS prototype system for spatial information access and test the usability and functionality of the system with the potential users at selected community libraries. Based on the first part of

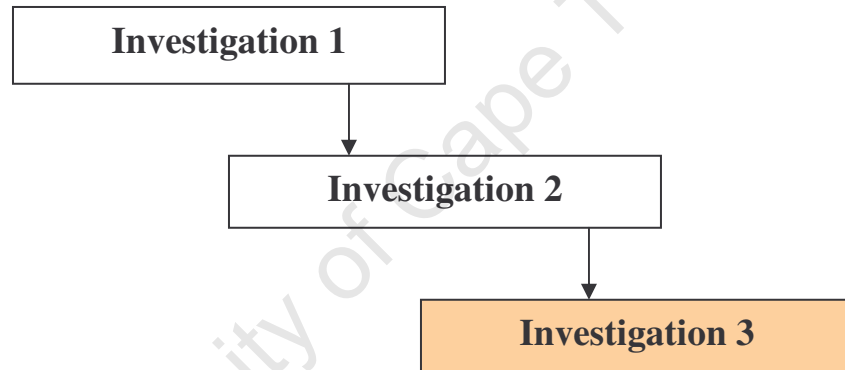
this objective, this chapter outlined the development of the prototype system, the system functionalities to be provided, the data model structure, as well as the technological tools used.

Using a combination of open source software, a web-based GIS prototype system intended to support interaction between municipality level and community level was developed. The web-based prototype is accessible and it is to be used at the community public libraries, it is also affordable as it uses open source software. The next chapter conduct usability experiments to satisfy the second part of the objective by determining if it may fulfil the needs and be accepted by the communities living at informal settlements.

University of Cape Town

# CHAPTER 6

## USABILITY EXPERIMENTS DESIGN



## **Chapter 6: Usability Experiments Design**

### **6.1 Introduction**

The usability experiments design of this research looks to test the usability of the system with the potential users at selected community. The experiments were performed after the implementation of the prototype and aimed to determine whether it can fulfil the users needs and if it can also be accepted and benefit the communities living at informal settlements.

This chapter also explains the rationale for the design of the usability experiments tasks chosen, discusses of the usability evaluation methodologies and the reason of choosing the methodology of the prototype test.

### **6.2 Investigation 3: Usability Experiments and Testing**

Simple data capture methods were used for the UCT CSIS prototype (for instance, the researcher was the prototype developer, coordinator, facilitator, and usability observer of the experiments), and the participants were recruited as they walked into the library to use Smart Cape Access Project workstations.

#### **6.1 Object**

- Community people living at Cape Town informal settlements.
- The City Council Access to Information Officer.

#### **6.2 Usability Evaluation methods**

- Observation (The observer stayed quite and recorded time taken to finish each task, noted errors made, user activity i.e. clicked map functions/icons to navigate the area).
- Post-questionnaire (the user read the question and registered the answers).

### **6.3 Usability analysis of software prototypes overview**

“Human Computer Interaction (HCI) is the study of how to design interactive systems that are both productive and pleasurable to use” (CSC2002S lecture notes, 2005).

HCI focus is not on what a system can do but rather on what people can do with it. Since the introduction of computers, the developers have been concerned how the machines and its software would be used (Sidlar and Rinner, 2006). These resulted in the concept of user engineering principles that went beyond programmer’s consideration as it incorporated iteration process that included paper prototyping, the production of prototype system, frequent testing and, the release of updated versions (Rosson and Carroll, 2002). As a result of this, usability engineering was formed. Rosson and Carroll (2002) state that initially, usability engineering focused on the design of the user interface but this principle has been extended to software engineering, in addition to that, Sidlar and Rinner (2006) emphasize that nowadays developers main concern is the user interface of the software.

From this theorem, this will determine how best to study the potential users of the UCT CSIS prototype system. Usually, systems are evaluated using different levels of controls, this led Kirkakowske and Corbet (1990) to categorise evaluation procedures into three types being:

- Naturalistic study,
- Quasi-naturalistic study, and
- Experimental study

According to Sidlar and Rinner (2006; 2007) explanation of the above three categories, Naturalistic studies provide realistically applicable results but, their research emphasis that in order to complete such a study, the investigator have to play a background role, and therefore collecting the required information to produce the desired results is a huge task which need a lot of resources. A quasi-naturalistic study uses a ‘real world’ context but is used with controls so that both evaluation and collecting of information are easier, and therefore a deeper investigation can be achieved. Finally, experimental studies use controls to focus on the independent variables that the investigators wishes to study, while mitigating variables that would cause errors in, or cloud the results, but occurs in the least ‘realistic’ context (Sidlar and Rinner, 2006; 2007).

## **6.4 Usability evaluation methodology**

Nelson (1993) state that it is important to realize that usability is not a single, one dimensional property of a user interface. Usability has multiple components and is traditionally associated with five usability attributes: *efficiency, learnability, memorability, error rate, and satisfaction*. The elements of usability by Nelson was applied by Chen *et al* (2007) to evaluate the web map zoom and pan functions of ten different interface design to facilitate their usage by the public. A similar study was conducted before by Steinmann *et al* (2004) where he conducted a qualitative expert analysis evaluating twelve PPGIS applications according to their usability, interactivity and visualisation, and performed comparisons between those from United State of America and Europe.

In addition to that, Wong and Chua (2001) investigated four beneficial aspect of the web-based interface that likely to aid the community participation as *low cost of entry, efficient data transfer, interactivity* and *connectivity*. Their research used this methodology to investigate the application of the InfoResource project created by the Center for community Partnership at the University of Pennsylvania.

Using a combination of the above two usability evaluation techniques, Sidlar and Rinner (2006; 2007) employed a quasi-naturalistic case study, the authors analyzed the usability of an argumentation map as a participatory spatial decision support tool. They focused on the general usability aspects such as *cost of entry, efficiency, interactivity, and connectivity* of the Argumentation Maps prototype. The combination trend was also applied by Zhao (2007) with a combination of both Nelson (1993) *heuristic evaluation* and *empirical user testing* for an empirical usability evaluation of a web-based public participation geographic information system and discussion forum through the use of a prototype system named GeoDF.

## **6.5 Choosing usability methodology**

With reference to Kirkakowski and Corbett's (1990) classification, this research project was designed as a quasi-naturalistic study. A quasi-naturalistic study was chosen on the basis that it allowed Keßler (2004), Sidlar *et al* (2006;2007) and Zhao (2007) to implement an Argumentation map prototype as a proof of concept, a web-based prototype that integrates a discussion forum and a simple mapping tool. With regard to the UCT CSIS prototype system, it consist of spatially referenced library photos for map orientation, spatial referenced reporting systems and access to spatial information request by using e-register board, where users will post a request to access any information held by the City Council.

The method chosen for investigating usability of UCT CSIS prototype system is similar to Sidlar *et al* (2006;2007) combination criteria of usability evaluation techniques. The UCT CSIS prototype usability investigation needs to be considered on two levels: the general aspects tool (UCT CSIS prototype system) and the specific functions offered. The general usability aspects of the prototype will be studied through investigating:

- Efficiency
- Interactivity
- Connectivity and,
- Intended users

Following a condensed version of the method employed by Wong and Chua (2001). The specific function of the prototype system will be analyzed by investigating the:

- Learnability
- Memorability, and
- Satisfaction from the usability tasks.

The usability aspects are explained below:

### **6.5.1 Efficiency**

Efficiency refers to the prototype system ability to fulfill its functions and objectives while taking minimal amount of resources, albeit time or hardware (Sidlar *et al*, 2006). In other words,



the prototype system should be easy to remember, so that once the user has learned the system, a high system user activity is possible.

### **6.5.2 Interactivity**

It is measured through the users questionnaire feedback on the responsiveness of the prototype systems.

### **6.5.3 Connectivity**

Refers to how easy it is for a user to access the prototype system. Being a web-based application, the potential users of the prototype system ultimately include anyone who has an internet connection or those who walk-in the community library to access it by using Smart Cape Access Project workstations. In order to support interoperability, the system prototype is designed from platform independent HTML and PHP programming language.

### **6.5.4 Intended Users**

In the formation of this usability study, the intended audience is kept in mind as our participants varied in background.

### **6.5.5 Learnability**

Learnability focuses how easy it is for a user to learn, understand and recognize the usefulness of the prototype or functions of the prototype (Sidlar *et al*, 2006). This factor must be analyzed in conjunction with the participants web-mapping experience, knowledge of internet and computer facilities usage from using Smart Cape Access Project.

### **6.5.6 Memorability**

It denotes how well a user is able to retain what he or she has learnt about using the prototype and re-apply this knowledge next time on another use of the prototype.

### **6.5.7 Satisfaction**

Is a broad category that encompasses both how the user felt while using the prototype, thus relating back to the learnability and memorability of the functions of the prototype and how the users felt the prototype facilitated its functions. In order to study satisfaction with the tool,

participation will be asked to rate their overall experience of the prototype system with a Likert scale from 1 to 5 with 1 being the lowest and 5 being the highest score on the questionnaire.

## **6.6 Usability Tasks**

### **6.6.1 Task 1:** Landmark Searching.

*“Can you find where you are on the map? Please use zoom and pan operations or other toolbar icons to assist in visualisation and navigation”*

Usability study of the UCT CSIS prototype system interface is important to communities at the informal settlement. The functionality of the prototype includes map navigation (four types of zooms and pan), layer management (switching of layers on and off), display of map labels (area names). In this research, the prototype system toolbar operation modes/functions will be selected as independent variables, i.e. pan mode, zoom modes and others. The toolbar operation will be tested independently to evaluate overall usability. The dependent variables are the usability measured by the user performance and subjective evaluation of the questionnaire.

**6.6.2 Task 2:** The usage of UCT CSIS prototype system encourages communities to report problems instead of passing them by.

*“Report, view, or update local community problems.”*

A user, who sees something broken in their own local area visits the site, uses the prototype system toolbar function to navigate to site area map and enters a short description and has the option to upload a document or photo of what is wrong. On clicking ‘submit’, the site publishes the problem for other users to view so that duplicates are avoided, and emails the system administrator with a copy of the report.

**6.6.3 Task 3:** Make requests in public to the UCT CSIS prototype system e-register board to access spatial information.

*“Using the UCT CSIS Access to Information request e-register board, post a request to access any information held by the City of Cape Town.”*

To help communities to find out inside information about what the City Council is doing as their motto says *“The city that works for you”*. The e-register board guest or registered users are able to choose the City of Cape Town Directorate that the users would like to find information from, and then write a brief note describing what they want to know. The response is automatically published on the website for the requester and anyone else to find and read

### **6.7 Usability experiments and experiments setup**

Refer to the Appendix D.3 for the usability experiments and setup for this research. The test procedure is discussed on Appendix D.2.

A simple method of quasi-naturalistic observation was done at the community libraries by watching users as they completed timed tasks and the facilitator evaluated them as they performed operation (see Appendix D.5 and D.6). The users were silently observed and no comments or questions were asked during the testing process so as to factor out any bias effects.

The questionnaire was designed for subjective evaluation of the interface experimental usage. The questionnaire sections or tasks were completed on a Likert scale being rated from 1 to 5, with 1 being strongly disagree, 3 is if the user is neutral/impartial and 5 being strongly agree. See Appendix D.1 for post-questionnaire.

### **6.8 Conclusion**

The chapter presented the design of the usability experiments for evaluating the prototype system and it also concludes the path of the investigations mentioned on the research framework. The experiments aimed to determine whether or not the prototype will benefit the communities, whether or not the prototype will enable participants to express their opinions more effectively and finally to evaluate the satisfaction and user acceptance of the prototype system.

The chapter reviewed the literature of the usability analysis of software prototypes, usability evaluation methodologies and the reasons for choosing it. The author presented the four general aspects and three specific functions for analyzing the usability evaluations of the UCT CSIS prototype. The usability aspects were analyzed by performing the usability tasks and observation methods. In the next chapter, the results and the analysis of the usability experiment are presented to measure whether or not the research hypothesis was correct.

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# **CHAPTER 7**

## **RESULTS AND ANALYSIS**

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## **Chapter 7: Results and Analysis**

### **7.1 Introduction**

This chapter present results and the analysis of the usability experiment based on the criteria discussed on section 6.5. This chapter present the qualitative and quantitative analysis of results based on the information collected during the experiment. The results include the task times at each community library, participants observation, user satisfactions rating of the post-questionnaire, user opinions and post interview of the access to information officer.

### **7.2 Analysis**

The survey population was selected from the Smart Cape Access project users as they walked-in the community libraries. There were 43 participants who took part in the survey. The post-questionnaire data was coded on notepad as an input for Civil Engineering course evaluation software which provides descriptive statistics from participants responses (such as minimum/maximum participants averages, and the average/percentage of each answer). This was helpful because it reduced the effort for data entry and data preparation. Online statistics was hosted by independent service providers being <[www.sitemeter.com](http://www.sitemeter.com)> for UCT CSIS website activities and users site summary (Appendix D.7).

### **7.3 Task Time**

Figure 25 shows the time taken for each task at different community libraries, some libraries section 1(background information) task times were below average time except Langa library where the time was 0:37:28 hrs more than its average time of 0:28:18 hrs. This might be due to the different number of participants surveyed compared to other libraries, Langa library has 8 participants survey while the rest of other libraries had 7 participants.

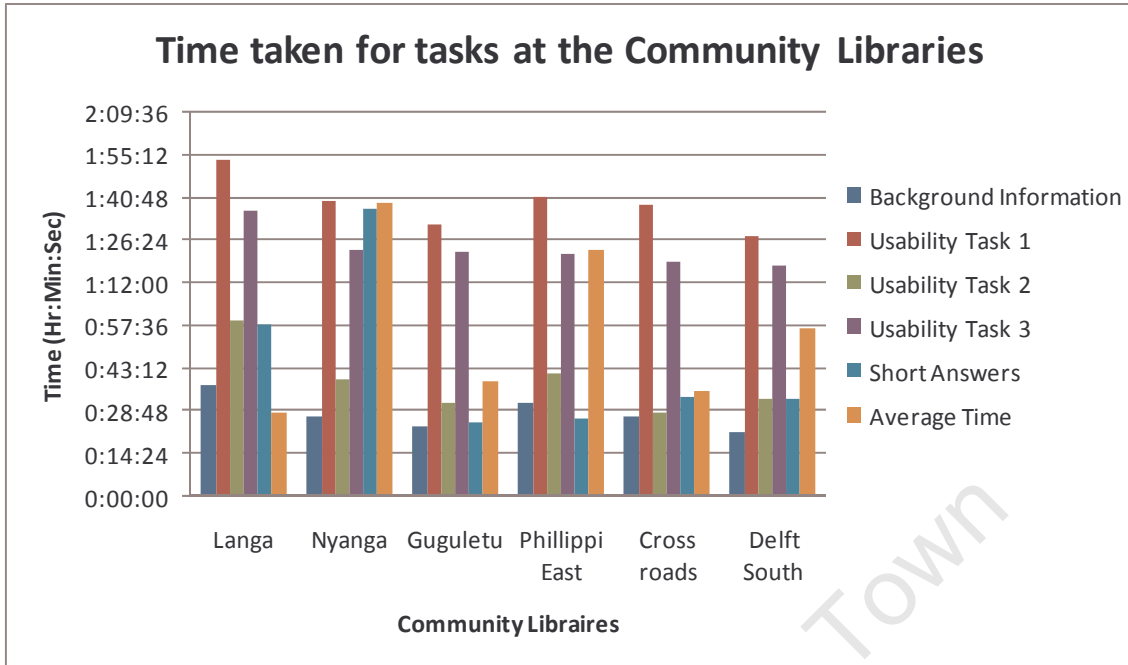


Figure 25: Time taken to complete each task at different community libraries.

The times were computed using the time calculator from [www.timecalculator.com](http://www.timecalculator.com), and its advantage is that it can handle time multiplication and additions.

#### 7.4 Observation Method

The observation process was to identify subject activities during the course of the experiment. The instances were listed as subject problems and technical problems on a form (Appendix D.5). The observer marked either “YES” or “NO” answer according to the participants action. Table 3 shows the cumulative results of the observation results.

<b>Subject Observations</b>	<b>Yes</b>	<b>No</b>
<b>Subject Problems</b>		
Don't know where to get started	38	5
Map toolbar navigation (zoom/pan)	41	2
Confused between mouse events	14	29
Tab navigation (Layer, Legends, About)	42	1
Sending a report	34	9
Accessing requests	43	0
Drawing Polygon, Lines and Points	21	22
Pressing wrong icon on the toolbar	11	32
Layer selection	29	14
Spatial Library photo displaying	40	3
<b>Technical Problem</b>		
Spatial server crashed	6	37
Slow internet connection	28	15
<b>Total</b>		
	347	169
<b>Percentage</b>		
	67.2 %	32.8 %

**Table 2: Frequency table of overall subject's observations.**

### **7.5 Usability results and analysis of the Post-Questionnaire**

The usability response of the post-questionnaire was evaluated by using the Civil Engineering student's course evaluation software, the raw data of the results is on Appendix D.4 and Figure 26-29 represents the computed statistics of the questionnaire results.



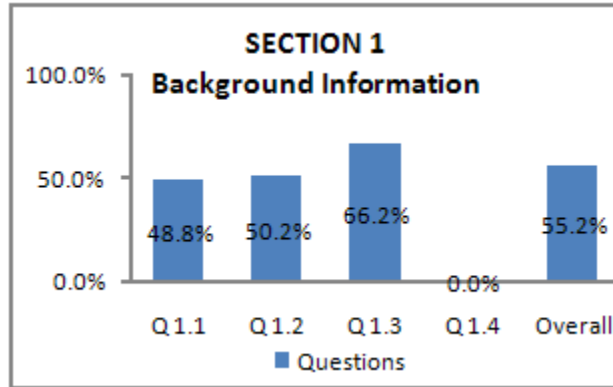


Figure 26: Background Information

Section 1 of the post questionnaire surveyed the background user information, the survey results depicted participants technical experience on using web-mapping applications, their knowledge of geography and awareness of the requesting information from the City Council. Figure 26 indicated that 66.2% of participants were aware of the access to information from the city council. The technical experience and knowledge of geography (Q 1.1 and Q 1.2) were below 55.2% overall average for communities who tested the prototype at the libraries. Q 1.4 which was to identify different number of participants who tested the prototype at each library was not evaluated but the same results were obtained by Table 2.

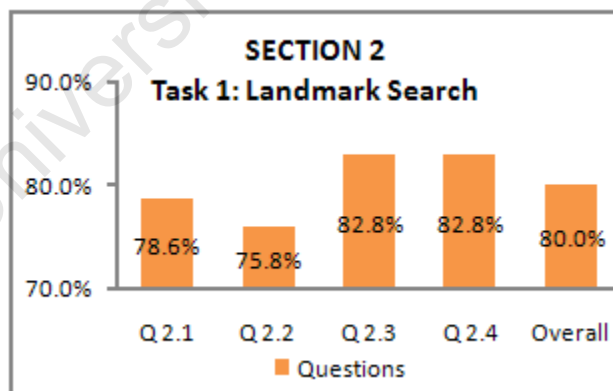


Figure 27: Usability Task 1

Task 1 required participants to search for a landmark on their familiar location, participants had to find their current location on the map. The participants managed to find their locations with the aid of other visualization and navigation function tools provided by the prototype. With regard to the functional tools, the survey indicated that 78.6% of participants understood the

purpose of toolbar icons they used regardless of the hint that appeared when a mouse was moved on top of the icon. Figure 27 showed an average of 75.8% participants matched the pan icon/function to their cognition. Even though they correctly matched the pan icon/function as utilized in web mapping applications, the result is below 80.0% of overall percentage. Both question 2.3 and 2.4 showed an equal percentage of 82.8, this indicated that participants found it easy to use the zoom function and the tool tip for information about the toolbar functions.

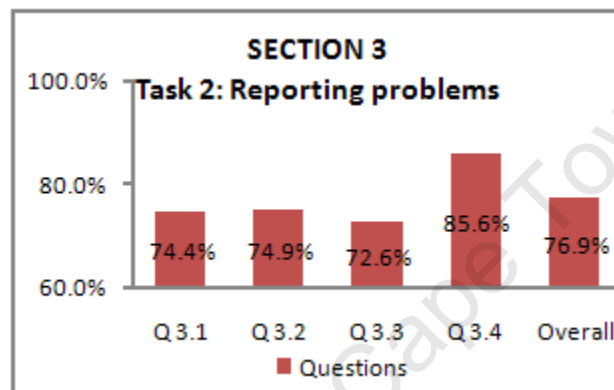


Figure 28: Usability Task 2

Task 2 required participants to use the prototype system to report problems around their area. An average of 74.4% participants felt empowered after using the system and an additional 0.5% from empowered participants found the prototype easy to use to make reports. A lower average percentage indicated by Q 3.3 showed that the participants did not find the usefulness of the statistical information provided by the system. Figure 28 showed that 85.6% participants liked the idea visualize spatially referenced community library photos for map orientation

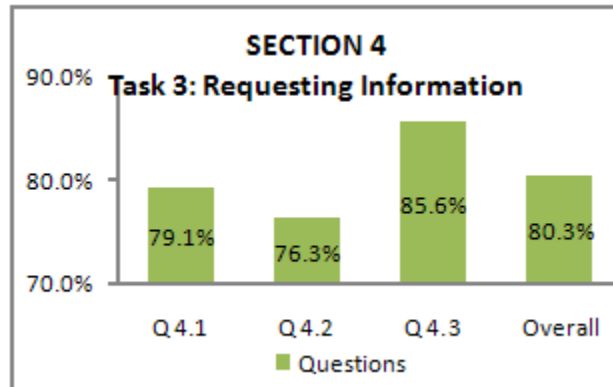


Figure 29: Usability Task 3

Figure 29 illustrate the results of usability task 3, An average of 79.1% indicated participants understood the purpose of a tool to requests access to information in public by using prototype system e-register board while 76.3% learnt the City Council department structure and how it serve its communities. The satisfactory level of 85.6% was depicted by community participants who tested the prototype at the selected libraries.

As mentioned in the previous chapter that the usability of the UCT CSIS needs to be considered in two level being: the general aspects tool (UCT CSIS prototype system) and, the specific functions offered. The analysis is as follows:

### 7.5.1 Efficiency

The efficiency of the UCT CSIS prototype system can be understood in two ways. Efficiency can be measured via a qualitative analysis of the posted e-register board requests, as well as from the user feedback. As previously outlined on chapter 1, the aim of this research was to investigate the use of prototype system for spatial information access and report spatial problem. Looking at the Access to Information e-register board, Community Development Directorate, the Department of Library Service (Appendix G.1) had couple of replied topics by a number of different participants, this could be thought of a being more popular than others with fewer or no replies. This can be assumed as participants required to know more information about issues pertaining to community libraries as their work environment or simply because this research was tested at the community libraries.

An analysis of user feedback from the post-questionnaire showed a different trend of results. The participants outcome indicated that Figure 29, question 4.1 and 4.2 which inquired about how difficult or easy was to post a request and learn the City Council structure showed below average mean compared to overall mean of 80.3%. The average mean percentages of the said questions are close to each other, it can be assumed that participants might have been tired of taking the survey and they were not concentrating as they did from previous tasks. Some commented that it was too much effort to place a request from task 3 specification when they had nothing in mind during the test. Another aspect of efficiency was that section 5 results of the post-questionnaire (see Appendix D.10) which required participants to complete their opinions on their own hand writing was kept concise and on context of the study.

### **7.5.2 Interactivity**

Interactivity of the prototype system by the participants was elicited by the use of task assignment of the post-questionnaire. Looking at the post-questionnaire statistics, question 4.3 which inquired about the overall enjoyment of using the prototype system shows that 85.6% participants on average enjoyed interacting with the UCT CSIS prototype system. Participants commented that they liked the way the prototype system showed a well orientated map location which they are familiar with. Their comments outlined that this made it easy for them to find their landmark question easy to answer at the beginning of task 1, all of them register “YES” answer. Another participants noted that the map can be useful to locate other map features that users would want to use it for besides the questionnaire tasks, the ability for them to add more map layers for school, police and fire stations was amazing a most of them said that they did not know most public service offices that are nearest/closest to them regardless to the area they reside in.

### **7.5.3 Connectivity**

UCT CSIS prototype system is a web-based application and can be accessed from anywhere where there is an internet connection. In order to support platform compatibility, the application conforms to the OGC reference and it is interoperable to other applications. It uses HTML language, PHP language and java scripts. The internet speed at most community libraries was

found to be slow, a common outcry in South Africa because of Telkom broadband monopoly, Table 3 of the observation report shows that 28 participants had a slow connection to the prototype system loading compared to 15 participants. In contrast, it was observed that the Access to Information e-register board was processing information quickly compared to the map area user manipulation. This is due to the reason that the e-register board uses the flat file format to stored data while the prototype system uses database connected over the network. The loading of files was improved by increasing Apache web server uploading session time but the situation did not help when most Smart Cape Access Project users are also online. Instantly, the situation will lead to the spatial server crashing and it was experienced by 6 participants compared 37.

#### **7.5.4 Intended users**

The UCT CSIS prototype system purpose is to investigate access to spatial information through a prototype implemented for Cape Town communities living at informal settlements. The main users are the communities at the informal settlements and during the formation of the usability study, the intended audience was kept in mind as our pre-questionnaire results varied widely in the technical background. The background information from section 1 of the post-questionnaire showed that question 1.1 and question 1.2 which inquired about usage of web maps and the level of geography/GIS knowledge level are below the overall average percentage of 55.2, contrary to the lower percentages, question 1.3 has a higher average percentage of 66.5 than the overall percentage, this question inquired about the awareness of making information requests from the City Council. This outcome contradicts with part 2 findings of the community service delivery during the pre-questionnaire. It can be argued that it might be due to using different participants for pre-questionnaire and post-questionnaire, the background information from the post-questionnaire did not inquire about the general education level of participants and their demographic information due to ethical consideration which could have given more significant outcome and reasoning.

### 7.5.5 Learnability

Looking at section 1 (Figure 26) statistics of the post-questionnaire, the participants did not have experience with web-based applications when they started the usability tests and their geography/GIS knowledge rate was below the overall average percentage. It can be estimated that the time they took to finish all the tasks was part of their learning experience. The expected time for the assigned tasks was 30 minutes but some participants took approximately 46 minutes as maximum time while others took 12-15 minutes as minimum time, this variance in time is not clear if the expected time to learn and perform the tasks was too short or long.

In the web mapping context, it is a common practice to put the tool functions on their spatial-related position that correspond to their usage, for example, the toolbar icons is embedded with the zoom initial, then zoom in/out , then pan and other tools consecutively. The functions tools are categorized according their basic functionalities and their spatial analysis capability (Chen *et al*, 2007). Although some developers or experts may argue that they can learn easily because the tool hint is provided when users hover the mouse on top of the tool or by trial-and-error. According Norman (1988), different conceptual models are formed during the process that may mislead users about the way the functions work, for example, a conceptual model of panning is to use a function with a *hand* icon as a pan function. It hints the users that they can move the map by dragging it with the hand, users usually click and hold the mouse to match their cognition. In contrast to that, users who just started to use mapping applications can wrongly interpret the pan icon as a cooking utensil. This lead to Harrower et al (2000) interesting finding on the learnability of a geographic visualization tool to support earth science learning, the author found that for users to understand the purpose of a tool and for users to recognize when it is useful to solve a problem are totally two different issues. With regards to these findings, it will be too early to say that the participants have learnt the prototype system. The learnability aspects might hold after observing the system usage statistics (site statistics) for a while.

Looking at the Task 1 of the post-questionnaire, question 1.1 and question 1.2 evaluated the toolbar functions of the prototype system, both their mean values are less than the overall mean of 4.00. This might mean that inexperienced participants had cognitive confusion of pan function (question 1.2) and the subject observation table shows that 14 participants were confused by the

mouse events when operating the toolbar function. The research assumes that the learnability aspect was not achieved from this experiment design.

### **7.5.6 Memorability**

For this research to test memorability of the participants, the participants needed to take some time away from the prototype system. Due to the nature of how participants were recruited to participate, it is not guaranteed that the study will get the same people when the next testing phase takes place with the same prototype system but excluding the briefing sessions. No contacts or information were taken from the participants because of the ethical reasons agreed by the University Ethical Committee. The other options are to investigate this aspect is to look at the site meter statistics and e-register board for user activities at another time for further statistical analysis.

### **7.5.7 Satisfaction**

The satisfaction aspect of the usability testing of the prototype system was investigated using task 4, question 4.3 structured as “*Overall I enjoyed using the prototype system*”, the participants indicated that they enjoyed using the prototype system, the average satisfaction rate was 85.6% compared to the overall rate of 80.3%. This gives an assumption that participants appreciated and saw a benefit of systems that can help communities at informal settlements to access to spatial information. One of the participants sent the Author an email, it can be assumed that this is an indication that the participants accepted and benefited from the prototype system.

## ***7.6 Post Interview with the Information Officer***

The Access to Information Officer appreciated the demonstration of the prototype system that is aligned to the office work (see Appendix G.4), the officer was satisfied with the information published on the prototype as it was accurate from the section 14 manual that the City Council uses. When asked about the way forward for processing access to information requests, the officer emphasized that the City Council is interested in using a computer system of this nature to give access and plans to revamp their traditional procedure is on the way as they are still holding meetings to decide on system specification.

The officer outlined that for the important functions on the system, they look for a similar to the UCT CSIS prototype but they want have more control and to monitor every activity of the system. The officer said they are planning to collaborate with other City Councils in South Africa like Johannesburg which is more advance on using IT systems to give access to information. Finally, the officer said that the system that will aggregate all the City Council information and a system that can be used by anyone would be important the City Council. The officer invited the Author to make presentation to other staff members in the department and from this, it can be assumed prototype system the officer realized the benefit and its usefulness of the prototype.

## ***7.7 Conclusion***

This chapter presented the findings of the usability investigations of the UCT CSIS that were considered in two levels usability aspects being the general aspects and specific functions. The results of the usability tasks and observation methods were presented, discussed and analyzed through the levels of the usability aspects. The Post-Information Officer interview is also interpreted after the prototype system was demonstrated.

The next chapter finalizes the research by briefly concluding the research objectives, answering the research questions and also provides recommendations.



# **CHAPTER 8**

## **CONCLUSION AND RECOMMENDATION**

University of Cape Town

## Chapter 8: Conclusion and Recommendation

This research associate Promotion to Access to Information Act (PAIA) and GIS at a grassroots level. This chapter concludes the research report by summarising the investigations carried out to achieve the research objectives and answer the research questions. It also provides recommendations of future research studies.

### 8.1 Conclusions

The results of the research experiment revealed some information about the usability of the web mapping interface and the ability to be used to access to information and reporting problems through the usage of UCT CSIS prototype system. This research has illustrated that through information sharing and access, GIS has the ability to help communities at informal settlements to report issues of concern and also it helps communities to learn and know how the City Council is serving them. Collaborative communication and collective efforts can achieve this live wire and hence improve the standard of the human environment at the informal settlements.

The summary of the main findings is reviewed under the specific objectives of this research:

#### Objective 1:

*To investigate the procedure that is used to give access by the City Council and identify user requirements of spatial information access from the communities at the informal settlements.*

*This will enable the research to identify better means give access to spatial information.*

The first investigation was conducted with pre-questionnaire survey at the community libraries and interviews from City Council officers on a fact finding mission to determine factors that hinder spatial information access and reporting of locale problems. From the 6 libraries chosen, 48 people were surveyed randomly as they walked in to the libraries. This stage of research also

strived to bring a better technological solution to them by eliciting the user requirements that defined the design of the prototype. The survey also identified community computer usage abilities at the libraries and their experience towards the use of internet.

The interviews were conducted to investigate the procedure used by the City Council to provide access to information to the public, process of reporting locale problems and to inquire about any existing systems. The interviews of the previous access to information officer and the current information officer outlined the procedures that are used to give access to any information while part 2 of the pre-questionnaire elicited community service delivery issues. At the present moment, the City Council uses the manual process to give access to information, the requester has to visit the City Council premises and make a request in a prescribed form and submit to the officer. If the request of the information is automatically available at the office, then the information is disclosed instantly hence if not, the officer has to process the application for the request with reference to the section14 manual document which takes a duration of 30 days.

The investigations brought the web-based technological solution instead of the current manual process and it widely reaches greater audience where users can view previously requested information, reported problems with different attachments and also participate on the process.

The Pre-questionnaire survey achieved the following goals

- Identified the user requirements of the important functions to be implementation through technical and community service delivery analysis.
- The technology strategy of the prototype system to be developed, i.e. the use of Internet and open source software at the community libraries.

#### Objective 2:

*To develop a prototype system with web-based mapping capabilities to be used by low-income communities.*

The UCT CSIS prototype system provides the web-based mapping capabilities and geospatial data services, the outcome of the system development from investigation 2 showed that the prototype development was guided by OGC standards (<http://www.opengeospatial.org/>). The selection criteria of the open source software application is commonly used by other developers and this research used best practice method of system development life cycle (see Figure 11).

The access to information e-register board allows participants to register or use the board as guests, but guest's users have a limited functionality to search and viewing top 25 users of the e-register board. The board provides open access without any authentication to any user but they have to abide by the terms of service. The users can also find out what problems other communities have reported. As the users send reports, the email message is automatically sent to the system administrator for notification of new reports. The users can examine the spatial datasets by using other functional tools provided on the prototype interface toolbar. They can also digitize data online (see Appendix G.5), save it and open it on the next session of their prototype visit or upload it to support a problem description for a locale report.

#### Objective 3:

*To provide dynamic and interactive user interface that can be easily used by communities at informal settlements.*

The results indicated that the satisfaction rate of using the UCT CSIS prototype system was 85.6% compared to 80.3% of overall rate. Apart from having to experiment with a system of this kind for the first time, the satisfactory rate indicated that participants used the tool and its functions with ease, this was indicated by the usability results and analysis of the post-questionnaire tasks and Appendix D.9 for UCT CSIS prototype system user feedback e-mail. The provision of camera and airport symbol, thematic data layer colouring of well known landmarks also helped users orientation on the map.

#### Objective 4:

*To permit dynamic link between geo-databases and maps so that data updates are automatically reflected on map and to permit interactive queries of information contained within the map.*

The UCT CSIS prototype system map area data is linked to PostgreSQL/PostGIS database and Shapefiles. The available Porthole reporting tutorial is an example that proved that PostGIS has editing capabilities and the availability of context XML tag configuration enable participants to edit the displayed PostGIS data layers using the eleven editing tools without any fear of destroying the data. The prototype system has embedded SQL statements on PHP files to retrieve non-spatial and spatial data from the PostgreSQL/PostGIS database to be displayed on the statistics webpage. For interactive queries, participants selected a button or tool function from the tool bar, drew a point or rectangle on a map area and the outcome is displayed on the sidebar frame of the UCT CSIS prototype system.

#### Objective 5:

*To provide statistics of the prototype system activities to the users.*

The statistics webpage displays statistics of site activities (visited and viewed pages) and study area reports (new/old problems and recently/old fixed problems). The study area reports showed the reports update (received report per week, month and total reports) while the site statistics provides detailed information about users visits (Appendix D.7). The statistics webpage shows documents and pictures of reported problems like potholes (tutorial link provided on the statistics webpage), broken paving slabs, saved map sessions and graffiti with just one click of a computer mouse. The statistical reports are presented on different formats such as pie charts, non-attachment section, photos section and documents section.

### Objective 6:

*To evaluate usability and user acceptance of the prototype with the potential users at selected community libraries.*

A combination of usability engineering principles which were previously used by Sidlar and Rinner (2006; 2007) was adopted to evaluate the UCT CSIS prototype system. The usability experiments conclude the path of the investigations and were analyzed with usability evaluation methodologies from two perspectives: on a general overview of the tool and on a functional level. When considering the general aspects of the tool, its usability from participants at community libraries were high and the specific functions was satisfactory. This answers the second part of the research question “*Can it be accepted by communities living in the informal settlements?*”

To summaries these conclusions, this research achieved the following:

- It demonstrated a prototype system that can be used as an alternate solution for information access and report locale problems for the communities at informal settlements. The functionality of the tool was evaluated through the first investigation. The second and third investigations were geared toward analyzing the usability of the prototype.
- It showed that a combination of free and open source software (FOSS) can serve at a community level with a cheap and easy to use prototype system and,
- Finally it proved that even though GIS applications are perceived to be complicated, a combination of usability engineering principles and participatory process can address the usability issues of technologies implemented at communities through a strategic planning and good research methodology. Moreover, training of the public about GIS applications is still needed in order to consistently attain high number of continuous usage of the prototype systems and build capacity.

## **8.2 Lesson learnt**

There were few setbacks that delayed the development of the prototype system which affected the system rollout plan. The frequent upgrades of the MS4W version resulted in the system being changed often and the commencement of the Free and Open Source Software for GeoInformatics Conference (FOSS4G2008) in Cape Town boosted the system stability as more insight was gained from open source software developers.

Working with people at the communities is challenging, verbal communication was the integral part to request users to participate in requirements elicitation of the project. Language barrier was realised when approaching and interviewing people at the communities as English is not their first language, majority of them preferred their mother tongue as a means of communication. To interact with the communities, I realised that there was a need to learn basic local language (Xhosa) for communication purposes.

## **8.3 Recommendations**

This research recommends that:

- The analysis of the pre-questionnaire were used as a basic guide for implementing user requirements functions of the prototype, the information obtained can be used in future research towards prototype designs for systems to be used at informal settlements.
- Further analyses could have been performed if there were larger population sample size, categorized according to age groups, gender, participants occupation and contact information so that other variables can be controlled and analyzed. If contact information was taken from participants, the same participants could have been used for pre and post questionnaires and other usability aspects such as momerability could have been assessed.
- The further development of the prototype should be continued but it should focus on high-level functional requirements derived from community involvement process. It is vital that the development strategy makes best of the limited resources. Open

source GIS technologies are recommended to be exploited for the full pilot system but OGC standards should be maintained all the time.

With regard to observations at the selected community libraries, educational awareness campaign about access to information should be done more often so that more people know the procedures that are used to access information. Besides new user requirements functions which should be added to the prototype in the future, the development should also aim at improving performance. The Internet speed needs to be improved at the public community libraries so that users do not wait for a longer period while the prototype system is loading. This research discovered that optic fibre cables for improving the Internet speed were still being installed at the libraries during the course of the research investigations.

Finally, increasing more computers and session time at the public community libraries is imperative and will result in an increased usage of the prototype system. As outlined in task time analysis, users firstly completed other tasks on the computer and then browsed the internet towards the end of the 45 minutes session allocated by the library administrator. If the session time is increased, users will have enough time to learn and explore other functions of the prototype system which were not covered by the usability tasks.

The research has demonstrated that it is possible to implement a system as described in the hypothesis. The usability findings and observations provided answers and evidence that web-based open source GIS software can be used for access to spatial information and for reporting locale problems at informal settlements. The research showed the significance of public spatial information systems built with user involvement process and applicable usability methodologies benefited low-income communities and lead to high number of system usage.



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# APPENDIX

University of Cape Town

## Appendix A

### Overview of the status of Real Access in Cape Town's communities and organizations by Bridges.org's Real Access/ Real Impact research in 2002.

Factor in Real Access to ICT	Communities	Organisations and businesses
<p><b>Physical access to technology</b></p> <p>Is technology available and physically accessible?</p>	<p>Communities have low access to PCs overall, and Internet use is also very low. Although Telkom has met its national rollout obligations during its five-year exclusivity period, the trend of increasing access to fixed line telephones is being reversed by rates of disconnection as high as 50-70%. Respondents reported greater access to cellular telephones than to fixed line telephones. Public access to connected computers is increasingly available in schools and libraries. Community access points are rare and cover only a small portion of the population. Although libraries, post offices, telecentres, and Internet Cafes have shown promise in giving people access to ICT, they have not yet managed to do so to large sectors of the community. Even where computers are available for public use in a local community centre, the majority of respondents were not aware that they have local, public access to computers.</p>	<p>Most organisations have basic access to PCs, faxes, and telephones. However, some CBOs and SMMEs do not have PC access. Some organisations that lack ICT see public access as an option. Although NGOs often have access to ICT, their effective use of the technology is severely limited by the lack of access among their clients and other organisations that they work with. Local Government is one of the main users and owners of ICT. Approximately two-thirds of the organisations interviewed have access to the Internet. Cape Town's three universities are all currently in the process of expanding their computer resources for use by staff and students alike.</p>
<p><b>Affordability</b></p> <p>Is technology affordable for people to use?</p>	<p>Overall, fixed line and cellular telephones, computer hardware, and Internet access are simply too expensive for most people in Cape Town's poor communities to use regularly.</p> <p>Charges for fixed line telephones are based on non-competitive pricing structures set by Telkom, the incumbent telecommunications provider. Telkom's new prepaid service offers promise to help people afford basic telephony.</p> <p>Low-cost prepaid phone cards have helped put cellular telephones within the reach of more people, if only to make the telephone available for receiving calls.</p>	<p>Overall, organisations feel that the benefits of ICT outweigh the costs. Although the SMMEs surveyed acknowledge the importance of ICT and the fact that it would give them a competitive edge to their businesses, most reported that high costs prevent them from buying equipment, training their staff, and paying telephone bills associated with Internet use.</p> <p>Even larger businesses and major NGOs indicated that Internet access costs are a major constraint to increased ICT use. The threat of theft is another problem that affects all of Cape Town's organisations, but especially SMMEs and CBOs located in economically depressed areas. The high cost of installing security adds another factor to an ICT purchase. The cost of training was cited as a reason why organisations cannot develop the capacity needed to start using ICT. Many organisations call for government-subsidised training courses.</p>
<p><b>Appropriate technology</b></p> <p>Is the technology that is available appropriate to local needs and conditions? What is the appropriate technology according to how people need and want to put technology to use?</p>	<p>The majority of people in Cape Town's disadvantaged communities lack electricity or a secure location to keep a computer in their home; so personally owned PCs are unlikely to be the most appropriate technology for them. However, that does not mean that they cannot participate in the information society.</p> <p>In light of current technology developments, more appropriate ICT options in the future will include handheld computers and public access points, and more effective use of cellular telephones, television, and radio, including for Internet access.</p> <p>There are numerous initiatives and organisations involved in promoting the use of open source software and "thin client" technology in the computer laboratories of schools and community centres.</p>	<p>There are many organisations in Cape Town that use ICT in new and innovative ways to meet specific needs, which could be replicated.</p>
<p><b>Capacity and training</b></p> <p>Do people understand how to use technology and its potential uses?</p>	<p>Overall, professional level training seems to be linked to employment, but basic ICT skills are far less in demand and there is a glut of unemployed people with low-end ICT skills.</p> <p>Low overall access to ICT among the unemployed means that trained people lose their skills because they cannot practice them.</p> <p>Cape Town has at least 120 private ICT training programmes. However, most of these programmes are in Bellville and the central city, with a severe lack of training centres in outlying and isolated</p>	<p>Many of the organisations surveyed have provided training to their staff members.</p> <p>Larger businesses and major NGOs tend to train their staff to higher levels of computer use than do SMMEs or CBOs.</p> <p>Overall, there is a lack of high-level ICT skills in Cape Town. The greatest demand among the City's businesses is for high-level technology skills, professionals, and teachers.</p>



	<p>areas.</p> <p>Most training programmes that serve township communities are locally organised, informal, and of unverifiable quality.</p> <p>There is a need for accreditation for ICT training programmes.</p>	<p>There is also a need for learning environments in the workplace, so that employees have the opportunity to practice their ICT skills regularly so that they are comfortable and effective in using the technology.</p> <p>In terms of capacity to imagine the possibilities for how they could use technology to improve what they do, Cape Town's organisations have shown vision.</p>
<p><b>Locally relevant content</b></p> <p>Is there locally relevant content available, especially in terms of language?</p>	<p>Although there are many efforts that generate information and content that is relevant to people in Cape Town, very little of it is disseminated electronically.</p> <p>Local Government information and forms made available as online resources offer promise as an incentive for Cape Town citizens to use ICT.</p> <p>Many community access points have noted the lack of locally relevant content as one of the key factors that limits the Internet use in the communities where they operate. Making information available in local languages would also be beneficial, but remains a secondary consideration.</p> <p>The predominance of English in online content may limit widespread interest in and use of the Internet among non-English speaking populations. High levels of illiteracy are probably a greater hindrance.</p> <p>Initiatives are starting to emerge in South Africa that will foster the development of local language content in electronic formats, especially in the education area.</p>	<p>There is a lack of up-to-date information about the City and its services.</p> <p>In particular, businesses want more information about the City's tendering process and policies for black empowerment.</p> <p>More and better online entrepreneurship support is needed.</p>
<p><b>Trust in technology</b></p> <p>Do people have confidence in and understand the implications of the technology they use?</p>	<p>The majority of respondents feel that Internet transactions are very safe. However, given that most have never used a computer, the level of trust reported could be misleading. It may be reflective of the fact that people do not understand the security and privacy issues at stake.</p>	<p>The organisations surveyed have confidence in ICT and are ready to use computers and the Internet for paying accounts and making purchases.</p>
<p><b>Integration into daily life</b></p> <p>Is technology use a burden to people's lives or does it integrate into daily routines?</p>	<p>Those who use PCs find them to be very useful, and easy to use.</p>	<p>There is a small segment of well-resourced, often larger, businesses that use ICT as an integrated part of their work. The same can be said of the major NGOs, albeit to a lesser degree. However, small businesses and CBOs struggle to integrate ICT seamlessly into their operations, because of equipment failure, lack of technical knowledge, and theft.</p>
<p><b>Socio-cultural factors</b></p> <p>Are people limited in their use of technology based on gender, race, or other socio-cultural factors?</p>	<p>Respondent computer users are disproportionately higher income, educated, and "Coloured".<sup>(3)</sup> (There were not significant enough numbers of "White" respondents in this study to reveal the bias toward the "White" population that is shown in other studies of ICT demographics in South Africa.)</p> <p>Differences based on gender were shown to be minimal.</p>	<p>ICT access and use in organisations echoes the patterns seen in the greater population, with clear divisions across racial lines.</p> <p>While the percentage of black-owned businesses is increasing, it still does not appear to reflect the population ratio, especially in the ICT sector.</p>
<p><b>Sustainability and the local economic environment</b></p> <p>Is there a local economic environment favourable to technology use? Is technology part of local economic development? If not, what is needed to make it a part?</p>	<p>Irrespective of how affordable the technology is and whether the required training is performed, if the local economic situation is poor - with high unemployment and poverty levels - access to technology will continue to remain out of the reach of ordinary citizens.</p> <p>Unemployment was a critical recurring theme in the community meetings.</p> <p>The vast majority of respondents want ICT access and training because they hope it will increase their chances of finding a job, or obtaining a better job.</p> <p>Among the communities studied, income relates directly to computer use.</p>	<p>Cape Town's ICT industry primarily serves South African businesses, with only a few companies that have become internationally competitive.</p> <p>Insiders view Cape Town's distance from the country's main business centre in Gauteng, and its small local market as major weaknesses for the ICT sector.</p>

<p><b>Macro-economic environment</b></p> <p>Is technology use limited by the macro economic environment, for example, in terms of transparency, deregulation, investment, and labour issues?</p>	<p>Overall, people are aware of the key macro-economic issues that affect them, notably privatisation; however, public opinion focused on negative implications such as work retrenchment.</p> <p>Most people in the communities studied do not understand the potential benefits of privatisation in terms of general economic growth and related employment opportunities.</p>	<p>The ICT companies located within the Bandwidth Barn are the organisations most aware of macro-economic issues that hamper access to ICT.</p> <p>The main macro-economic issues raised are related to telecommunications environment, high telecommunications and Internet access costs, and substandard or restrictive telecommunications services.</p> <p>Community organisations find themselves in a difficult situation when it comes to lobbying for the liberalisation of the telecommunication sector: on the one hand increased liberalisation is expected to mean cheaper phone calls and Internet access, on the other hand it could lead to the retrenchment of lower end staff (often the clients of CBOs) when the telecom companies downsize to become more cost-effective.</p>
<p><b>Legal and regulatory framework</b></p> <p>Do laws and regulations limit technology use and what changes are needed to create an environment that fosters its use?</p>	<p>Overall, people are unaware of how legal and regulatory matters related to ICT impact on their lives.</p> <p>There is a need for citizens to be informed of the implications of laws and regulations in this area.</p> <p>Furthermore, stakeholders want to be consulted and engaged in policy processes to ensure that their views are taken into consideration.</p>	<p>Three issues emerged during this assessment as primary ICT policy concerns among Cape Town organisations: the need for an ICT training certification authority; the need for regulation of Internet Portal Companies, and the need for an e-rate for community organisations.</p>
<p><b>Public support and political will</b></p> <p>Is there political will for Government to do what is needed to enable the integration of technology throughout society? Is there public support for Government ICT policy?</p>	<p>The majority of respondents feel that the City should be responsible for improving public access to ICT.</p> <p>Contributions from the Provincial and National Government are also cited as important, reflecting the widespread perception that the public sector has a role to play in driving ICT development.</p>	<p>The organisations interviewed believe that the public sector should take a leading role in improving ICT use: local, Provincial, and National.</p> <p>The vast majority of organisations are interested in working with the City to improve ICT access and use in Cape Town</p>

## ***Appendix B***

### **City of Cape Town Section 14 Manual**

**This document (known as the Section 14 Manual) is a requirement in terms of section 14 of the Promotion of Access to Information Act.**

It explains how to use the Act, as well as details of the kinds of information and records available at the City.

One of the objectives of the Act is to promote transparency, accountability and effective governance. The purpose of this manual, therefore, is to:

- enable people to exercise their rights in terms of the Act
- create an understanding of the functions performed and records kept by the City of Cape Town.
- assist in fostering a culture of transparency, accountability and promote public participation

The manual is available in three languages:

Section 14 Manual: [English version \(PDF, 524kb\)](#)

Section 14 Manual: [Afrikaans version \(PDF, 471kb\)](#)

Section 14 Manual: [Xhosa version \(PDF, 538kb\)](#)

#### URL Address

<http://www.capetown.gov.za/en/AccessToInfo/Pages/Section14Manual.aspx>

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## **Appendix C.1**

### **Community Questionnaire**

This questionnaire forms part of Masters Research project attempting to identify problems that are encountered with promotion of access to spatial information between communities and various institutions and seeks to bring a better solution to them. This survey aims to establish the extend which the Cape Town City Council or other organization interact with its communities through its spatial information systems and looks to establish a case study from this feedback.

The purpose of this questionnaire is to gather user requirements and draw functional specification from the participants and follow-up interviews will be done afterwards. I will liaise with the supervisor and get approval for the second questionnaire for the prototype testing phase.

All the information provided in this survey will be treated with the strictest confidentiality. These details are purely for the contact purposes of the research.

#### **Part 1: Technical**

1.1 How often do you visit the computers at the library?

---

1.2 Do you know how to use a Computer mouse?

Yes

No

1.3 Do you know how to use a Computer keyboard?

Yes

No

1.4 Do you know how to use internet web browser?

Yes

No

1.5 Can you upload multimedia information (documents, pictures and video clips) on the internet?

Yes

No

1.6 Do you know how to read a map?

Yes

No

1.7 What do you mostly use a computer for (CV, e-mail, games, facebook or news)?

---

**Part 2: Community service delivery**

2.1 Do you know where to report a burst water pipe, or an overflowing stormwater drain?

Yes

No

2.2 Do you know who to contact when there is loose power cables or fallen poles around your community?

Yes

No

2.3 Do you know where to go (City of Cape Town Offices) to report the situation in 2.1 and 2.2?

Yes

No

2.4 Have you ever used the City of Cape Town website to get information about your community or municipality?

2.5 Have you heard of the Access to Information act?

Yes

No

2.6 If “Yes” to question 2.5, have you seen any form of promotion to access to information act (PAIA) around you community as a means of creating awareness?

Yes

No

2.7 Have you ever been informed that you can find the information about Cape Town, Government Structures and Service delivery on the internet?

Yes

No

2.8 What improvements do you like to see with regard to promotion to access spatial information around your community?

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## **Appendix C.2**

### **Access to Information Meeting 28<sup>th</sup> June 2007**

The Meeting was between

#### City of Cape Town Council Representatives

*Mrs. Jill Fading (Legal Service Department, Access to Information Act Unit)*

#### University of Cape Town Representatives

*Mr. Jeofrey Ditsela*

*University of Cape Town Master of Science Engineering student.*

*Mr. Joseph Lehobo*

*University of Cape Town, Honours Research Supervisor.*

#### **Questions and Answers**

Q1. Can you brief us about your office and what you do?

A. We fall under the unit called Legal Service Department, our function is in two folds, we deal with Section 62 Appeals and Access to Information. Section 62 Appeals takes 90% of our work that we deals with and we have a coordination function as far as Access to Information is concerned, what we do is that we support an Information Officer who is a City Manager by receiving some requests and we even open files for all the request that our office received. For all the requests received, we refer those entire requests to the relevant departmental Deputy Information Officers who has been delegated to help information officers. It's possible for us to provide information that is *automatically available*, we do that directly to the requester else you have to go through the formal process of granting or refusing information.

Q2. I am trying to understand what do you need to distribute that information?

A. We don't hand information ourselves, the information lies with different departments, so it is the Deputy Information Officer who needs the information from relevant department in order to hand the information to the requester, we co-ordinate the function in the sense that the requester is sending the requests to us, *we actual need a request in order to disseminate information effectively*. We have to report to SAHRC on annually basis about the access to information request, granted and refusals. Firstly we should have the Section 14 manual, the manual describe everything about the organisation and all the records we have and a lot of other things like monies, R35 involved.

Q3. If you were to use a system, what kind of a system would you look at or would have been useful/helpful?

A. I think its best if all departments should have their own section 14 manual because most people are educated as far as access to information is concerned; they will know that if a person comes in asking for information, they can easily and immediately go to the list of records that are automatically available if it's a straight forward request. Most requests are not straight forward, for example, somebody comes in and says he/she wants the housing file but the housing file

might be big, small or any size. Our best interest and job is to give information to the people that request it.

Q4. If you say they are procedures or guidelines for Access to Information, do you have documents of that nature that this Research can refer to?

A. Section 14 manual will definitely assist you, it has anything from a flow chart, queries or guidelines. That can be obtained from our website.

Q5. With regard to the records you said you submit to the SAHRC, do we have access to that and can we have a copy.

A. I don't think you will have a problem looking at SAHRC reports from our office, but we are busy working on last year report that is to be submitted on 2<sup>nd</sup> July but unfortunately I am not in possession to give it to you. We understand that the purpose of this Act is to be transparent, accountable and give out the information

Q6. What kind of people comes to you?

A. Anyone

Q7. How do you categorize them, do people from Khayelitsha come to your office and how do you categorize them? Because we have business people, lawyers, staff, councillors.

Yes, anyone comes, we don't categorise them neither we don't discriminate.

Q8. I will refer to people on the ground (Informal Settlement). Do people know that your Office exist?

A. We did exhibition on January 2006 in Khayelitsha, Gugulethu, Mitchels Plain and other areas as the whole City Departments but not our individual department.

Q9. Definitely you go out to the Sites (Communities),

A. Yes.

Q10. How often?

Not that often, we have done it once as a group of departments. This is also hampered by people leaving their Jobs and because of restructuring which means skills level and experience changes among us.

Q11. Do you guys have client surveys?

A. yes, we did have client surveys when I started but we did not do subsequent surveys but I am not sure about the duration, I can refer you to my manager to expand on that.

Q12. At the Sites, do you guys go to Community centres, Libraries, Churches or other places where people gather?

A. We haven't gone to the Libraries or Community Centres. We have Municipal Offices at those communities and they can go ask for any information. Those offices should have Section 14 manual which will direct them where to go or they will inform us.

Q13. Generally with this Access to Information Act, from your point of view, having been to the office almost 2 years, do you think that the people at the communities use the information or need it?

A. I can't say yes or no, it's going to depend on each person wanting to know, especially when it comes to housing. People want to know when the RDP houses are getting finished or who is getting allocated. Most of people are concerned with people who lives in council houses, people comes here and say they want to know what is in the file.

Q14. Do councillors come here a lot?

A. No, they don't come here a lot; I haven't seen councillors coming here to access information. Most people are the public or people who think they is a corruption and all the like. For instance, if Mr X is awarded a contract, they come forward and scrutinize how and what was they procedure.

Q15. Who do you report to because you already mention SAHRC?

A. We support to the Information Officer who is the City Manager in dealing with the request, receiving the request and co-ordinating request. As far as the Access to Information is concerned we report to the SAHRC with a statistics we received at our office in terms of the law on annual basis.

Q16. After this interview, this research is going to the communities to get their side of their story, we are going to ask them that what do you guys need, have you guys seen flyers about Access Information Act or have they attended those exhibitions you held last year. Do you think they know where you are and your office numbers? We will be just going to get both sides of the story.

A. They might know the buildings. I am not sure whether the communities really know about the Access to Information, the fact that they can come to Municipal office to request a record. Maybe that's one of the problems.

Q17. Generally, what has been your experience having been in the Office.

A. Previously Access to Information was 90% unit functions, but now Section 62 Appeals have taken the number. Access to Information is being dealt with accordingly and the procedure hasn't changed.

Q18. To what extent a record becomes refused?

A. To refuse a record, we take into account chapter 4.

Q19. Earlier, I asked about a useful System, I was thinking on the lines of internet as IT system or Management system? I believe that you process most stuff manually rather than using the available technology.

A. We have internet link on the main website (quick links of the left), some people phone and email us; they can also fill the form online. The online systems is needed in the City.



## **Appendix C.3**

### **Knowledge Resource and Support Meeting 27<sup>th</sup> June 2007**

The Meeting was between

City of Cape Town Council Representatives

*Mrs Ronelle Rudman (Knowledge Resource and Support GIS manager)*

University of Cape Town Representatives

*Mr. Jeofrey Ditsela*

*University of Cape Town Master of Science Engineering student.*

*Dr. Joseph*

*University of Cape Town, Honours Research Supervisor.*

#### **Questions and Answers**

##### **Previous Office (Access to Information)**

Q1. From your previous office, we want to know about Access to Information Act. What did it meant and its key requirements.

A. The Act is in terms of bill of rights and the Access to information is a basic right. My understanding is that the purpose of that is to give you fact to right to access to information. There are certain document which are freely, voluntarily, available to the members of the public, I mean you just actually go the local Authority and you ask for that document, you don't have to go thru the whole formal process of completing forms. For example, document you will obtain when going to the city internet. There is a *list of records automatically available* but I don't how it is up-dated. That was compiled when I was there but to date I don't how they are operating at the present moment.

Q2. During your time at the Access Office, was there a strategy to disseminate information. For example, was there any booklet/document that shows a mandate to do that?

A. I don't think there was a booklet/document but they were definitely some guideline document that we used as a reference. I will say ask Jill for that but again there was a very specific procedure to follow if you want access to information.

Q3. During your time, what did you need to give access or distribute information?

A. Maybe I need to understand on what you mean when you say distribute, I need to be clearer when you say what did you need, certain information were automatically available, a member of the public can just walk in and say I want a copy of something, we will make that copy but that person will pay for copies. For a example, if a person want a policy plan and town planning which is always automatically available, if it is not in a *list of records automatically available*,

the member of the public have to go through formal process. They have to complete forms and Jill will be able to show you and pay the prescribed fee of R35. That is part of the process to get a record that was handled by Corporate Office, after that the corporate office will send the request to the Deputy Information Officer in the department where the information is held. So the City manager in terms of the act of the local authority is the Information Officer.

Q4. If you were to use the system, what kind of a system would you have been to look at or useful/helpful at that time?

A. I will think of *the internet but many people don't have access to the internet or computer facilities*. For those who doesn't have access to the internet, that's won't be a very valuable source for accessing information. I will put the emphasis on creating awareness, educating everybody where they can access information. I also saw one of your question asking about the linkage of Smart cape project with GIS, that's an excellent question but first all I will make people aware that they have the right to information. In my time, there was NO ordinary person coming forward to ask for that information, it was the "normal people" as lawyers, the attorneys who knows about the law but an ordinary person who doesn't have a job never showed up, this make me think that awareness will make it better.

Q5. I will refer mainly to people on the ground (Communities), did people knew that your office exist?

A. I can't say definitely yes or no, at some time you had people referred by the City Ombudsman office or an outside person. I very much doubt that people on the ground knows about the Access to Information Office. Things change quickly, in 2 years time, things might be different to what I have experienced.

Q6. Were you going out to the site to create that awareness or try to distribute information in any ware like giving out flyers, posters or talking to ward/sub-councillors?

A. Unfortunately NO, we didn't go to the communities. Corporate office arranged training and we either did ourselves or a service provider was used and then we will get a chairperson or sub-councillor who has contacts with the communities to distribute leaflets or flyers. We did had a local government week where we distributed flyers in Civic Centre but not at communities.

Q7. What kind people were coming to you because you mentioned lawyers as one of the people who knows the law?

A. let me think, University of Cape Town often asked for documents, they were our regular customers, here and there we will often get a member of the public. At that time we had to submit an annual report to the Human Rights Commission on the annual basis. I think we provided statistics but it was more general as how many request we received and other things and also we had to do report to the Corporate Services portfolio committee. This is where you can pick up whether it was a law firm or an ordinary member of the public.

Q8. Great, to wrap from the previous office, what was the general experience like to Access to Information Act.

A. Through the Act, people got access to information because they had the right to appeal and we worked very closely to the legal office and advisers. I definitely think in some or many cases, It did provide access to information.

### **Current Office (Knowledge Resource and Support)**

Q9. Can you brief what you do in the Current Office?

A. Presently I am called the manager of Knowledge Resource and Support services. I have been in this Office for about a year and half. The emphasis is on the HR, Finance and Admin point of view. I really do 80%-90% on this but the big project for me is the establishment of Knowledge and Information Resource centre. As a first leg (round 1), this will be geared towards members of the Staff and Councillors but the public but would like to extend it to members of the public at a later stage. We do not foresee at this stage that we will focus to all information, we have actually categorised certain information, for example, Policy documents, town planning policy framework and consultancy research report that is submitted to the local government.

Q10. With regard to the public, do you think that they access GIS data/information?

A. I haven't worked a lot with GIS/spatial information, do you regard town planning policy framework as spatial or what, I really don't know?

Q11. If you are going to implement Knowledge and Information Resource Centre, are you promoting access to information? For instance, you have a task of setting up a Map Kiosk.

A. The Map Kiosk is a larger extent focused on the public, my role is different now, at this stage, Knowledge resource centre is primarily focus on the staff and councillors. I haven't even given it a thought on how we will include the public, whether we will extend it to the public on this phase.

Q12. What is required from the Staff and Councillors to Access Information at the Knowledge and Information Resource Centre?

A. We are primarily trying to implement it with the *intranet* so that they can access the information using the computer facilities. At the moment we have been given 100 square metre at the podium 4 so that they can just grab the maps, brochures or anything they need.

Q13. After you extend it, are you intending to use Libraries as I think it's an area where people usually visit most? We talked about the Smart Cape Project, how are intending to use the advantage of it?

A. At this stage, we are on planning stage, I can't give you answers now.

Q14. Do you guys have a strategy on how you are going to market Knowledge and Information Resource Centre in order to disseminate information?

A. Not at the moment because we are still on the planning phase. We don't have any strategy and now we are still focusing how you get the project off the ground.

## **Appendix C.4**

### **Pre-Questionnaire feedback for open-ended questions**

#### **Part 1**

Question 1.1: How often do you visit the computers at the library?

- Once = 7
- Twice =4
- 3 times =7
- 4 times =5
- Everyday =19

Question 1.7: What do you mostly use a computer for (CV, e-mail, games, facebook or news)

- CV = 35
- Email =37
- Games = 8
- Facebook = 11
- News = 26
- Others (i.e research e.t.c ) = 15

#### **Part 2**

Question 2.8: What improvements do you like to see with regard to promotion to access to spatial information around your community?

##### ***Feedback***

- more workstations.
- be able to draw on the map and save the output so that we can show the city council of our ideas.
- If they can supply us with more computers with internet.
- more computers and the system should allows us to draw on the map.
- I think they could supply more computers in our areas and also give us more time in computer.
- It is more convenient and successful to communicate information verbally than in written format.
- more computers in our society/library
- upgrade hardware/software to the present computers.
- Quick, fair/standard community services for all regardless of race, gender and backgrounds.
- More media publicity.
- More station and fast internet.
- The internet is very slow.
- I would like to see more stations being built.
- The accessibility has to be increased.
- more equipment for body builder.
- I want to see the information about the community.
- I would to see many computers in libraries.

- Need the service providers to work more efficiently, and also work with care. E.g, police, clinics.
- Fast computer, more computers and extend the SCAP session time.
- More advanced and more stations to work on.
- More computer and computers which use USB flash drives.
- Open up information centres.
- More work stations and ability to use USB flash drives
- Development in facilities.
- Installing more computer that are using Microsoft product or you install both Linux and Microsoft because nicrosoft products are user friendly. Installing fast ADSLor broadband network in libraries particularly. City of Cape Town Municipality must educate people about clean as you go to keep our township clean so that every commuter must be responsible.
- An increase of computers in our libraries.
- I want the computers to have fast server.
- Fast computers with more advance features.
- More work stations.
- Workshops, short course about computer, provide information.
- I would like to see improvements like fixing of light and blocked drains in time.
- The services is very slowly and sometimes computer get stuck, freezing internet, broken computer pieces.
- I would like to see more computers.
- Road map for new roads, Tender information for small Business and landscape/public spaces.
- Practical check by government.
- Promotions are good, but are the people in charge reliable enough to handle complaints.
- It will be much better if you can build work stations.
- I would like to see information of tenders available, the people who stay at area must be given a chance to do the job or to work as sub-contractors.
- By training our people ho w to use computers.
- I think they should upgrade the libraries with more stationary and computers.
- To have a door to door community paper delivery in crossroads with this information which does not happen? i.e. Vukani and the City of Cape Town vision.
- Initiatives like this should be made visible to go schools.

## Appendix D.1



### Department of Civil Engineering

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#### **Questionnaire for investigating the use of web-based open source GIS prototype system to enhance access to spatial information at Cape Town communities living at informal settlements.**

This questionnaire forms part of postgraduate research project for investigating access to spatial information through a prototype, open source GIS implemented for Cape Town communities living at Informal Settlements.

The survey consists of 5 sections.

*Please tick or circle the appropriate answer of your choice.*

#### **Section 1: Background Information**

1.1 How often do you use web maps? i.e. Google earth maps

1. never    2. about once a month    3. about once a week    4. 2-6 times a week    5. everyday

1.2 How would you rate your knowledge level of Geographical Information Systems (GIS)?

1. none    2. beginner    3. intermediate    4. expert    5. professional

1.3 Are you aware that you can make a request for information from the City of Cape Town?

1. no    2. not sure    3. Impartial/neutral    4. partly yes    5. yes

1.4 Which community area do you stay at?

1. Langa    2. Guguletu    3. Nyanga    4. Delft    5. Crossroads    6. Philippi



Using the UCT CSIS prototype system, please

- Make a report of a problem around your area and submit it. (e.g. abandon car, faulty traffic lights or broken water pipe)
- View the submitted report.
- Update the submitted report.

*Hint:*

*Click the area of your choice in the map and select it from the form.*

3.1 I managed to do what I wanted from the prototype system.

1. strongly disagree    2. disagree    3. neutral/impartial    4. agree    5. strongly agree

3.2 The uploaded content was easy to find on the prototype system.

Statistics

1. strongly disagree    2. disagree    3. neutral/impartial    4. agree    5. strongly agree

3.3 I found the submitted reports very useful (Photos of recent reports, documents of recent reports, report updates, website statistics and study area statistics).

Statistics

1. strongly disagree    2. disagree    3. neutral/impartial    4. agree    5. strongly agree

3.4 I like the idea of being able to see spatially referenced photos of the community libraries on the map.

photos

1. strongly disagree    2. disagree    3. neutral/impartial    4. agree    5. strongly agree

## Section 4: Usability Task 3

Request



Using the UCT CSIS Access to Information request e-register board,

- Post a request to access any information held by the City of Cape Town.
- View a posted requests

*Hints:*

*First, you might want to explore and familiarize yourself with the UCT CSIS Access to Information request e-register board.*

*You can be a guest or register to use other board functions (i.e. search and top 25 users).*

*You can view other requests/announcements or replies from the board on the left hand side. Click the ones that seem interesting to you.*

*You can choose a topic that seems interesting to you or start a new post about things that concern you.*

4.1 It is clear how one posts information to City of Cape Town Access to information office and how to review other post on the e-register board.

1. strongly disagree    2. disagree    3. neutral/impartial    4 agree    5. strongly agree

4.2 I learned about City of Cape Town Directorates structure and how they work with each other.

1. strongly disagree    2. disagree    3. neutral/impartial    4 agree    5. strongly agree

4.3 Overall I enjoyed using the prototype system.

1. strongly disagree    2. disagree    3. neutral/impartial    4 agree    5. strongly agree

## **Section 5: Short answer questions.**

*Please complete this section with your own hand writing.*

5.1 What problems did you encounter when using the UCT CSIS system prototype?  
(e.g. understanding the map or terminology, navigating the map including turn on/off layers or zoom in/out of the map, exploring the e-register board, starting a new post or replying to a post, registration process on the e-register board)

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5.2 Would you use a system like this to report problems around your community, post request for information access?

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---

5.3 What additional information or tool would you have liked/wished to see on the system prototype?

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5.4 What type of function interests you when using the system prototype? (e.g. reporting problems, posting access to information requests, viewing submitted reports and statistics)?

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5.5 What other sources do you use when you look for environmental/spatial/geographical information? (e.g. radio, newspaper/magazine, Television and map brochures/books)

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5.6 Any comments?

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**Thank you for participating in this survey.**

## **Appendix D.2**

### **Test Procedures**

#### **Part I: To do list at the Community libraries**

1. Checklist for test day,
2. Computer Workstation set up during the test day
  - Checking Firefox browser,
  - Browser set up (enable cookies)
  - Chair
3. Call day before to remind the library administrator about the test,
4. Arrive 30 minutes earlier to set up computers, white/paper board
5. Print out question-based tasks
  - Make participants' copies. One copy for each test subject,
6. Print out research cover letter and consent form,
7. Prepare R240.00 Shoprite vouchers for every library
8. Check the Dictaphone batteries and tapes.
9. Check the camera
10. Test procedure revision, THIS DOCUMENT
11. Pen/Pencil and a clipboard.

#### **Time**

30 min each test session.

1000hrs *Start*

1600hrs *End* (The time end depend on the delay or how quick the subjects can finish the tasks)

*NB: This time frame was dependent on smart cape access project users were willing to participate on the survey.*

#### **Equipment**

- Camera
- Pen and clipboard
- Vouchers
- Car
- White/paper board

## Part 2: Test Protocol

Jeofrey will be the observer and note taker. For each task, determine the following:

1. Time taken to finish a task and the whole session,
2. System technical errors (server crashing or slow internet connection) or mistake made by subjects (observing subjects),
3. Users subjective satisfaction (survey after each task),

Test takes about 30 min start to finish,

1. Greet user and ask them if they want to be subjects of the research.
2. Brief participants at the beginning of the session about the scope of the research project
  - Explain the layout of the UCT CSIS on the paper board,
  - Print out the layout of the UCT CSIS - explain to the subject, about the three frames being , Sidebar frame for tabs, map area frame, toolbar frame,
3. Give the subject time (5 min) to read the research cover letter and sign research consent letter,
4. The subject begin pre-defined tasks,
5. Give the subjects a choice to complete the post questionnaire after finishing the tasks or while performing the tasks,
7. Debrief the subject at end of session,
6. Hand the R30.00 voucher reward to the user,
8. Thank the subject for participating.

## **Appendix D.3**

### **Experiment Setup**

The usability experiment was conducted at each community library for the whole day (see Appendix D.2). The test procedure was structured in three parts.

1. An introductory session to brief participants at the beginning of the session about the scope of the research project.
2. A hands-on session where the participants use the prototype system and complete a set of predefined tasks.
3. A questionnaire session where the user registers the answers for subjective evaluation rating.

The participants were given an option to combine the last two test procedure sessions or complete them as they are listed.

For each task, the observer will determine the following:

1. Time taken to finish a task,
2. System technical errors (server crashing or slow internet connection) or participants actions during the test procedure like mistake made by subjects (observing subjects),

The participants introduction to the system will be 5 minutes. The participants will be briefed about the concept of the case study and shown how to access the prototype system for the first time, participants will also be asked to complete an informed consent research form. Participants will be given an option to complete the questionnaire during test case process or at the end of the whole test case duration,

The prototype setup will be as follows:

- The interface is best viewed at 1152 X 864 screen resolution on open source Firefox browser.
- The interface map cover an area of: 800 X 800.
- The application tool icons are designed at size: 18 X 18
- The application tabs buttons are designed at size: 48 X 20.
- Icons representing landmarks (e.g. school or clinics ) at size: 128 X 128 and are similar the ones used by the City of Cape Town map book (e.g clinics, libraries, schools icons e.t.c).
- The fonts of the prototype system are “Accidental Presidency Regular”.
- The background color of the interface area is set to yellow RGB :(#ffffcc) and site logo with (#ffffcc).
- The map is based on real map of the City of Cape Town and the data was obtained from the Faculty of Engineering GIS Research laboratory.
- The map content is designed with content of which participants orientation are familiar with. For example, the major freeway (i.e. N2, Lansdowne freeway, and Cape Town

International airport) is visible and styled according how it appears on the ground and the study areas has different colors (see Figure 12).

- Computer facilities: Smart Cape Access Project workstation at community libraries that use open source software and Firefox browser.

University of Cape Town

## Appendix D.4

### Course: All Libraries Post-Questionnaire Statistics

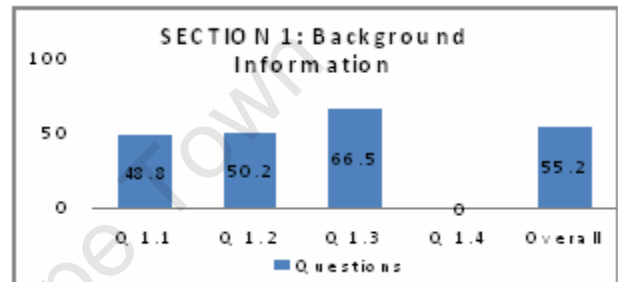
Presenter: Jeofrey Ditsela

Nr of evaluations = 43

Individual Participants averages and % :  
 minimum average = 2.42857 48.5714  
 maximum average = 4.64286 92.8571  
**OVERALL AVERAGE = 3.69269 73.8538** <<<<<

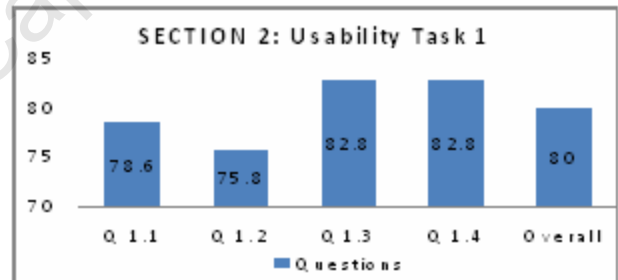
#### SECTION 1: Background Information

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	16	10	6	4	7	2.44	48.8
Q 1.2	2	19	20	2	0	2.51	50.2
Q 1.3	5	4	13	14	7	3.33	66.5
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						2.76	55.2 <<



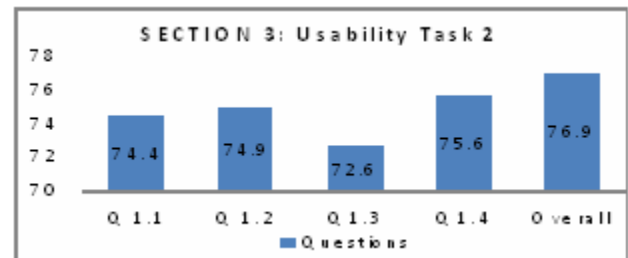
#### SECTION 2: Usability Task 1

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	1	1	9	21	11	3.93	78.6
Q 2.2	0	2	9	28	4	3.79	75.8
Q 2.3	1	2	4	19	17	4.14	82.8
Q 2.4	0	2	3	25	13	4.14	82.8
overall average =						4.00	80.0 <<



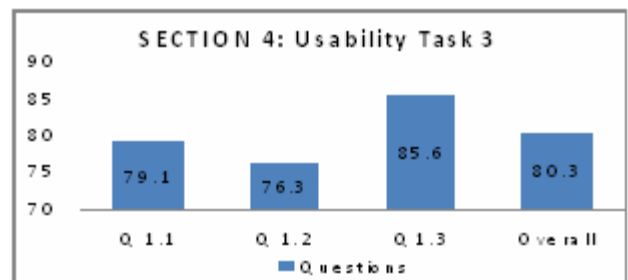
#### SECTION 3: Usability Task 2

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	2	3	4	30	4	3.72	74.4
Q 3.2	0	2	16	16	9	3.74	74.9
Q 3.3	0	3	15	20	5	3.63	72.6
Q 3.4	1	1	2	20	19	4.28	85.6
overall average =						3.84	76.9 <<



#### SECTION 4: Usability Task 3

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	1	0	7	27	8	3.95	79.1
Q 4.2	0	2	11	23	7	3.81	76.3
Q 4.3	1	1	4	16	21	4.28	85.6
overall average =						4.02	80.3 <<



Processed by program CE version 3.00 (NJM 01/01)

**All Libraries Post-Questionnaire raw data**

1220 3344 4434 443  
2340 3344 4444 445  
4350 4445 4545 335  
5340 4434 4335 444  
1330 4453 2334 445  
3250 2543 4532 324  
3240 5342 4354 434  
2340 5455 4334 555  
5240 5554 4344 445  
2210 4455 5555 445  
1240 5454 4544 455  
3330 3455 4344 445  
4340 4525 4345 455  
3350 5214 3524 345  
1240 4444 4343 444  
1120 4444 1421 141  
1230 4434 4445 534  
1240 5444 4445 444  
2350 4445 2434 445  
4350 5455 4434 334  
1230 4344 2543 534  
3420 4453 1324 435  
1230 5455 5355 555  
5330 1454 4345 554  
1330 5454 4335 435  
5330 5455 4455 445  
2310 4444 4445 444  
2230 3234 4334 343  
1310 3344 4334 332  
3240 4444 4444 545  
1230 4444 4435 425  
2220 4444 4445 434  
1210 3454 4445 444  
1230 4444 4444 444  
2310 4324 4234 434  
2350 3344 3345 443  
5340 4444 5544 444  
5340 4335 3235 445  
5340 5555 4455 555  
1140 4455 5545 555  
1230 3345 3334 445  
2230 3452 4435 334  
4450 4454 4544 443



**Course: Phillippi East Library**

Nr of evaluations = 7  
Individual Participants averages and % :  
minimum average = 3.21429 64.2857  
maximum average = 4.14286 82.8571  
OVERALL AVERAGE = 3.61225 72.2449 <<<<<

**SECTION 1: Background Information**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	2	1	2	1	1	2.71	54.3
Q 1.2	0	3	4	0	0	2.57	51.4
Q 1.3	0	1	1	3	2	3.86	77.1
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						3.05	61.0 <<

**SECTION 2: Usability Task 1**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	0	1	2	3	1	3.57	71.4
Q 2.2	0	0	3	3	1	3.71	74.3
Q 2.3	0	0	1	5	1	4.00	80.0
Q 2.4	0	1	2	3	1	3.57	71.4
overall average =						3.71	74.3 <<

**SECTION 3: Usability Task 2**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	0	1	0	6	0	3.71	74.3
Q 3.2	0	0	3	2	2	3.86	77.1
Q 3.3	0	0	4	2	1	3.57	71.4
Q 3.4	0	1	0	4	2	4.00	80.0
overall average =						3.79	75.7 <<

**SECTION 4: Usability Task 3**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	0	0	2	5	0	3.71	74.3
Q 4.2	0	1	2	4	0	3.43	68.6
Q 4.3	0	0	1	3	3	4.29	85.7
overall average =						3.81	76.2 <<

**Raw Data**

1220 3344 4434 443  
2340 3344 4444 445  
4350 4445 4545 335  
5340 4434 4335 444  
1330 4453 2334 445  
3250 2543 4532 324  
3240 5342 4354 434

**Course: Nyanga**

Nr of evaluations = 7  
Individual Participants averages and % :  
minimum average = 3.50000 70.0000  
maximum average = 4.14286 82.8571  
OVERALL AVERAGE = 3.94898 78.9796 <<<<<<

**SECTION 1: Background Information**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	1	2	2	1	1	2.86	57.1
Q 1.2	0	3	4	0	0	2.57	51.4
Q 1.3	1	0	1	4	1	3.57	71.4
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						3.00	60.0 <<

**SECTION 2: Usability Task 1**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	0	0	1	2	4	4.43	88.6
Q 2.2	0	1	0	4	2	4.00	80.0
Q 2.3	1	1	0	0	5	4.00	80.0
Q 2.4	0	0	0	3	4	4.57	91.4
overall average =						4.25	85.0 <<

**SECTION 3: Usability Task 2**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	0	0	1	5	1	4.00	80.0
Q 3.2	0	0	4	0	3	3.86	77.1
Q 3.3	0	1	1	4	1	3.71	74.3
Q 3.4	0	0	0	5	2	4.29	85.7
overall average =						3.96	79.3 <<

**SECTION 4: Usability Task 3**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	0	0	1	5	1	4.00	80.0
Q 4.2	0	0	0	4	3	4.43	88.6
Q 4.3	0	0	0	0	7	5.00	100.0
overall average =						4.48	89.5 <<

**Raw Data**

2340 5455 4334 555  
5240 5554 4344 445  
2210 4455 5555 445  
1240 5454 4544 455  
3330 3455 4344 445  
4340 4525 4345 455  
3350 5214 3524 345

**Course: Langa Public Library**

Nr of evaluations = 8  
Individual Participants averages and % :  
minimum average = 2.42857 48.5714  
maximum average = 4.00000 80.0000  
OVERALL AVERAGE = 3.47321 69.4643 <<<<<<

**SECTION 1: Background Information**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	5	1	1	1	0	1.75	35.0
Q 1.2	1	4	2	1	0	2.38	47.5
Q 1.3	0	2	2	2	2	3.50	70.0
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						2.54	50.8 <<

**SECTION 2: Usability Task 1**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	0	0	0	6	2	4.25	85.0
Q 2.2	0	0	1	7	0	3.88	77.5
Q 2.3	0	0	1	5	2	4.13	82.5
Q 2.4	0	0	1	5	2	4.13	82.5
overall average =						4.09	81.9 <<

**SECTION 3: Usability Task 2**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	2	2	0	4	0	2.75	55.0
Q 3.2	0	0	2	5	1	3.88	77.5
Q 3.3	0	2	2	4	0	3.25	65.0
Q 3.4	1	0	2	3	2	3.63	72.5
overall average =						3.38	67.5 <<

**SECTION 4: Usability Task 3**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	1	0	1	4	2	3.75	75.0
Q 4.2	0	0	4	4	0	3.50	70.0
Q 4.3	1	0	0	5	2	3.88	77.5
overall average =						3.71	74.2 <<

**Raw Data**

1240 4444 4343 444  
1120 4444 1421 141  
1230 4434 4445 534  
1240 5444 4445 444  
2350 4445 2434 445  
4350 5455 4434 334  
1230 4344 2543 534  
3420 4453 1324 435

**Course: Guguletu Public Library**

Nr of evaluations = 7  
Individual Participants averages and % :  
minimum average = 2.92857 58.5714  
maximum average = 4.35714 87.1429  
OVERALL AVERAGE = 3.68367 73.6735 <<<<<

**SECTION 1: Background Information**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	3	2	0	0	2	2.43	48.6
Q 1.2	0	2	5	0	0	2.71	54.3
Q 1.3	2	0	5	0	0	2.43	48.6
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						2.52	50.5 <<

**SECTION 2: Usability Task 1**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	1	0	2	1	3	3.71	74.3
Q 2.2	0	1	1	5	0	3.57	71.4
Q 2.3	0	0	1	2	4	4.43	88.6
Q 2.4	0	0	0	5	2	4.29	85.7
overall average =						4.00	80.0 <<

**SECTION 3: Usability Task 2**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	0	0	0	6	1	4.14	82.9
Q 3.2	0	0	5	2	0	3.29	65.7
Q 3.3	0	0	3	2	2	3.86	77.1
Q 3.4	0	0	0	2	5	4.71	94.3
overall average =						4.00	80.0 <<

**SECTION 4: Usability Task 3**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	0	0	2	3	2	4.00	80.0
Q 4.2	0	0	2	3	2	4.00	80.0
Q 4.3	0	1	1	2	3	4.00	80.0
overall average =						4.00	80.0 <<

**Raw Data**

1230 5455 5355 555  
5330 1454 4345 554  
1330 5454 4335 435  
5330 5455 4455 445  
2310 4444 4445 444  
2230 3234 4334 343  
1310 3344 4334 332

**Course: Delft South Library**

Nr of evaluations = 7

Individual Participants averages and % :

minimum average = 3.07143 61.4286

maximum average = 3.92857 78.5714

OVERALL AVERAGE = 3.53061 70.6122 <<<<<

**SECTION 1: Background Information**

Questions nr of 1's 2's 3's 4's 5's average %

Q 1.1 3 3 1 0 0 1.71 34.3

Q 1.2 0 5 2 0 0 2.29 45.7

Q 1.3 2 1 2 1 1 2.71 54.3

Q 1.4 0 0 0 0 0 0.00 0.0

overall average = 2.24 44.8 <<

**SECTION 2: Usability Task 1**

Questions nr of 1's 2's 3's 4's 5's average %

Q 2.1 0 0 2 5 0 3.71 74.3

Q 2.2 0 0 2 5 0 3.71 74.3

Q 2.3 0 1 0 5 1 3.86 77.1

Q 2.4 0 0 0 7 0 4.00 80.0

overall average = 3.82 76.4 <<

**SECTION 3: Usability Task 2**

Questions nr of 1's 2's 3's 4's 5's average %

Q 3.1 0 0 1 6 0 3.86 77.1

Q 3.2 0 1 1 5 0 3.57 71.4

Q 3.3 0 0 2 5 0 3.71 74.3

Q 3.4 0 0 0 3 4 4.57 91.4

overall average = 3.93 78.6 <<

**SECTION 4: Usability Task 3**

Questions nr of 1's 2's 3's 4's 5's average %

Q 4.1 0 0 0 6 1 4.14 82.9

Q 4.2 0 1 2 4 0 3.43 68.6

Q 4.3 0 0 1 4 2 4.14 82.9

overall average = 3.90 78.1 <<

**Raw Data**

3240 4444 4444 545

1230 4444 4435 425

2220 4444 4445 434

1210 3454 4445 444

1230 4444 4444 444

2310 4324 4234 434

2350 3344 3345 443

**Course: Crossroads Library**

Nr of evaluations = 7  
Individual Participants averages and % :  
minimum average = 3.35714 67.1429  
maximum average = 4.64286 92.8571  
OVERALL AVERAGE = 3.93878 78.7755 <<<<<

**SECTION 1: Background Information**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 1.1	2	1	0	1	3	3.29	65.7
Q 1.2	1	2	3	1	0	2.57	51.4
Q 1.3	0	0	2	4	1	3.86	77.1
Q 1.4	0	0	0	0	0	0.00	0.0
overall average =						3.24	64.8 <<

**SECTION 2: Usability Task 1**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 2.1	0	0	2	4	1	3.86	77.1
Q 2.2	0	0	2	4	1	3.86	77.1
Q 2.3	0	0	1	2	4	4.43	88.6
Q 2.4	0	1	0	2	4	4.29	85.7
overall average =						4.11	82.1 <<

**SECTION 3: Usability Task 2**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 3.1	0	0	2	3	2	4.00	80.0
Q 3.2	0	1	1	2	3	4.00	80.0
Q 3.3	0	0	3	3	1	3.71	74.3
Q 3.4	0	0	0	3	4	4.57	91.4
overall average =						4.07	81.4 <<

**SECTION 4: Usability Task 3**

Questions	nr of 1's	2's	3's	4's	5's	average	%
Q 4.1	0	0	1	4	2	4.14	82.9
Q 4.2	0	0	1	4	2	4.14	82.9
Q 4.3	0	0	1	2	4	4.43	88.6
overall average =						4.24	84.8 <<

**Raw Data**

5340 4444 5544 444  
5340 4335 3235 445  
5340 5555 4455 555  
1140 4455 5545 555  
1230 3345 3334 445  
2230 3452 4435 334  
4450 4454 4544 443

## Appendix D.5

### Subject Observations Evaluation form

Subject Number \_\_\_\_\_

Subject Observations	Yes    ✓ No     ✕
Subject Problems	
Don't know where to get started	
Map toolbar navigation (zoom/pan)	
Confused between mouse events	
Tab navigation (Layer, Legends, About)	
Sending a report	
Accessing requests	
Drawing Polygon, Lines and Points	
Pressing wrong icon on the toolbar	
Layer selection	
Map displaying (refresh maps button)	
Technical Problem	
Spatial server crashed	
Slow internet connection	
Others	
Total Problem Time	

## Appendix D.6

### Usability Task Time evaluation

Subject Number \_\_\_\_\_

Usability evaluation sections	Time (Minutes, Seconds)
Section 1	
Background Information	
Section 2	
Usability Task 1	
Section 3	
Usability Task 2	
Section 4	
Usability Task 3	
Section 5	
Short answer question	
Others (Map Exploration)	
Total Session Time	



## Appendix D.7

### UCT Community Spatial Information System (UCT CSIS)

The screenshot shows the Sitemeter website interface. At the top left is the Sitemeter logo and a 'login to my account' section with fields for 'Codename' and 'Password', a 'Login' button, and a 'Remember Me' checkbox. Below the login section is a navigation menu with categories like 'home', 'general', 'recent visitors', 'visits', 'visits and page views', and 'page ranking'. The main content area features a green header for 'UCT Community Spatial Information System (UCT CSIS) Site Summary'. Below this, there are two sections: 'VISITS' and 'PAGE VIEWS', each with a table of statistics.

VISITS	
Total	29
Average Per Day	-
Average Visit Length	-
Last Hour	0
Today	0
This Week	0

PAGE VIEWS	
Total	65
Average Per Day	-
Average Per Visit	-
Last Hour	0
Today	0
This Week	0

-- Site Summary ---

Visits

```

Total ..... 67
Average per Day ..... 3
Average Visit Length ..... 2:50
This Week ..... 18
    
```

Page Views

```

Total ..... 128
Average per Day ..... 5
Average per Visit ..... 1.8
This Week ..... 33
    
```

<http://www.sitemeter.com/stats.asp?site=s49dtsjeo>

--- Visits this Week ---

Day

Hour	10/31	11/1	11/2	11/3	11/4	11/5	11/6	Total
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	1	1	1	0	3
12	0	0	0	0	0	0	0	0
13	0	0	0	1	2	0	0	3
14	0	0	0	0	1	0	0	1
15	0	0	0	3	1	1	0	5
16	2	0	0	1	1	1	0	5
17	0	0	0	0	0	0	1	1
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
	2	0	0	6	6	3	1	18

--- Page Views this Week ---

Hour	Day 10/31	11/1	11/2	11/3	11/4	11/5	11/6	Total
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	1	2	1	0	4
12	0	0	0	0	0	0	0	0
13	0	0	0	2	2	0	0	4
14	0	0	0	0	1	0	0	1
15	0	0	0	3	1	4	0	8
16	2	0	0	1	1	5	0	9
17	3	0	0	0	0	0	4	7
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0

24	0	0	0	0	0	0	0	0
-----	-----	-----	-----	-----	-----	-----	-----	-----
	5	0	0	7	7	10	4	33

UCT Community Spatial Information System (UCT CSIS  
(s49dtsjeo)

-- Site Summary ---

Visits

Total ..... 49  
Average per Day ..... 3  
Average Visit Length ..... 6:14  
This Week ..... 20

Page Views

Total ..... 95  
Average per Day ..... 4  
Average per Visit ..... 1.5  
This Week ..... 30

<http://www.sitemeter.com/stats.asp?site=s49dtsjeo>

--- Visits this Week ---

Hour	Day 10/24	10/25	10/26	10/27	10/28	10/29	10/30	Total
-----	-----	-----	-----	-----	-----	-----	-----	-----
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	1	0	0	1
11	0	0	0	2	0	1	0	3
12	0	0	0	2	1	0	1	4
13	0	0	0	1	0	1	1	3
14	0	0	0	1	1	0	0	2
15	0	0	0	1	1	2	0	4
16	0	0	0	0	0	1	1	2
17	0	0	0	0	1	0	0	1
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
-----	-----	-----	-----	-----	-----	-----	-----	-----
	0	0	0	7	5	5	3	20

--- Page Views this Week ---

Hour	Day							Total
	10/24	10/25	10/26	10/27	10/28	10/29	10/30	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	1	0	0	1
11	0	0	0	3	0	1	0	4
12	0	0	0	3	3	0	2	8
13	0	0	0	1	1	1	2	5
14	0	0	0	1	1	0	0	2
15	0	0	0	1	2	2	0	5
16	0	0	0	0	0	1	2	3
17	0	0	0	0	1	0	1	2
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
	0	0	0	9	9	5	7	30

UCT Community Spatial Information System (UCT CSIS  
(s49dtsjeo)

-- Site Summary --

Visits

Total ..... 70  
 Average per Day ..... 0  
 Average Visit Length ..... 0:33  
 This Week ..... 3

Page Views

Total ..... 133  
 Average per Day ..... 1  
 Average per Visit ..... 1.7  
 This Week ..... 5

<http://www.sitemeter.com/stats.asp?site=s49dtsjeo>

--- Visits this Week ---

Hour	Day							Total
	11/7	11/8	11/9	11/10	11/11	11/12	11/13	
1	0	0	0	0	0	0	0	0

2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	1	1
14	1	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	1	0	1
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
-----								
	1	0	0	0	0	1	1	3

--- Page Views this Week ---

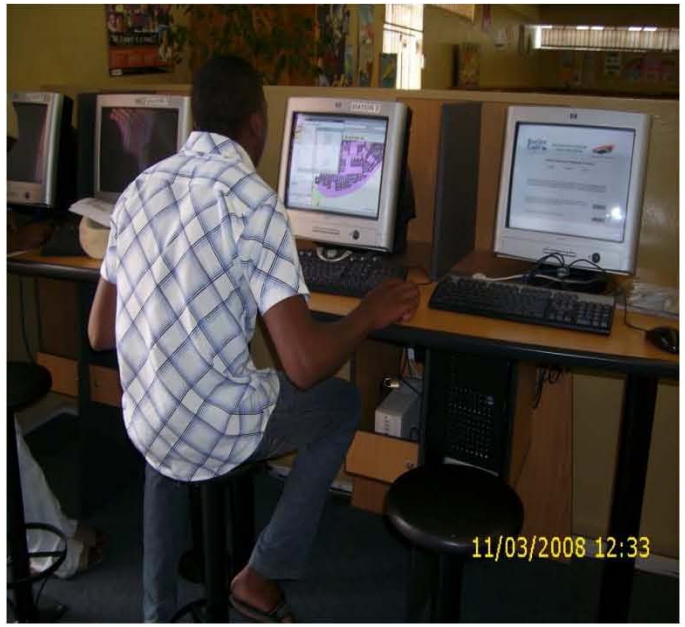
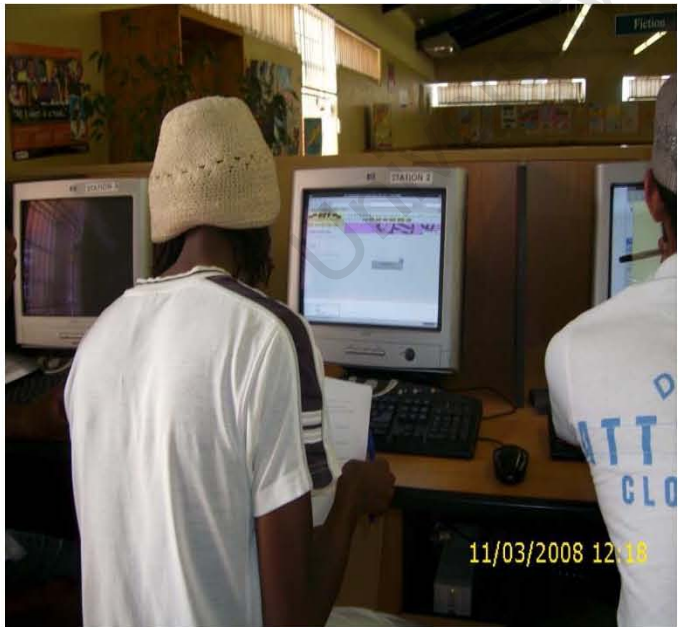
Hour	Day 11/7	11/8	11/9	11/10	11/11	11/12	11/13	Total
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	1	1
14	2	0	0	0	0	0	0	2
15	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0
17	0	0	0	0	0	2	0	2
18	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0
-----								
	2	0	0	0	0	2	1	5

*Appendix D.8*

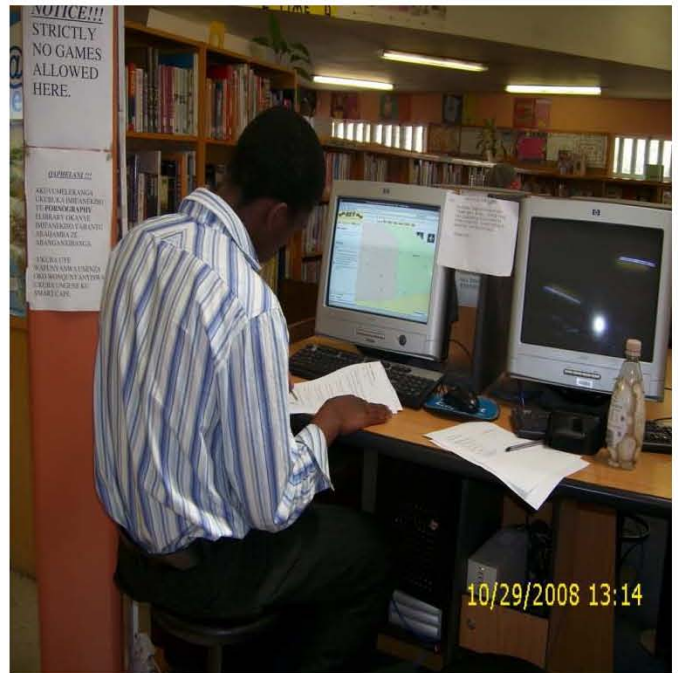
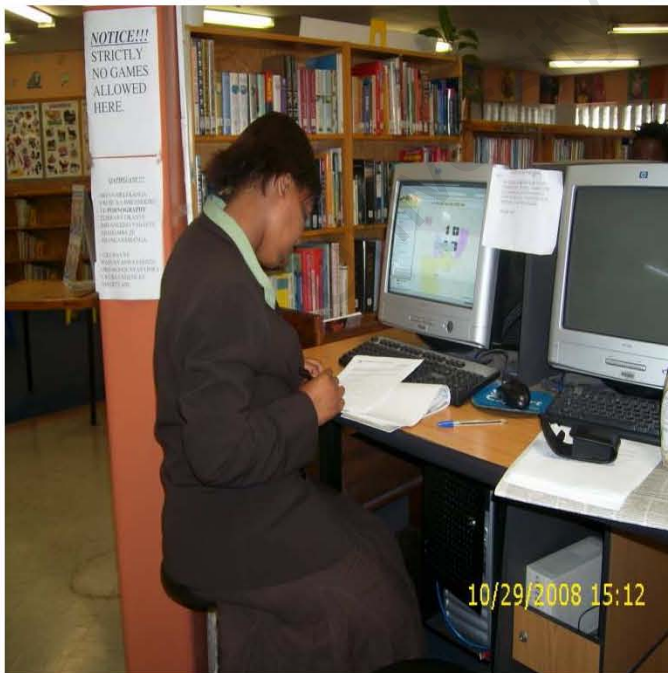
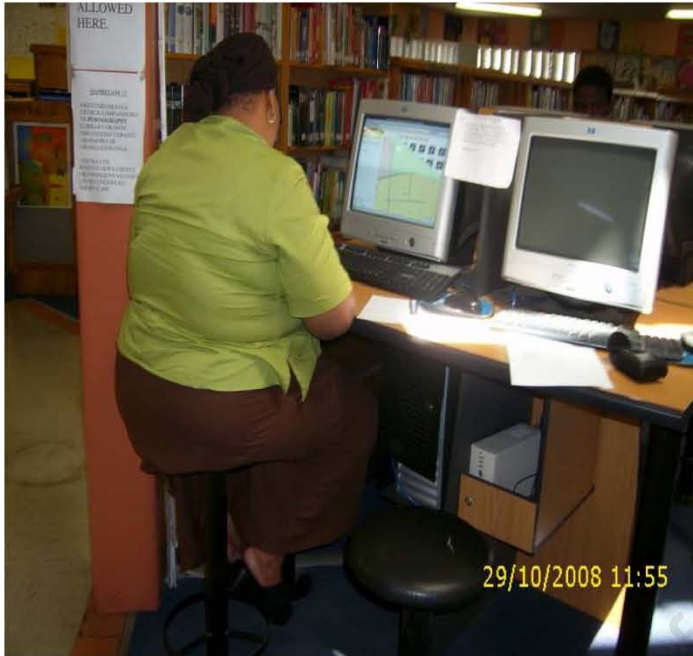
**Langa Public Library**



# Delft South Public Library

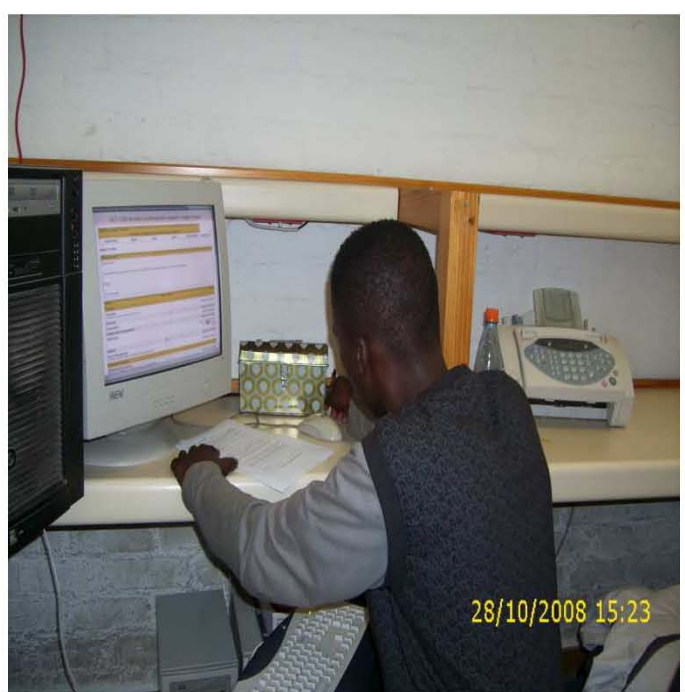
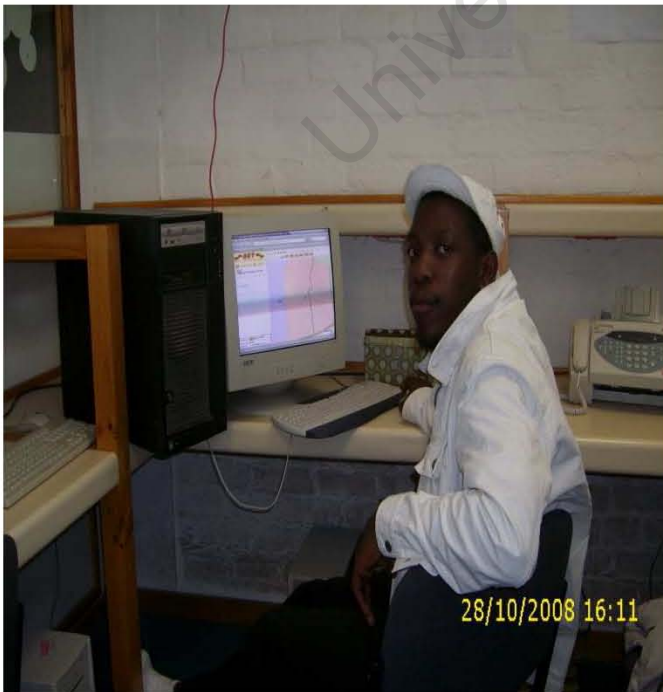
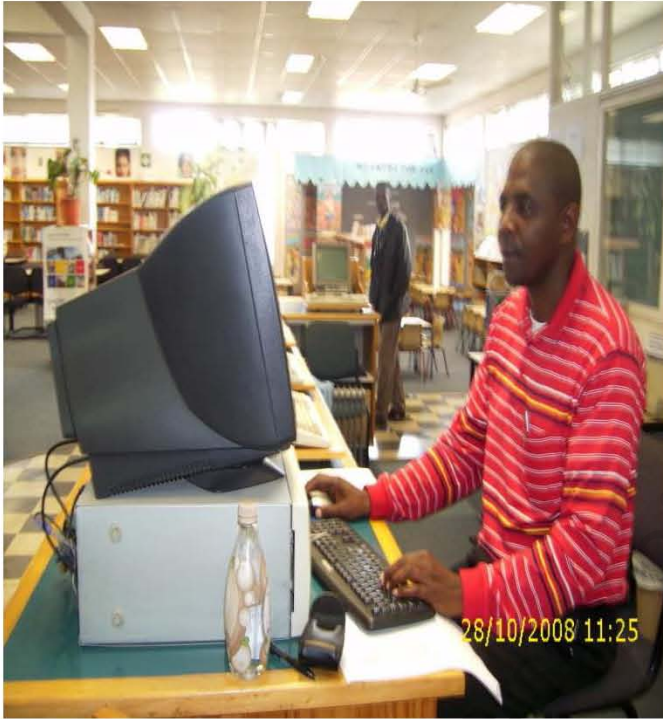


# Crossroads Public Library

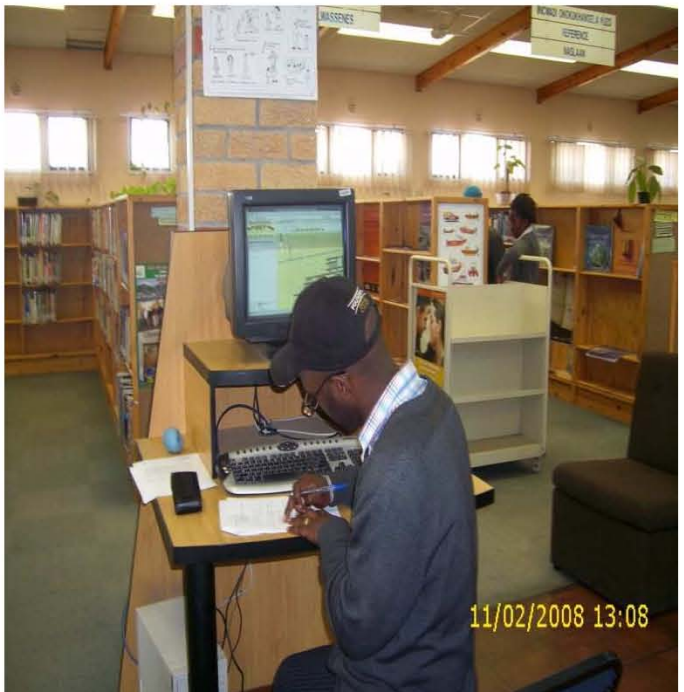
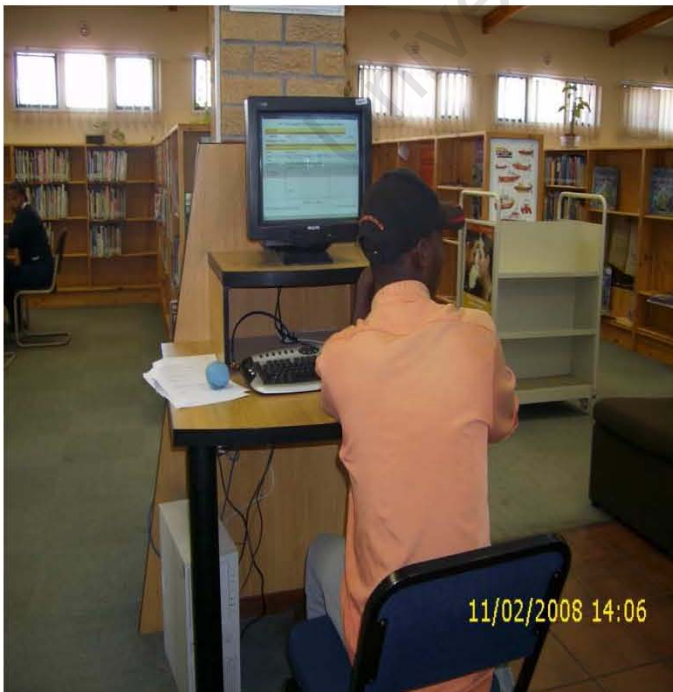
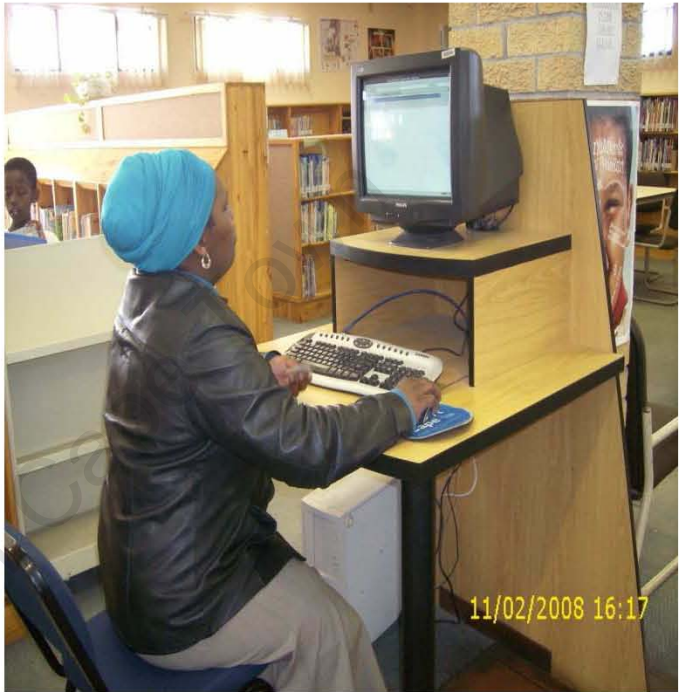




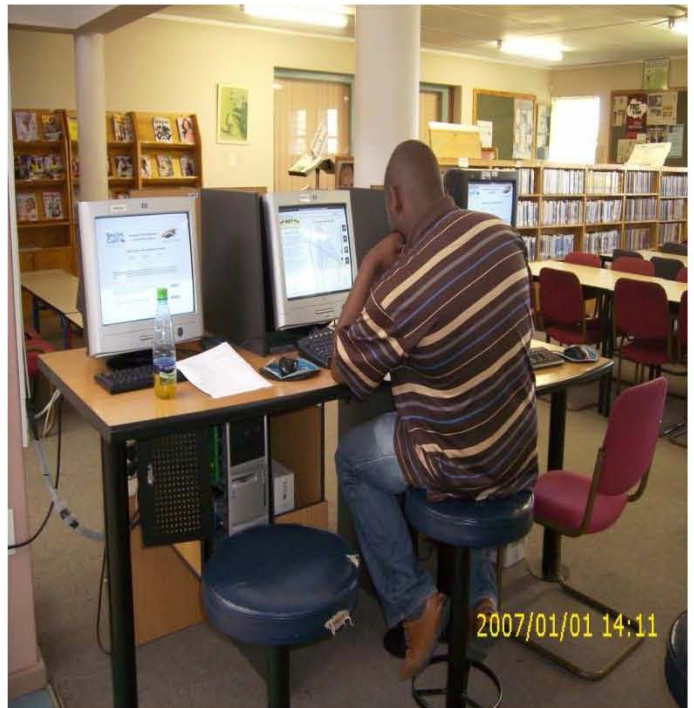
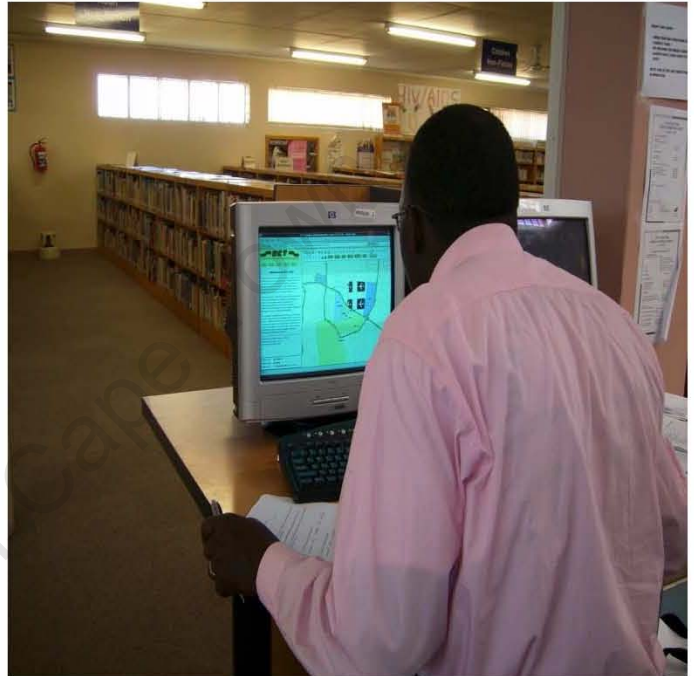
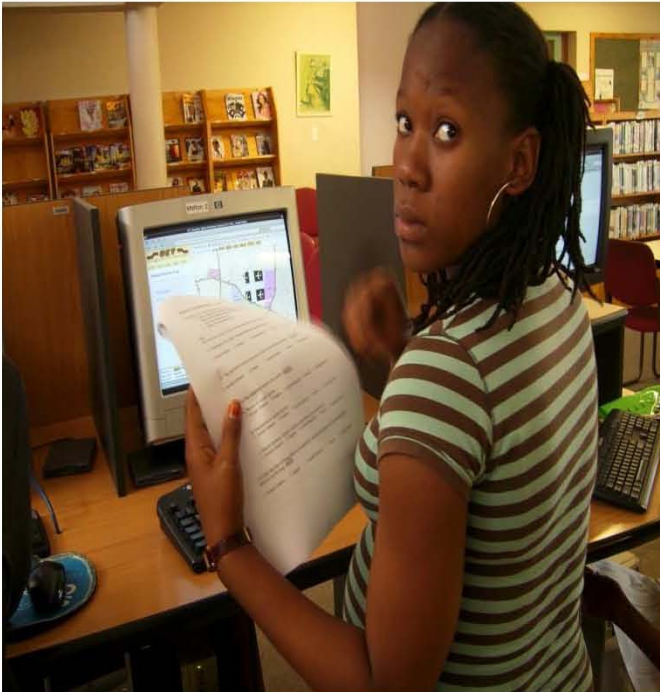
## Nyanga Public Library



# Phillippi East Public Library



# Guguletu Public Library



## ***Appendix D.9***

### **UCT CSIS User e-mail feedback**

**Jeofrey Ditsela**

**From:** lonwabo kilani [kilani.lonwabo@yahoo.com]

**Sent:** Friday, December 19, 2008 4:28 PM

**To:** dtsje001@uct.ac.za

**Subject:** re:

hey jeofrey

how are things going, cause i'm doing good you won't believe how many people i have thought to use the site you showed me. I thought them how to report, see the streernames of their own locations i even thought the library administraters and they are getting on it almost everyday.if you want me to give them your e-mail address so that they can give you feedback on the site. Man it's good and fun to use that site but i told each and everyone of them to report the right things

hope to hear from you real soon

University of Cape Town

## Appendix D.10

### Post-Questionnaire feedback

#### Section 5: Short answer questions feedback.

**Question 5.1:** What problems did you encounter when using the UCT CSIS system prototype? (e.g. understanding the map or terminology, navigating the map including turn on/off layers or zoom in/out of the map, exploring the e-register board, starting a new post or replying to a post, registration process on the e-register board).

- There was no problem but to me it was a new thing
- Registration process on the e-register board
- The UCT CSIS system is kind of complicated to someone who is not familiar with computers but other than that, it is OK.
- I agree for everything.
- Nothing much, but the internet as bit slow.
- There was no problem beside slowness of the computer we used.
- Starting a new post.
- Have not yet come across any stumbling blocks.
- I did not have any problems with the UCT CSIS system, it was easy to use.
- I did not have many problems because it guided me to everything I wanted to do.
- Problems!!! None because the system is clear to anyone can access information easily.
- Nothing much but really enjoyed.
- None
- Some of roads are not listed on the map.
- No problem
- Understanding the terminology was a bit problem.
- The system is very useful and not difficult to use, I am sure many people will find it helpful.
- I did not have any problems simply because everything was clear and everything was explained to me.
- I did not encounter much problems because the help functions was very usable.

5.2 Would you use a system like this to report problems around your community, post request for information access?

- Yes
- Yes oh yes
- Yes
- Yes
- It is good for helping the community to report their problems
- absolutely
- Of course yes
- Yes
- Yes
- Yes. It would be the only and easiest way to access such information.

- Yes, because its accessible and user friendly and since other forms have been tried and tested, an idea like this will be very successful.
- Yes because it is easy and you can be able to express yourself fully and mostly it is exciting when doing it
- Yes
- Yes but it's a definitely yes.
- Yes
- Yes
- Yes
- Yes
- Yes
- Yes I would use this system like this and they could be a lot of change in people's lives.
- Yes
- Yes of course, I will especially problem that affect us in Nyanga. Eg Pipes burst or blockage of the drains.
- Yes I would use it, as its very much useful.

**Question 5.3:** What additional information or tool would you have liked/wished to see on the system prototype?

- It should be linked with all institutions in order to have an access to their information.
- You can add the biography of that place for example, police station, clinic and library. When did it open and the structure of management and updated every year.
- To search the schools and the libraries
- Reported problems around communities
- History about the library
- everything seems fine at the moment.
- Maybe the number of sections of Delft maybe like 13's, 12's and others because mostly that is how we locate our areas.
- It is good enough for a person to do report or something and is easy to use.
- I would like this program to grow and expand to other area all over South Africa.
- It is already advanced but will have to think about any improvement.
- Nothing ... it shows everything and its clear and easy to use.
- Community profiles
- History of the community as we are leaving on.
- Background/the history of lower crossroads community when it was build, who stays there and history of Phillip East library.
- Community profiles
- Something like spell check because not everyone's grammar is excellent.
- I think I do not have any additional information.

**Question 5.4:** What type of function interests you when using the system prototype? (e.g. *reporting problems, posting access to information requests, viewing submitted reports and statistics*)?

- i liked the way the prototype system showed a well orientated map location of my location.
- Reporting and accessing information.

- spatially referenced photos of libraries on the map
- Reporting problems and posting access to information requests.
- Reporting problem with sending a photo of the problem
- Reporting problem, posting access to information requests and viewing submitted reports and stats.
- It is interesting to the community to search the maps of the other libraries.
- Posting access to information requests
- Reporting problems and posting access to information requests.
- Statistics
- Making request for information
- Reporting problems
- Reporting problems because it was so easy.
- Reporting problems in our City because it's the better way that can keep it clean.
- Access to information about service delivery.
- Almost everything that is listed on above, I mean your question.
- Reporting problems and seeing what has been done about them.
- Reporting and area allocation.
- Report problems
- Photo and situation of each and every building around the library.
- Viewing submitted reports and information request
- Reporting problems.
- To me it seems as if all the types of systems interest me.
- Reporting and requesting information, viewing photos of what I want.
- Reporting problems and accessing clinics, schools, police stations that are around us and pictures.
- Reporting problems, requests and viewing submitted reports

**Question 5.5:** What other sources do you use when you look for environmental/spatial/geographical information? (e.g. *radio, newspaper/magazine, Television and map brochures/books*).

- Television, newspapers/magazines and books
- Books and internet
- Books, Television and newspapers
- I agree to everything to take the report for the newspapers, magazine and maps.
- Newspaper
- Television and map brochures
- Books and newspapers
- Books
- Atlas
- Map brochures
- Newspaper and television
- Television and radio are much quicker.
- Map brochures and newspapers.
- Television
- Newspapers
- Community newspaper

- Internet
- Newspapers
- Books
- Radio and newspaper
- books
- Internet
- Map brochures.

**Question 5.6:** Any comments?

- The system should be used in most places including schools.
- Please also add history about the library and its pictures.
- It is quite interesting and informative.
- Agree to learn about this, it keeps me to know about the other things that I didn't know about before. I thank to meet the one.
- It was very crucial. I found this helpful and wishing to visit this site again next time.
- I am so interested about this research project of UCT CSIS system prototype and I am interested to continue using it.
- I think this is a great system to use when you want to know that you are going on around your area.
- It is great that someone has come up with a system like this, as many people would use it for the problem reporting in future. Do not tell people about the incentive price to the doing the questionnaire as that would be the only reason they agree to test the prototype system.
- The system is easy to use and will be very useful in delft because there are many problem and some telephone numbers we don't know to ask for help.
- It is good and exciting formation of keeping our City clean and healthy and safe.
- Big up to this system, keep it up Buddy for helping the communities!
- It was quite interesting and will ask my friends to use it as well
- It could help people get more access to the system because it can make a huge difference and can help people and our environment.
- History of the institutions
- None so far.
- The system is very good, I just wish many people will use it.
- No, I do not have much comments but I would like to thank The UCT for installing a new system for us. It's worth it and thanks to Jeofrey for showing us a new thing.
- I find the system very useful and would promote it to other users as it helps with the service delivery around the city.



## **Appendix E.1**

### **Meeting 30th May 2007**

The Meeting was between

*Mrs. Thandeka Tukula*  
*Cape City Council Environmental Information System (EIS) Manager*

*Mr. Jeofrey Ditsela*  
*University of Cape Town Master of Science Engineering student.*

Cape Town City GIS department's categories

GIS Department	Managers	Office Location
Information and knowledge Management	Craig Haskins	17 <sup>th</sup> Floor, Civic Centre, Cape Town
Corporate GIS	Dr Solomon Bhunu	4 <sup>th</sup> Floor, Keller House, 121 Loop Street, Corner Wale/Loop Street
Environmental Information System	Mrs. Thandeka Tukula	9 <sup>th</sup> Floor, 44 Wale Street, Corner Wale and Long Street

### **Environmental Information Systems (EIS)**

#### **Problems encountered with Access to information before**

- there was no limit to the public access with regard to data or information.
- private consultants asked for a lot of data which they did not need and some were caught selling it. For example, aerial photograph data is expensive to produce but one of the consultants was caught selling it for R30 000.00 to another private company.
- strict legal issues were not implemented.

#### **How did they overcome the problem?**

- the public has to come to individual department which distribute data and maps (i.e. EIS).
- they are intending to develop a map shop.
  - One stop shop for all the city maps and data.
  - The public will be paying for optical device only like CD blanks or DVD blank are used to store data.

- The public will be able to fill up a requisition forms so that to avoid misuse of data.

-EIS Dept will be following ASD (Spatial Data Act 2003) which adhere to ISO9000 which is a family of standards for quality management systems.

-EIS held first GIS expo (8<sup>th</sup>-11<sup>th</sup> May 2007) for general members of the public at University of Western Cape as one of the create awareness.

-EIS is working together with Education Department on the new GIS curriculum at high schools to teach the importance of GIS and how to access spatial and non spatial data.

### **What are its functions?**

-It's a department which houses all Cape Town City Council data to be access by the public and private institutions.

-EIS department uses all ESRI GIS products.

-they standardized all City Council projects which are now platform compatible to any data because other departments used different products before (like mapserver, mapquest, mapguide and others) to make or publish their data to the internet which resulted to:

- Data duplication.
- Platform incompatibility.
- The use of different projection and datum.

Progress of EIS department:

- They completed data inventory where by the have converted all city council to into one projection and datum.
- They are still on data warehouse phase (one stop shop for all the City Council data and maps)
- They are planning to move into internet mapping.
- They are looking to implement strict legal issues with regard to data/information distribution.

## Appendix E.2

### Corporate GIS Meeting 14<sup>th</sup> June 2007

The Meeting was between

#### City of Cape Town Council Representatives

*Dr. Solomon Bhunu (Manager of Corporate GIS)*

*Mr. Mark van der Merwe (GIS Spatial Data Management)*

*Mr. Jasper (System Integration and Operation)*

#### University of Cape Town Representatives

*Mr. Jeofrey Ditsela*

*University of Cape Town Master of Science Engineering student.*

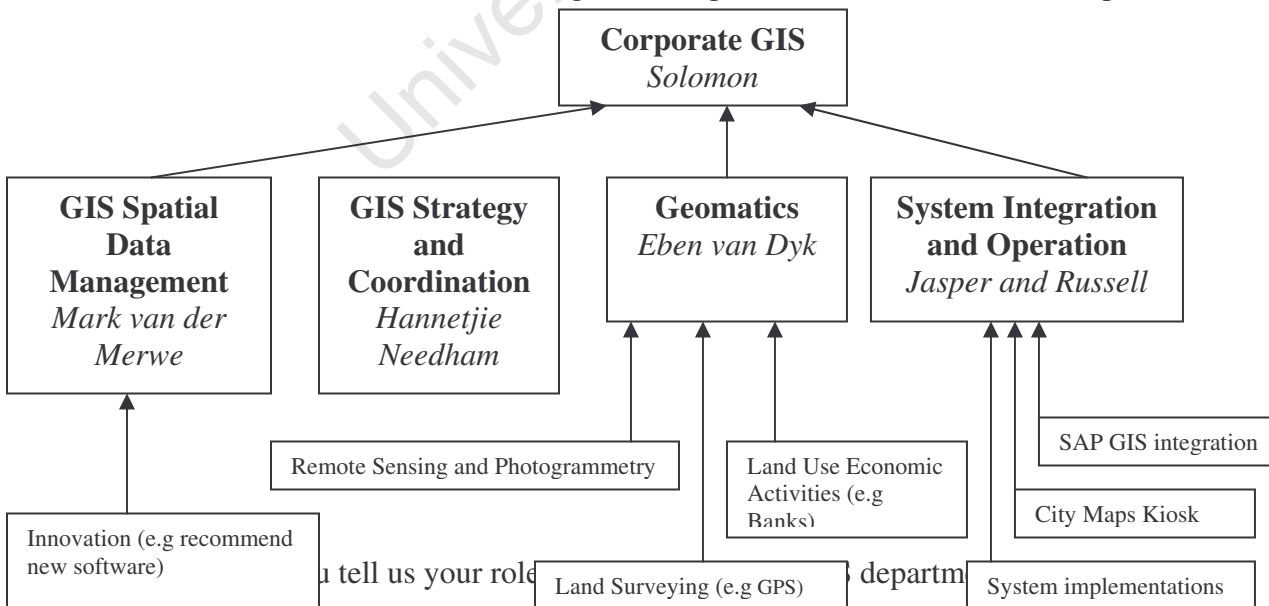
*Dr. Ulrike Rivett*

*University of Cape Town, Research Supervisor.*

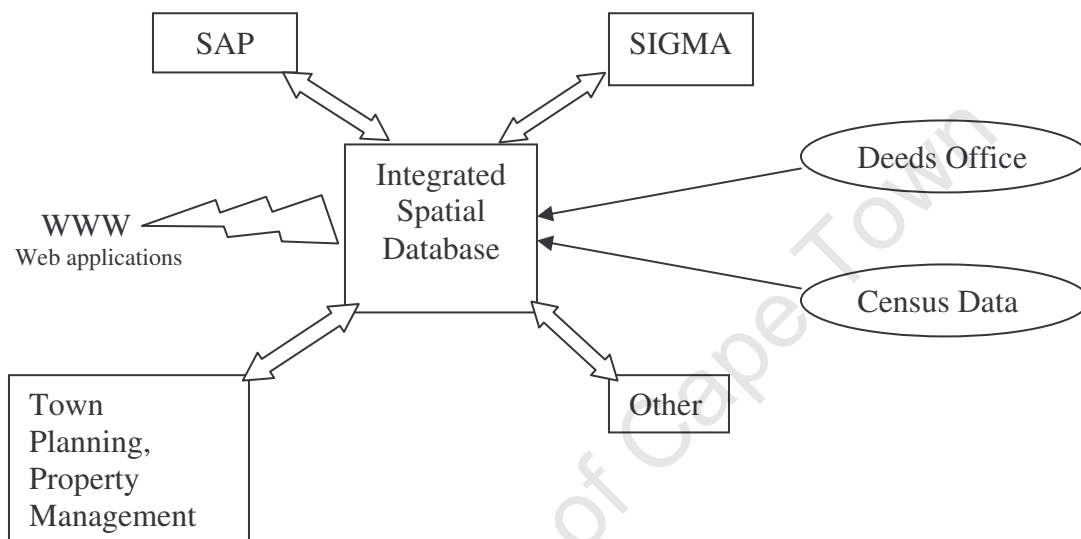
#### Questions and Answers

Q. What we have done with regard to the Cell-Life project, we do everything in Open Source, and we have gone into the government policy trying to understand what the requirements are. If you have a councillor at the Khayelitsha, does that person have access to the data, does they to walk in or log in a call, or bring CD to collect data? When we look at the legal framework, if you are talking about access to information, what actually do you mean? Do you mean the access that you have to walk there or is the access that you can get when you make an effort?

A. Before I give you any answer to this overview, I will give the overview of our structure; we are a Directorate/Branch from Strategic Development Information and GIS department.



A. I am in SAP ERP implementation project where we develop GIS module that is integrated with GIS.SAP is a commercial product and it contains the IC module, the Utility services but the whole system have to be changed for our purposes because it's a customer system, this project will like to integrate our spatial system with SAP because we found that there is a need for different system to work together (interoperability). Regarding the SAP integration with GIS, we are going replace Land Information System (LIS) with an integrated Spatial Database, for example, integrating Spatial and Attribute data (Cadastral & Property Ownership details). We are also going to integrate all Council's property systems by linking them to Integrated Spatial Information System project (ISIS).



Q. How do people access data/information at this time?

A. They walk in the office and make a request

Q. Do you have a web-based application that disseminated information or where people can download data?

A. Not yet, we going to build it on this project, you can understand that most people do not have computer or internet connectivity or vice-versa.

Q. Corporate GIS is deals with spatial data and Strategic Information Services deal with non-spatial data, how are you related and when do you guys come together to produce a coherent report, for example when you talk about 33 people in Khayelitsha have been moved to Delft, you are talking non-spatial (number: 33) and location (Khayelitsha).

A. Strategic Information Services data gives us direction or its a pointer where data can be found, the data is not an attribute data to link to GIS from our side. Where we get attribute, it's coming to us as value chain, we got our spatial warehouse that is linked to property, housing and all other department. This is currently working in a manual process but we going to use automated process to structure it to fit into spatial data.

Q. From this big picture integrating SAP with GIS, we heard about Smart Cape Project, what it is?

A. Smart Cape project is an initiative that brings electronic media to every households in the communities, for people who have access in the households is different, they have put computers in the libraries (pilot project in 2003) as the centre point where most people go. People can use internet and other computer literate tasks like typing out assignments/documents, online banking, making CV's, looking for Overseas jobs and accessing information at large for different reasons. The education dept is busy rolling out the project where they are integrating the Computers in all senior schools across the province. They are now intending to install broadband fibre optic networks through out the city which cost R400 million.

Q. We researched that the Smart Cape is going to be integrated with GIS; this means that the platform is already there, are you guys going to embed your Web-based module to those library so that people can have access to spatial data?

A. Yes, that one the things that we will look at

Q. The Smart Cape project says that they had 6 libraries as a pilot project in 2003, we don't know whether is still continuing because its apparently under City Council ICT.

A. yes, we can confirm that it's under ICT.

Q. With regard to accessing information, you said people walk in, how do they know that your department exist? One of the key holding holes in the system has been identify is that if someone in the community needs certain information but they might not be able to express themselves exactly what they are looking for or they might not know where to find it and the blue pages of the phone book are not the most useful or the easiest pages to read to people on the ground. How do you promote yourself within the communities that they know you exist and if someone were to need spatial data that your department to come to, is this some of kind of vision or at the moment outside the scope.

A. Yes, we are kind creating a clearing house to serve that to external and internal department,

Q. Will that be internet based, how does someone at the communities knows where to look?

A. We have another unit called Strategic & Coordination (Mrs Hanneljje Needham), at present she is working on a GIS strategy for the city, the main focus of unit is marketing, she has been instrumental on organising GIS days that the City had ever had where they inviting schools and the GIS day. They have "adopt a school" concept where each and every organisation tries to adopt a school and students move around learning a lot of things. Lately, she been marketing information related to GIS at school but at every households/communities. So getting the information to the societies, at the present moment it's been through schools but not necessarily approaching households. We have trained councillor to know about GIS, the viewer is weak because it was designed by ICT, when ICT does things, they take it from a technical point view rather than a business point view, in that case the viewer is not popular as it should have been, that's why we are doing this project so that we can get input from everybody around the city and what they really wanted in terms of business point.

Q. This year, the GIS curriculum has been enrolled into schools, do you guys work hand on hand with Education Department.

A. Well, when GIS started in schools, one of our guys who is heading city maps project is called Russell Hope and is a current chairman of GISSA,, he pushed and started the initiatives to start GIS at school, we are very much involved in the GIS curriculum.

Q. How often do you fly over to informal settlement to verify data on the ground (data created) from other diverse source that feed to your system like census data using photogrammetry point of view?

A. Currently we are flying once a year, the financial year 2007-2008, we are going to fly twice but ideally we want to fly much more, for informal settlement, we have this project funded by Danida because we have realised that we have this data that is very important to people, we have project of this kind in South Africa funded by Danida called Informal Settlement Growth Monitoring System which target informal settlement, it takes the aerial image of informal settlement and then it takes in all other surveys from water quality, housing settlement, police and other, it aggregates that information, then the intention is to make that system to be accessible people through the smart project in libraries and who ever have the PC should be able to get visual maps of informal settlement, be able to know the utilities, to be able to know the quality or anything and can be used by disaster management. Its kind of complete system but targeting the informal settlement at the present moment and it captures all the surveys, and statistics prevalence of disease or whatever the system it supposed to capture, so just started it now.

Q. Do you always give feedback to other department or do you have direct contacts to the public.

A. No, we don't direct contacts with the public, we are like ICT, we are a support services for other department.

Q. When you finish with the GIS/SAP integration, are you going to train the councillor or public?

A. Part of the project, there is a training component to test the system, which will be important part. There should be training as part of the life cycle in order to sustain the system. That's why we strategically created the section of Systems Integrations and Operations to sustain the systems at the informal settlement for the number of project that are currently running. Sustaining the system has been the responsibility of ICT but they have doing it from the infrastructural point of view, which is what we don't need. We need people to manage the system from business perspective.

Q. With regard with the libraries, there is obviously the whole confusion about the department responsibilities (GIS and ICT). One of the complicated things is that we try to understand is that which department do you go to when you have certain needs, our experience is that we have implemented a lot of systems in public health but there are situation where there is no network points and we have to apply for them which is one of the bottle neck when work working at the communities. How do people from communities know who to contacts or approach in those case scenarios?

A. Within our department, we have a project called Knowledge Resource Centre, it's been run by Ronelle Rudman, it was made to work within the libraries and strategically it is meant to take over the libraries. If you need everything like to know about the health information, to submit an application plan and other things; it is supposed to give you direction for doing this and that.

Q. How do Corporate GIS and ICT interact? How do you relate?

A. Firstly, it's kind of one way traffic, if we need to do something with IT according to the processes; we do it through a project. In that way, it's a certain requirement where we interact with IT, if it's an Information System related project, the IT side have to approve the element of it. From the IT side, there is nothing that enforces them to take action.

Q. How do you set a boundary line with IT, if you set a system of spatial nature, how do they define it if they are not concerned about GIS work?

A. We have got another initiatives on the side called "Roles and Responsibilities with IT" where Mark and Jasper meet IT every fortnight. It has been going on for 8 months because overtime we realised was IT was managing everything and we gave them aerial images and all the spatial information to put it in the viewer that was also not updated; they also transferred the data from our server at which it lost its geometry. People were blaming us about the situation. IT was forced to come the table with us and resolve these things. Nowadays we have our own developers who know about spatial data.

Q. Do you have GIS specialists in Water or other department because you just said that now you have IT programmer in Corporate GIS?

A. Some GIS specialists in different department are like cartographers and here we have geoscientists professionals who know about databases, programming.

Q. I have two things which are relevant to this research with regard to open source, do you have a strategy to start including open source environment.

A. Well, we are following the City of Cape Town standards, we have invested a lot in ESRI GIS, our guys have been to training and to move away from it overnight it will be difficult. We do look at other software but not at a larger scale.

Q. How do you choose software?

A. We do a research to choose which software to go with.

Q. The one concern with Open Source most of the time we don't have maintenance contract like ESRI GIS, or identify people that can give you a support. Is that a key concern?

A. It is a big concern to us, previously we had database but not really a database that was created but a single person, when he retired, we invested a lot of money to migrate data to another environment. The database served a different purpose but database design and modelling rules were violated, we have to do everything with SQL environment.

Q. When you put a tender out, will you accept a tender with Open Source or will you shy away from it because of that reason.

A. Well, according to Government policy, we are not supposed to say which application is appropriate to what and what? But whoever is tendering is supposed to convince us of whatever the system is going to be developed, this is how the system is going to fit with current system and this is how it is going to be sustained.

Q. In GIS, it is certainly a challenge because there is nobody out there right now and who actually does system development. We have done a little with regard to water with Cell-Life.

What we are trying to find is that when you are using ESRI product, there is obviously maintenance support contract with them, how successful is with and is it something that you can pick up the phone and lodge your call.

A. Firstly, we have a problem where the city is not paying the contract in time but they have been always been on hand. Obviously the expertise goes to certain levels but we are actually building our own internal expertise. When we the city discuss different licensing, we actually realised that 70% GIS people doesn't actually need ESRI product and you go use open source route but on the main flip side, you can keep your little application and link to ESRI products ArcObjects.

Q. I was going to ask if you guys you are going to couple some lightweight Open Source application with ESRI product.

A. We do search on Open Source, we can see that open source work, but the problem is capacity, we just advertised that 6 posts, one of our requirements is that we need young guys with IT background and they have to be capable of doing scripting and to do research.

Q. Where does your data repository sitting at the moment and is it accessible to the public?

A. Our data is sitting at Civic centre but you will see production environments sitting in different environment, none of our data is accessible to the public.

Q. So, if this research looks into developing an application for accessing part of the geo-database, are we going to get that permission of access?

A. No, because what we have we have a situation that everyone will come at any time to do that which will cause problems because they might affect it, they is also legal implication posed to this, we need to control that. For this research, we will look into it rather than granting permission for random people.

Q. Looking at the big picture, we have the public in the centre and legal implication and security on the side, how are you guys dealing with it?

A. To the public, in terms of information, we have IT guy who take care of security issues because the system have fire walls, virus scanners, file download restrictions and all those makes security issues. The legal implication can be handled by signing a memorandum of agreement before you can download or use any information from our geo-database.

Q. If you look at all these policies that are coming up with regards to Open Source and access to information. What are your greatest concerns, what do you see it feasible or not, what is useful for you, when you are sitting on the other side of the public perspective, where do you see the greatest bottle necks with regard to delivering on your side.

A. Capacity, there is an issue of capacity as a concern, having a centralise point for information, which is the City maps quest. Then there is an issue of bureaucracy, then the hierarchal structure in which the city operates where by even if you have a small need down there, it have to go up, when it goes up there it have to go to another directorate, followed by departments until it filters down to another person who doesn't have any knowledge of its importance. That's a big challenge.

Q. Is there any direct approach between Managers in another department?



A. Its limited, you can only interact so much but not more. If you need to do something else, it needs to go all up the hierarchy. According to our structure as it goes up, the less technical those guys become, so that another challenge. The technical knowledge of managers affects us.

Q. How many people are in Corporate GIS?

A. +- 20.

Q. As to take away from this meeting is that the concern with regards Open source is support?

A. Yes, support, capacity and again the problem is change in management. How do you introduce something that new to people with 25, 20, 30 experience, who have with ArcInfo dos-based compared to ArcGIS 9.2. I have gone with guys to ArcObjects training and we are preparing them to program ArcObjects. Its tough to change the system when most people in the city have qualification/certificate of ESRI products, then they wont have jobs anymore because most of the time you find that they only did Matric.

Q. If you have time, you should come to Cell-Life and we will show you what we have done with regard Open Source.

A. We would love to come to Cell-Life research office and see exactly what you have done, at the present moment we have invested in ArcGIServer, what ESRI have done is they have given people a programming/development platform. With this, you can develop what you want; it's more like their "open source" house. Once you have it, it's like the fraction of the money you pay and people personally develop skills.

Q. With regard ArcGServer, when you do development, what with the code that you produce? Can you make it with GPL licence as open source?

A. Unfortunately it won't be available because you need runtime environment license; I won't take it out and deploy it because we have paid for the license.

Q. At the present moment, if you want data/information, where do I go?

A. You come in person to the Corporate GIS office.

**Appendix E.3**  
**Meeting 11<sup>th</sup> June 2007**

The Meeting was between

*Mr. Craig Haskins (Strategic Information Services)*  
*Strategic Development Information and GIS Department*

*Mr. Jeofrey Ditsela*  
*University of Cape Town Master of Science Engineering student.*

*Dr. Ulrike Rivett*  
*University of Cape Town, Research Supervisor.*

**Questions and Answers**

Q. How many people do have in your department and what is your responsibilities within the City Council GIS department.

A. We have 60 people, we are responsible for strategic information and the corporate GIS. When you meet Dr S. Bhunu, then you will be dealing with the larger part of the branch at which he have approximately 40 people, he is responsible for amongst others all the corporate GIS functions in the City. At the moment its the hub and spokes model, he is the **hub**, so all the layers is of GIS data that approximately 400 in Spatial database engine or house, cadastral, all the links to the surveyor general, e.t.c, e.t.c . But within the City, Individual departments have GIS capability located within them, water is well resourced, electricity is well resourced; social development may be not so much.

The Other three people

Resource and Support manager, Ronelle Rudman was unable to make it our meeting. She is responsible for Access to Information and she is in charge of setting knowledge resource centre which is a vehicle disseminate information knowledge.

Information and Knowledge Strategy manager, Mr. Kevin Tabisher he does not have staff or either Ronelle. He is kind of intermediate between Corporate GIS (Data) and myself (Strategic Information Services) my branch is only 6 people and we are responsible for non-spatial information of a strategic high level/high order level information, we don't have all the information about everything in the city but we have one slice.

Q. When you say strategic information, what will that include?

A. One of the most of important elements that we contribute to this is the integrated plan which is a very high level, 5 years strategic development, and we provide information based to this, in other words are the factors in the City is happening at present. And of that, the strategic/political agenda set, we will serve unemployment, poverty, environment, and housing e.t.c. We have external sources as well such as StatsSA, Census and other.

Q. Do you do any household survey?

A. We provide survey consultancy to organisation, we per say that having this capabilities anymore to do surveying though we do small ones. We almost advice other departments on how to go about it. We little project manage from a complete solution, where we will draw potential reference and manage consultancy and quality assure recommended solutions. If they just need help with the questionnaire, we help them with a questionnaire, if they need help with the terms of the reference, we do that. At anytime we probably involved in three services, next year I have one (survey) going up which is run by us but managed on consultant basis that's looking at customer satisfaction services ,so that will go out the whole city probably 35000 household to be interviewed. It's a quite comprehensive questionnaire, it's basically to know from the household and what is their happiness index in the following services.

Q. With regards to the survey, if you select 3000 households, how do you choose these households?

A. We will sub-contract a market research company, for example, we want a statistics to be valid for metropolitan, so we will say we need to come with social groupings, we will use house types to approximate, we will say in space of 5 house types, we have urban, middle, poor and informal. In each of these, we will start to collect some data. We will be quite ultimately involved in actually doing the research design as well as having to look what is actually contained in the questionnaire and in most cases we draw up the questionnaire for them and then we tweak it because we kind know of what we want. And then we obviously ask for when they are finished, we request all the raw data to back to us as well because they will give one set of stuff and we will like to cross check and also do compare of what they present to us. We have the capability enough to do it, we don't do the field research and the data clean-up but on smaller surveys we do for example, just recently there is an opportunity for public engagements around the IDP with good sponsors, we will code the data, clean it up and write the report.

Q. Will that data go to Solomon's Office?

A. No, his is dealing spatial data. The data is stored by us and some is published on our website or intranet. Some of the data is on the internet is already in internet like all of the census data, labour force e.t.c that make provincial figures.

Q. If somebody want to know what was the customer satisfaction in my area, how will they combine spatial information and non-spatial information you produce.

A. I have to GIS people in my unit, we would package that information specific to the requirements.

Q Who could the user be?

A. The user could be bank, property developer, petro-chemical company, another market research company, academic institution, politician and we serve everyone.

Q. What type of people comes a lot to your office?

A. Most of our requests are internals, the City of Cape Town staff, most of the external are the NGO's/ private entities as opposed to public in other words non-governmental broadly and the business community.

Q. Usually non-spatial and spatial data are integrated together, when is your unit and Solomon come together to combine this information to meaningful?

Most of the time the final combined information is from our unit in a presentable format, Solomon's duty is to save data in spatial format, his role is not to make more understandable/intelligent or to add analytical knowledge aspect to it. What he does is to present it as, this is the water data, this is the biodiversity network, this is the veld-fire data or this the roads network. We will take Solomon's data and build something depending if there was a query. Let's say that we are looking at informal settlement, his unit will capturing and encoding every informal settlement dwelling in the city and they do that every single year. What they do is that they provide us with a layer, with informal settlement located within it and with each one layer, all the map dwellings within those settlements. We will then take it and do some train analysis, let's say from 1993, what happened from year to year, what are the implications to the city in terms of the population growth, in terms of native migrations e.t.c, how is this going to impact the city services. We take his data and make it into information/knowledge, make it useful. That's the kind of relationship we have, there is not much that goes from us to him, and we are reliant on him for a part that we need to serve the city.

Q. I have researched about the Smart Cape project, I want to know which department does it fall?

A. It falls to ICT department.

Q. The Smart Cape project is integrated with GIS, we want to know how did your department contribute to this.

A. basically Solomon can be able to answer that question during his interview time, basically there is a move all the spatial information to one function. For example, the city is backed by SAP which is non-spatial, is not bad though it has short comings but it was necessary, we had 7 metropolitan council in 2000 and probably 5 different financial systems, they all needed to come into one. Solomon will be a better person to answer this but anyway, our department is been run by **Jasper**, who is basically running a project where the SAP GIS integration is going to happen in the next 18-24 months, we will be able to do all your queries spatial, the project will be on the form of the workflows

Q. Is the project on the pipeline

A. The consultants have been appointed and they are 4 months on the job. They are other initiative building on this project.

Q. As the Smart Project stands, you as a department, are you supplying any sort of information with regard to Smart Cape project because it has been clearly integrated it with GIS.

A. You have to ask Solomon, if its spatial data, he will know better else if non-spatial I will be able to give some answers.

Q. As a department, you have external or internal request for information, do they have to pay for information or they can just get it.

A. No, they don't have to pay anything, the only payment that is required from my nit and Solomon is media optical devices like CD's. Most of the public requested information has been migrated in internet to avoid the hassles of asking for the same thing time and again.

Q. Do people know if you exist? We kind of trying to find what exist and then we go to the communities to find what is the different between perception and reality is!

A. No, people does not know that you exist

Q. We are trying to understand "Access to Information" which comes in two words, the one way is from the government that you have a top down approach and we say ,we from the Government we are making a concerted approach to let people know that we exists on what we do. The other word is that, you have the communities make themselves educated and understanding. One of the realities is that some of us struggle with blue pages in the telephone directory to find to with the emergency numbers. Do people in the communities (specifically informal settlement) where you have little or no internet, if will have access, will they find or have you have had any interaction which communities at that level.

A. No,

Q, So you don't have like politician from Khayelitsha saying I need to understand this and that?

We do have ward councillors that knows that we exists, but not from the communities themselves, obviously through their Reps, within the City of Cape Town internal requests, 40% is the Political Reps that request information. We just been on a process and we will continue thru July, the sub-concillor have changed and now they are 23 of them. We started with a presentation to the forum of chairs of sub-councillors to say look, he is all (unfortunately we were still using 2006 data) because we made this presentation to let the know about new political boundaries, there has been a lot of information about ward boundaries and suburbs. Instead of them coming individual, we tell them that it's on the intranet, this how you find it.

Q. Do you find that a lot of ward councillors use internet.

A. It's coming more and more, it's not evenly spread

Q. Do u do your searches on the engine or website to find out where most of your searches/request is coming from?

A. No, what you we are doing at moment, our stuff is based on the internet but it's one level down and I have motivated our City website committee that out URL link should be on the front page City website quick links and we are trying to create City maps on the internet.

Q. Do you find that people are confused to which department to promote what?

A. Yes, people are confused every time. They even have no understanding on local, national, and provincial governance. They don't understand the task and responsibility and how the link or who report to who. Within the city, we have 21000 staff and 53 services.

Q. As such there is a challenge with regard to Access to Information, because if you don't know where to look, you will never find.

A. yes, it's a problem, the website construction has been neglected for 6 yrs, they are working on it. There is a new initiative underway to get the site to work of 2 functionalities, one is kind of intuitive and the other one is the structure.

Q. Apart from the SAP GIS integration that the consultants are 4 months on, what are other projects in mind or in the pipeline.

A. We do population projection of the city, all the demography, population migration e.t.c . We are also looking at urban growth monitoring, socio-economic profiling, existing human developments. We take some time working on requests as opposed to analysing information.

Q. If you have hot topics like Inzamayethu, do you find that they are a lot of request from the communities or from the politicians at the same time.

A. At the moment we know what coming, we are always ready with data or information to anyone.

Q. Are you in your department promoting that kind of information as the city motto says "the city that works for you".

A. Well, we don't. There is a communication department to that. We do sell ourselves as a department to tell people that we exist. We are involved in maybe 5 or more public/academic events during the year. These are like GISSA, GIS week, Seminar in UWC for GIS curriculum.

Q. Do you feel that is your legal obligation if you look at 'Access to information' or it's anybody or the community have to know how to understand/read the blue pages?

A. It's both, it's everybody obligations, you can't do data analysis without user requirements, there is a certain responsibility for a community to find us if they need an information.

Q. Which colour population do you think require extensive education to actually understand that guys are available, where do you say they is a greatest need for data and less.

A. It's one up and the other down, those who have access to resources , there is no ask that is necessary, but what they ask is a lot. For example, the Green Point people a lot of information because they want to oppose the stadium to be built while in Inzamayethu is not needed as much or more often (like how many house are being built in Stranfontein).

Q. If there is a way to be a campaign to promote Access to Information.

A. In a large case for us, they could be a set of information people are looking for that doesn't reside with involves us. For example, we analyse a lot of the call centre data, as long that call is waiting, how long a person is communication before the line cuts, e.t.c e.t.c. They could be also be useful information that doesn't have to be only at strategic level, that could be at management information system level.

Q. With StatsSA, there is also a limitation of what they provide, how do you get the most updated data and relevant data.

A. We have a very good relationship with StatsSA.

Q. You have said that you have 6 staff member in your unit, but Water Services has integrated GIS into their system, is their GIS staff independent or they consult GIS department for expertise.

A. If they need additional capacity, they consult the Corporate GIS because they serve request fro maps, shape files data, metadata, database design, front-end design and e.t.c. The idea is that they are a corporate function, the have to control who is serving what information to what format and also all more general requests need to go through them but not through Water GIS section. Ideally we are going to have City maps where you are just going to register your request by email and ArcPDF can be sent to you or select the layers from the 400 layers.

Q. Do you currently have a web application?

A. Its on the pipeline, the SAP GIS integration is going to serve that. At the moment you have to physically go to the office in person to get what you requested.

Q. With regard to access to information, all the GIS information that you providing on the Website are non-spatial. What kind of information is and what is their format?

A. It's PDF's, html, word documents. There are maps in there but just jpeg pictures. Well, most of our market need that kind information supposed to Corporate GIS unit which is more spatial.

Q. So generally, your website much of Information website but not interactive and dynamic or doesn't have much content.

A. No, there is a lot of content is the website, we have the census data, city sub-council, ward and suburbs (approximately 400) but its a lot of categories.

Q. Do you think that the fact that you use ESRI products that's the limitations to Access to Information?

A. Yes we do, but that will be suitable to Solomon but personally I don't have any particular believe in ERSI products because the licences are quite expensive related to Open Source because they provide the same functionality, in terms of integration within the City, if the open source doesn't talk then they is a problem but we are aware that we are spending a lot of money.

Q. The reason why I ask this question is that there is a big push at the National level that says we need to go open source to save money and the other question is that could you get people more access at community level if fro example they were to have open source interface so that they interact with the data they might not afford those licenses.

A. When you speak to Solomon, you will have a clear idea on that. We are supportive of the idea, there is this viewers like GeoPDF's which are aimed at the market, its not necessarily a cost constraints and most people don't full GIS functionality, we need something less, A lot of that can be services through Web-based service or other instruments, but they need to come off something and they need the support.

Q. Have you had request often request from politicians, like what is the outcome of the customer satisfaction, do you find that people use data the interpret the agenda in some ways.

A. What we really to is try to provide much of as openly as possible, for example, in the last five years, people have misused the Census data, example ,in estimation of the population of Khayelitsha, province actually did population validation of Khayelitsha, they came out with the number but it wasn't much more of the census and increment. It took province 10 months to sanction the release of the data, if you spoke to anyone, they will tell you that 0.5-1 million and you wonder that Cape Town has a population of 3.5 million.

Q. Does the media come to your office to ask about information?

A. Absolutely, the media is very import and the always come.

Q. Are they good or bad to your.

A. They are fine, I don't care but I am here to tell the truth and serve the public, if they write things I didn't tell then, it's up to them. The one thing about information that we provide is that it need to be robust, it need to be statistically valid, it need to be defensible.

Q. Are in the business of interpretation the data?

We are doing that, we have to analyse and interpret data because often when you serve the data raw as it, people misinterpret it and you end up in trouble. Nowadays when we write things, we actually contextualise it and define it to avoid some misinterpretation. When you are dealing with the media, they kind include their opinions and if you don't give them the brief what the data is all about it, they will write anything, we have been very careful whenever we do analysis and interpretation to reduce that.

Q. If you interpret the data, do you also create data?

A. No, that's Solomon's job, our job is to analyse, interpret, put it on context and present it (gave us book they compiled to show us how the present the information).

Q. With regard to the SAP integration, do you feel by developing the whole backbone on the financial system that will have the impact on what type of data you provide and how you provide the data?

A. Yes, SAP is a financial system but you can build whatever you want because it has different modules, we are just starting strategy document now to motivate for an integrated Spatial enabled emergency response system. This will exists in Provinces but not in the cities, basically it will allow all our services and all in one screen to send a notification and dispatching mechanism, for example, when the is a big truck rolled on the highway with a lot a fish, in one screen, you can just see the police, ambulance, waste truck and all parties that will rescuing the accident. You can additional see where those vehicles are, where the incident occurs and other things. In SAP, you can buy a module, like public safety module, you can use as a police notification mechanism despatch mechanism, you can buy the utilities module, you can combine all the modules to get a kind of interoperability system.



## **Appendix F.1**

### **REQUIREMENTS SPECIFICATION**

#### **1. INTRODUCTION**

##### **1.1 Purpose**

The purpose of this document is to identify the functional requirements that have been gathered through the requirements engineering process of inception, elicitation, elaboration, negotiation. It details the functional requirements that the stakeholders of the application have been agreed to and prioritizes those requirements in relation to the project resources available.

##### **1.2 Intended Audience**

This document is intended for readers that have previous experience using GIS software. The readers are expected to have knowledge of GIS terminology such as geo-referenced, spatial, panning, zooming and querying.

##### **1.3 Additional Information**

For additional information on the process used to gather requirements for this project, please refer to the Requirements Engineering Process on Chapter 4.

##### **1.4 Contact Information**

For further information about these requirements are: Jeofrey Ditsela, email: jeofrey.ditsela@uct.ac.za or jeffy\_ditsela@yahoo.com

#### **2. OVERALL DESCRIPTION**

##### **2.1 Product Perspective**

The prototype system will be used by communities at selected informal settlements public libraries to request access to spatial information and report environmental problems. The prototype must be user friendly and be usable by non-expert users. It should be accessed on the web browser and that can be accessed from virtually any computer over any Internet connection, even the slowest dial-up connection.

##### **2.2 Production Functions**

The system primary goal is to submit request for spatial information and report environmental problems in the form of a GIS interface. The non-expert user must use the interface with ease and be accessible from anywhere through the internet at community libraries.

##### **2.3 Operating Environment**

The prototype will use Smart Cape Access Project which uses open source platform at the selected community public libraries. The prototype will be implemented with a combination of open source software.

##### **2.4 User Environment**

Users will operate the application from anywhere where they can access the website because it's online. This study is focused on the communities at the informal settlements.

### 3. EXTERNAL INTERFACE REQUIREMENTS

#### 3.1 User Interface

The user interface will conform to the user interface requirements as gathered from the HCI, usability methodologies and GIS best practice interface designs literature review.

#### 3.2 Hardware Interfaces

The user will interact with the web-based application by means of a computer monitor, web browser, mouse and keyboard.

#### 3.3 Software Interfaces

The data used for the prototype was in Shapefiles format and the other data is connected through PostgreSQL/PostGIS database.

#### 3.4 Communication Protocols and Interfaces

The prototype is hosted by the University of Cape Town server and its web address is [http://137.158.137.68/fist/fistAdmin.php?site=uct\\_csis](http://137.158.137.68/fist/fistAdmin.php?site=uct_csis)

### 4. SYSTEM FEATURES

#### **4.1 Request access to spatial information**

##### 4.1.1 Description and priority

The user must be able to send request for *list of records/information that is automatically available* and share feedback of previous response, as well as to post new access to information requests. The E-register board should allow guest users to view, post and reply access to information requests

##### 4.1.2 Results

A request should be displayed on the e-Register board. The board should also signify number of views and replies of a certain topic.

##### 4.1.3 Functional Requirements

This will be achieved by the user choosing a relevant directorate on the e-Register board. The user will then choose a department to request information and post a request. The results must then be published publicly on the board so that other users can view them. A user should have the ability to reply other users post if they want to share the information to avoid the waiting period from the administrator.

#### **4.2 Report problems of spatial nature.**

##### 4.2.1 Description and priority

The user must be able to report any problems in their area by using the prototype, describing it in details and uploading any documents or multimedia files to support it.

##### 4.2.2 Results

The statistics webpage should be updated by the new reported problem, and it should be published listed in the front page so that any prototype user can view it.

#### 4.2.3 Functional Requirements

The users must be able to select a tool from the tool bar and locate the area they want to report the problem. Once the area is selected, they should click the links and fill-up the form that will be displayed on the pop-up on the new window. The form has the listed category of the problem, description text area and other necessary field for required details. The reported problem is then submitted online and it can be view immediately on the statistics website.

### 4.3 View Statistics

#### 4.3.1 Description and priority

The statistics of the reported problems and online access are updated when an activity happens on the prototype. The statistics of the reported problems are extracted from the PostgreSQL/PostGIS database and is display to the users. The online access statistics display the number of visitors no the website, it also keeps statistics on the number of visits each hour and every day.

#### 4.3.2 Results

The statistics webpage present the statistics on a pie chart, it displays newly reported problems in the past week, fixed problems in the past month, pending problems in the past month and a total of all the problems. The users can also view all reported problems from the study area statistics link and site statistics link.

#### 4.3.3 Functional Requirements

This is achieved by the user clicking on the statistics button on the tool bar, the statistics webpage will then be displayed on the new pop-up window.

### 4.4 View Spatial Photos

#### 4.4.1 Description and priority

The user must be able to view navigate the map area and view the photo of a community public library that he/she want to visit.

#### 4.4.2 Results

The selected community libraries of where this research was conducted were spatial referenced with photos so that users have a good orientation of the library location. The photos should be displayed on the new resized pop-up window.

#### 4.4.3 Functional Requirements

The user will have to select a photo tool from the toolbar and select the photo icon of the library. The photo of a particular library will be then displayed on the new pop-up resized window.

## **Appendix F.2**

### **1. Community Use Case Narratives**

#### **1.1**

<b>USE CASE NAME</b>	Use basic map functionality tools and navigate features.
<b>GOAL IN CONTEXT</b>	The user should be able to use basic GIS map functionality tools and navigate features provided on the map viewer. The tools are for zooming, select, and pan functions and navigation can be accomplished by selecting layers, identifying features on the layers and editing data on the map by using other provided tools.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user must have read the tool tips on the toolbar and selected the correct tool icon to do the operation as wished.
<b>SUCCESS END CONDITION</b>	The user clicks the tool on the toolbar and click on the map viewer, the results of the tool action will be displayed on the map viewer or prototype sidebar frame. Depending on the tool that is clicked some results will be populated on the pop-up window.
<b>FAILURE END CONDITION</b>	The user stops the process or did not read the tool tips.
<b>PRIMARY ACTOR*</b>	Community user, Information Officer use.
<b>TRIGGER</b>	User selects the right tool from the toolbar.
<b>MAIN SUCCESS SCENARIO</b>	Identifier tool (Scenario) <ul style="list-style-type: none"> <li>• Use selects the identifier tool.</li> <li>• User selects a feature on the map to view its metadata.</li> <li>• Metadata results are populated on the pop-up window from database.</li> </ul>
<b>FAILURE SCENARIO</b>	Slow internet connection or database server crashes, in case of the system error the user is alerted

\*The Use Case consists of 1 or more actors.

## 1.2

<b>USE CASE NAME</b>	Read the information on the system.
<b>GOAL IN CONTEXT</b>	For the user to understand the purpose of the research project and the system, they should read the about page on the system. If they want help while using the system they should read the Frequently Ask Question (FAQ) or look at help page on the system which stipulate all system functions. A tutorial is also provided to illustrate porthole reporting scenario.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user should load the website on the web browser address bar.
<b>SUCCESS END CONDITION</b>	The user clicks on the about tab of the system and the information is shown on the sidebar frame. The help button on the toolbar shows information on a pop-up window.
<b>FAILURE END CONDITION</b>	The user not reading or not be able to find the about tab or help button.
<b>PRIMARY ACTOR</b>	Community user
<b>TRIGGER</b>	User click on the about tab, or the help button.
<b>MAIN SUCCESS SCENARIO</b>	Help button (Scenario) <ul style="list-style-type: none"><li>• User clicks the button</li><li>• The new pop window shows the help information regarding the system.</li></ul>
<b>FAILURE SCENARIO</b>	Slow internet connection.

### 1.3

<b>USE CASE NAME</b>	Report an environmental problem.
<b>GOAL IN CONTEXT</b>	Apart from users sending request for access to information, they should be able to supply information or submit reports of environmental problems around the area.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user must check if the problem to report is not already reported from the statistical website to avoid duplicates. If not, then user must have read the tool tips on the toolbar and selected the report button as wished. The form for filling details should pop-up on a new window.
<b>SUCCESS END CONDITION</b>	The user clicks the report tool on the toolbar and clicks a point or rectangle on the map viewer, the suburb names to report from is displayed on prototype sidebar frame. The user select the suburb name and clicks the link so that the report from pop-up on the new window.
<b>FAILURE END CONDITION</b>	Uploading the wrong file format of the photo or documents, the file extension is written as a recovery error message when the user submits the form.
<b>PRIMARY ACTOR</b>	Community user
<b>TRIGGER</b>	User click on the report button.
<b>MAIN SUCCESS SCENARIO</b>	<p>Help button (Scenario)</p> <ul style="list-style-type: none"> <li>• User clicks the button</li> <li>• The new pop window shows the help information regarding the system.</li> </ul>
<b>FAILURE SCENARIO</b>	Slow internet connection that might lead to server timeout or database server crashes.

## 1.4

<b>USE CASE NAME</b>	Produce system report
<b>GOAL IN CONTEXT</b>	The user should be able to manipulate the map using the tool provides, digitise the map sessions to suit a scenario of choice and print map copies for reporting purpose in any layout.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	Once the system is loaded, the create map tool is ready.
<b>SUCCESS END CONDITION</b>	The user manipulate map viewer with the provided tools and finally select the create map tool. The system will render the manipulated map session and convert it into PDF document. The user can print the PDF document or save it.
<b>FAILURE END CONDITION</b>	The user not using the appropriate tools to create a map session.
<b>PRIMARY ACTOR</b>	Community user
<b>TRIGGER</b>	User clicks on other tools for map manipulation and finally clicks create map tool.
<b>MAIN SUCCESS SCENARIO</b>	Printing a map documents (Scenario) <ul style="list-style-type: none"><li>• User clicks the create map tool</li><li>• The system renders the current map session and converts it into a PDF document.</li><li>• The user clicks the print icon on the PDF document.</li></ul>
<b>FAILURE SCENARIO</b>	Slow internet connection.

## 1.5

<b>USE CASE NAME</b>	Send a request to access information and view feedback from other users.
<b>GOAL IN CONTEXT</b>	The user should be able to send the request to access any information held by the City Council. They should be able to see the feedback from other users of the system.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user click should click the request tool button and post new access to information requests.
<b>SUCCESS END CONDITION</b>	The user selects the request tool. The new window for requesting information should pop-up for the user to post a new request. Once submitted, the request should publicly appear on the system for other users to see it and avoid duplication of the same requests.
<b>FAILURE END CONDITION</b>	The user not reading the tool tip might not be able to find the request button.
<b>PRIMARY ACTOR</b>	Community user
<b>TRIGGER</b>	User clicks on request tool and the new pop-up window for request for spatial information appear.
<b>MAIN SUCCESS SCENARIO</b>	Post a new request on the system (Scenario) <ul style="list-style-type: none"><li>• User clicks the request tool</li><li>• The new window access to information request pop-up.</li><li>• The user selects the department to request information from.</li><li>• The user post the request for information and it immediately appear on the system.</li></ul>
<b>FAILURE SCENARIO</b>	Slow internet connection.



## 2. Information Officer Use Case Narratives

### 2.1

<b>USE CASE NAME</b>	Reply request for information access on the system and make announcement on the system.
<b>GOAL IN CONTEXT</b>	The user should be able to reply the request of access to information posted by users. The user should be able to make announcements on the system.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user click should click the request tool button and be able to reply new request.
<b>SUCCESS END CONDITION</b>	The user selects the request tool. The new window for requesting information should pop-up for the user to view newly posted requests and reply to them. Once replied, the feedback should publicly appear on the system.
<b>FAILURE END CONDITION</b>	The user not reading the tool tip might not be able to find the request button.
<b>PRIMARY ACTOR</b>	Information Officer user
<b>TRIGGER</b>	User clicks on request tool.
<b>MAIN SUCCESS SCENARIO</b>	Reply posted request on the system (Scenario) <ul style="list-style-type: none"> <li>• User clicks the request tool</li> <li>• The new window access to information request pop-up.</li> <li>• The user view recently posted request from all departments.</li> <li>• The user replies the post the request and it immediately appear on the system.</li> </ul>
<b>FAILURE SCENARIO</b>	Slow internet connection.

## 2.2

<b>USE CASE NAME</b>	Send feedback on environmental problems reported.
<b>GOAL IN CONTEXT</b>	The user should send progress report about the situation of the reported environmental problem. It should be updated as pending or fixed for other users not to report the same problem again.
<b>SCOPE</b>	Prototype system
<b>LEVEL</b>	Summary
<b>PRE-CONDITIONS</b>	The user must have look up the new reports from the statistical site.
<b>SUCCESS END CONDITION</b>	The user clicks the statistics button on the toolbar and the new statistical window pop-up. The user select the reported problem, update the status. The statistics webpage will be updated.
<b>FAILURE END CONDITION</b>	Forgetting to update the reported problems as they will remain pending even when fixed.
<b>PRIMARY ACTOR*</b>	Community user, Information Officer user
<b>TRIGGER</b>	User clicks on the reported problem link on the statistics webpage.
<b>MAIN SUCCESS SCENARIO</b>	Update report as fixed (Scenario) <ul style="list-style-type: none"> <li>• User clicks the Statistics button.</li> <li>• The new pop window shows the reported problems.</li> <li>• Click of the picture of the problem, document or the listed links.</li> <li>• The user select <i>yes/no</i> to the fixed option.</li> <li>• The user clicks submit button and then the statistics webpage is automatically updated.</li> </ul>
<b>FAILURE SCENARIO</b>	Slow internet connection that might lead to server timeout or database server crashes.

\*The Use Case consists of 1 or more actors.

## Appendix G.1

### Target Area Statistics (Nyanga Area)

The target area webpage extract the chosen area data from the PostgreSQL/PostGIS database and display it to the users. The report is displayed according to whether it has attachment of a photo, a document or no attachment. The status of the report problem is initially shown as pending by default and it can be updated as fixed by the public or the City council through the link as the problem is displayed on webpage.

NYANGA		
<b>Reports with pictures attached</b>		
<b>Problem Subject</b>	<b>Problem Date</b>	<b>Problem Staus</b>
• <a href="#">trees fell on a car</a>	2008-06-25 14:49:01.546	fixed
• <a href="#">trees fell on a car</a>	2008-06-25 14:49:07.875	fixed
• <a href="#">Students paintings</a>	2008-10-23 17:36:48.906	fixed
• <a href="#">rubbish around houses</a>	2008-10-29 14:57:36.638	fixed
• <a href="#">No stop signs in the area</a>	2008-10-29 15:55:33.247	fixed
<b>Reports with documents attached</b>		
<b>Problem Subject</b>	<b>Problem Date</b>	<b>Problem Staus</b>
• <a href="#">teko 2</a>	2008-08-18 23:01:10.75	pending
<b>Reports without any attachment</b>		
<b>Problem Subject</b>	<b>Problem Date</b>	<b>Problem Staus</b>
• <a href="#">docs qape</a>	2008-07-24 22:39:05.796	pending
• <a href="#">teko 2</a>	2008-08-18 23:01:10.75	pending
• <a href="#">trees fell on a car</a>	2008-06-25 14:49:07.875	fixed
• <a href="#">trees fell on a car</a>	2008-06-25 14:49:01.546	fixed

### Library Services

#### Board Index - Post Topic

Topic	Creator	Posts	Views	Last Post
<a href="#">New library staff recruitment</a>	Maureen	1	5	October 30, 2008 / 08:54:06am
<a href="#">Library Transfer</a>	Sisanda	1	4	October 29, 2008 / 06:47:05am
<a href="#">Promotion</a>	Chippa	1	4	October 28, 2008 / 05:00:37am
<a href="#">New libraries</a>	Siviwe	2	8	October 27, 2008 / 08:28:11am

Library Service Department shows the topics, creators, number of posts and topic viewed.

## **Appendix G.2**

### **1. Data**

The data consisted of shapefiles of vector type points, polygons, and polylines, the data list is as follows:

- Clinics
- Libraries
- Center line roads
- Schools
- Suburbs (Informal Settlement)
- Government Hospitals
- Private Hospitals
- Fire Station
- Police Stations
- Library photo

Almost all the data was loaded into the PostgreSQL except Suburbs and Photos.

### **2. Hardware**

The UCT CSIS was developed on the new computer hardware acquired on 1st June 2007 with the following specification:

Hard drive

- 250GB SATA II hard drive
- Hard drive 2 “Backup HDD” (120.0 GB Western Digital Portable External HDD)

RAM

- 1GIG RAM (2 x 512MB RAM modules for dual processing)

Processor

- Intel Core 2 Duo P4M900 – 3.8 GHZ processor LGA775, 2 front back access USB slot

Operating System:

- PC is loaded with Windows XP Professional and MS Office 2003 according to our Campus License Agreement with Microsoft.

Monitor

- elg LCD Black 17" LCD

DVD Rom and Super Multi DVD Rewriter

- elg Black DVD Rom
- elg Black GSA-H42N

Display Cards

- MSI NX7300GT-TD256EH, 256MB, 16X PCI-E, DVI, TV-OUT CARD

Case

- 300 Black Case and 240 Watts power cable fan

Mouse and Keyboard

Genuis keyboard, Genuis Optical mouse and 4 USB Slots

### Appendix G.3

#### UCT CSIS Access to Information request e-register board

a

**UCT CSIS Access to Information request e-register board**

[Guest \(Login\) - Register](#)

There were 0 registered users active in the last 5 minutes.

[Board Index](#)   [About](#)   [FAQs Search](#)   [Terms of Service](#)   [Top 25 Users](#)

**Board Index**

**Announcement**

Good Day All,

I am pleased to announce the the Access to Information request e-register is open to be used by anyone.

Thanks,

UCT CSIS Admin

Board	Topics	Posts
<b>Safety and Security</b>		
<b>Emergency Services</b>	0	0
<b>Traffic and Metro Police</b>	1	2

There are no topics.  
August 01, 2008 / 07:47:47am  
**Speed camera**  
by Admin

b

**UCT CSIS Access to Information request e-register board**

[Guest \(Login\) - Register](#)

There were 0 registered users active in the last 5 minutes.

[Board Index](#)   [About](#)   [FAQs Search](#)   [Terms of Service](#)   [Top 25 Users](#)

**Traffic and Metro Police - Speed camera**

[Board Index](#) - [Topic Index](#) - [Post Reply](#)

**Speed camera**

By [calvin](#) [137.158.60.105] on August 01, 2008 / 06:35:16am [Post #001](#) - [Quote](#)

Hi

I just want to know the policy of implemeting speed camera traps along N1 next to Centuty City .

Regards,  
CP ☺

By [Admin](#) [5 Karma] on August 01, 2008 / 07:47:47am [Post #002](#) - [Quote](#)

Hi Calvin,

I think the speed limit is 120km per/hour and it also depends on the traffic flow. If there is a big space between cars, the camera will snap you.

I hope i answered your question but wait to hear from City of Cape Town authorities .

Regards,  
J.D

(a) E-register board of the UCT CSIS prototype system for access to information requests and (b) shows the feedback from the administrator to the user.

## **Appendix G.4**

### **Access to Information Meeting 5<sup>th</sup> December 2008**

The Meeting was between

City of Cape Town Council Representatives

*Mrs. Jill Fading (JF)*

*City of Cape Town, Legal Service Department, Access to Information Act Unit.*

University of Cape Town Representatives

*Mr. Jeofrey Ditsela (JD)*

*University of Cape Town Master of Science Engineering student.*

#### **Demonstrating the system.**

JF: How can I read the prototype system?

JD: The users have can read the help page, about webpage, terms of services and frequently asked questions.

JF: What is the package or the software being used?

JD: This research used open source software which is free and available, there are a lot of software available, but you have to put the idea of what you want to get from it.

JF: Requests for access to information is not free, where do users pay for the procedure.

JD: The prototype is useful for requests that are automatically available and ready to be made to the public, this prototype incorporate a lot of information outline in the City Council section 14 manual and it also encourage users to read in it. In terms for paying money for information that need to be processed, we encourage them to contact your office for advice as stipulate in the manual. This prototype system has not and will never implement any paying functions.

JD: What do you think is the way forward for processing requests for Access to Information after you have seen a prototype system like this?

JF: We are interested in the computer system, there are other Metropolitans which use the computer programs, and we are going to revamp the whole access to information process to be on the IT application.

JD: What is the City Council progress as we speak?

JF: What we really need in the City Council is a good computer system like the prototype you have developed, we should have the website that we enable the public to send the online requests and we can deal them instantly. We need the whole process to be integrated from the computer system, the Access to Information Office should have the control on the events, money paid online for access to information requests and the monitoring should be at the highest level. We are planning to collaborate with other Cities. The Johannesburg City Council is already at an advanced stage and we want to follow through, they are really advanced in using computer system. Currently we are still holding meetings to decide what we want to be in the system. I will appreciate if you can come and present your idea to other managers of this department.

JD: Any other requirements in mind with the system that the City Council would want

JF: We want a system that can also register calls, or people can just access and be able to forward the request without having to come to the premises. We want the system like the prototype system that you are demonstrating. We want a system that can be used by people who are not educated so that we can see their input and work on it.

JF: What happens if other users are off the topic because some people do not really know what they want, we often firstly get their idea and discuss on what we do or what we have so that they can be clear on what they want.

JD: In case an off topic is posted on the wrong directorate, the moderators or administrator can move the topic to a proper directorate where it is supposed to be posted. They can also ban, censor and suspend words from different users.

JF: How do you integrate the City Council work with the UCT CSIS prototype system?

JD: At the present moment we haven't integrated any City Council work with the prototype system, this is a prototype system for the research project to demonstrate other alternatives to enhance access to information procedures used in the City Council. Participants were also notified during the testing phase at the community libraries that this is a pilot study, the outcome of this results can be used to implement a fully functional system or some user requirements discovered can be useful for your department as you intend to build a system of this nature.

JF: Can I also make report in the system.

JD: You can report of a problem in the system and view the report in the statistics webpage. The report acknowledgement will be sent to the system administrator. There is also a pothole reporting tutorial provided to help users as a sample of how to report a problem.

JF: Your prototype system is quick to deliver the results or to show the next page, this can be useful because most of computer systems as they are slow.

JD: I agree with you, the prototype systems e-register board was made to respond to the users actions approximately 0.2-0.5 seconds range as you can see on the webpage information bar. Technically, this is because it does not use databases but text files storage mechanism.

JF: I want to see the system again so that I can explore it when you are around.

JD: The system is online and can be accessed any time by browsing the web address.

JF: I really like your system I will appreciate it. Do you mind to come to talk for 15 minutes if I can arrange a workshop in future?

JD: I would love to do that, keep me posted on that and I will come.

JD: Thank you for your time you reserved for this demonstration that aims at helping community people and the help City Council to move from the manual procedure of giving access to the computer prototype system.

JF: Thanks for coming.

## Appendix G.5

### UCT CSIS Tutorial

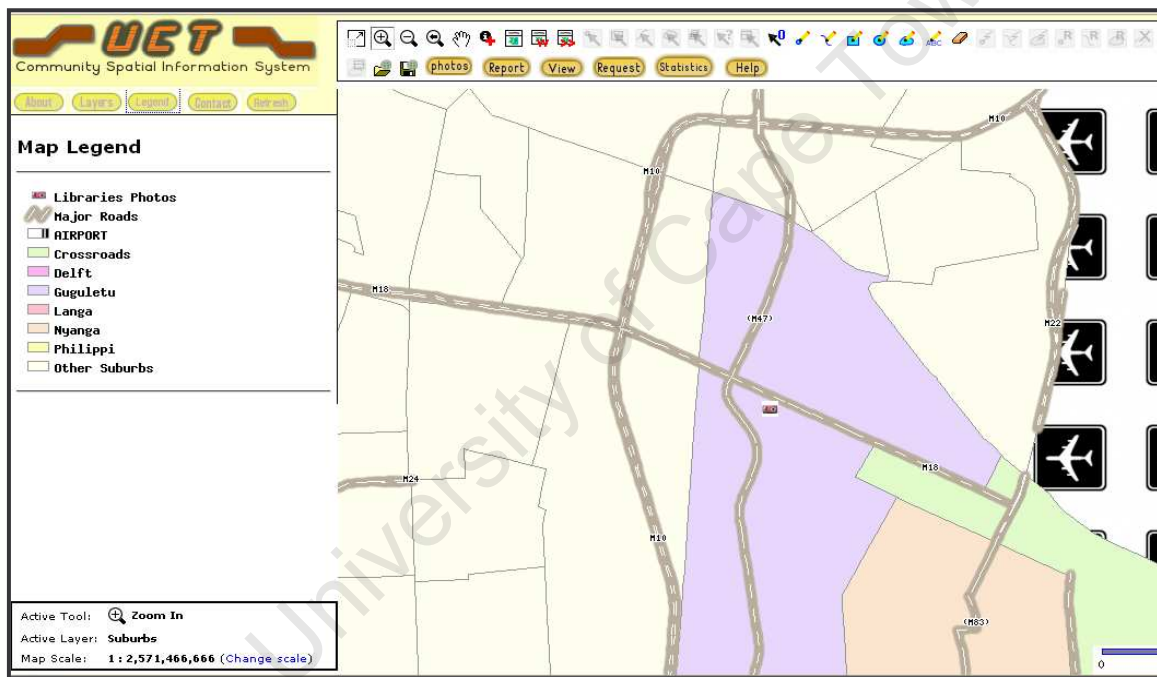
By Jeofrey Ditsela, September 2008

#### Porthole drawing and reporting using UCT CSIS Web mapping interface.

##### Digitizing the Porthole on the map

This tutorial shows how a road can be digitized to show portholes. After digitizing, the user can save the map session on a local computer hard drive and later submit it using report tool on the toolbar.


1. *Zoom* to the road you want to report.

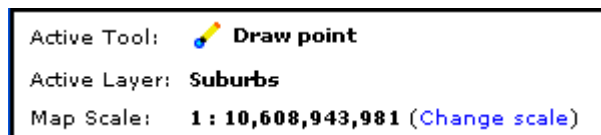


2. Use the tools

shown below to draw or digitize the road to show the porthole.




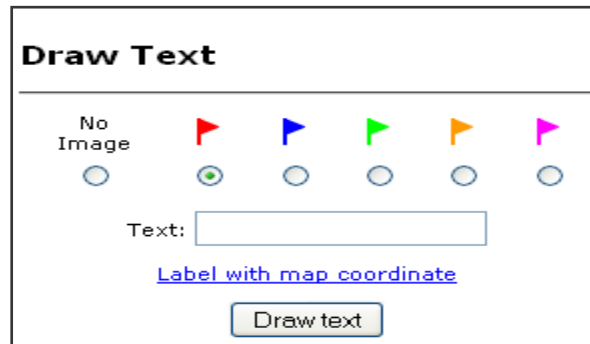
3. Click *draw a point*  from the tool bar, you can hover the mouse on top of the toolbar icon to read the tool tip. Please check if the icon is active on the left bottom panel.






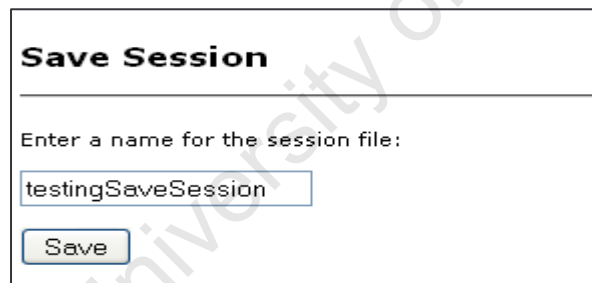
4. Click the road on the map where the porthole is located and wait for the map engine to draw the point.

5. Click *draw text*  from the tool bar to name or write about the port hole, you can indicate this by drawing a flag or just writing with plain text. The following diagram shows the *draw text on the left panel* that appears as you click the icon.



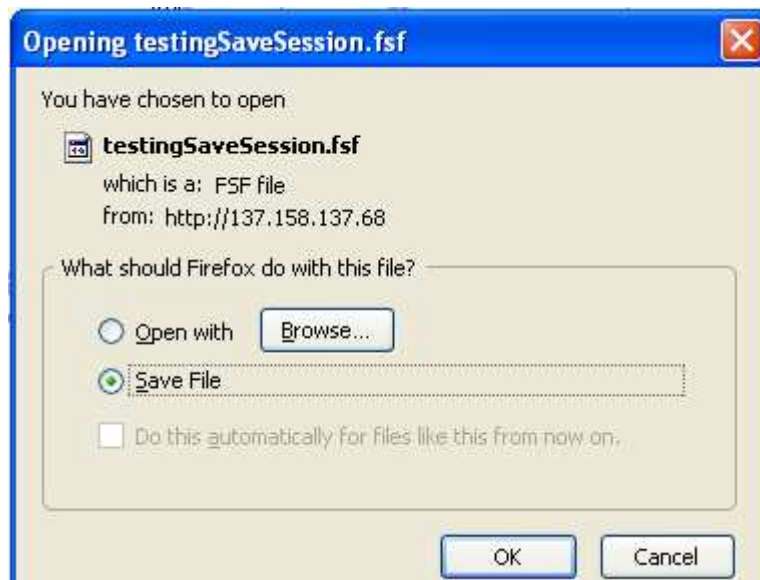
6. Choose the *different colored flag image or no image* and write on the *text field* using the keyboard and press *draw text button*.

7. After you have finished drawing, click *save session*  so that you save the map session of your drawing. The following diagram shows the *save session on the left panel* that appears after you click the save session icon.



8. Name the *session* to be saved and click *save button*.

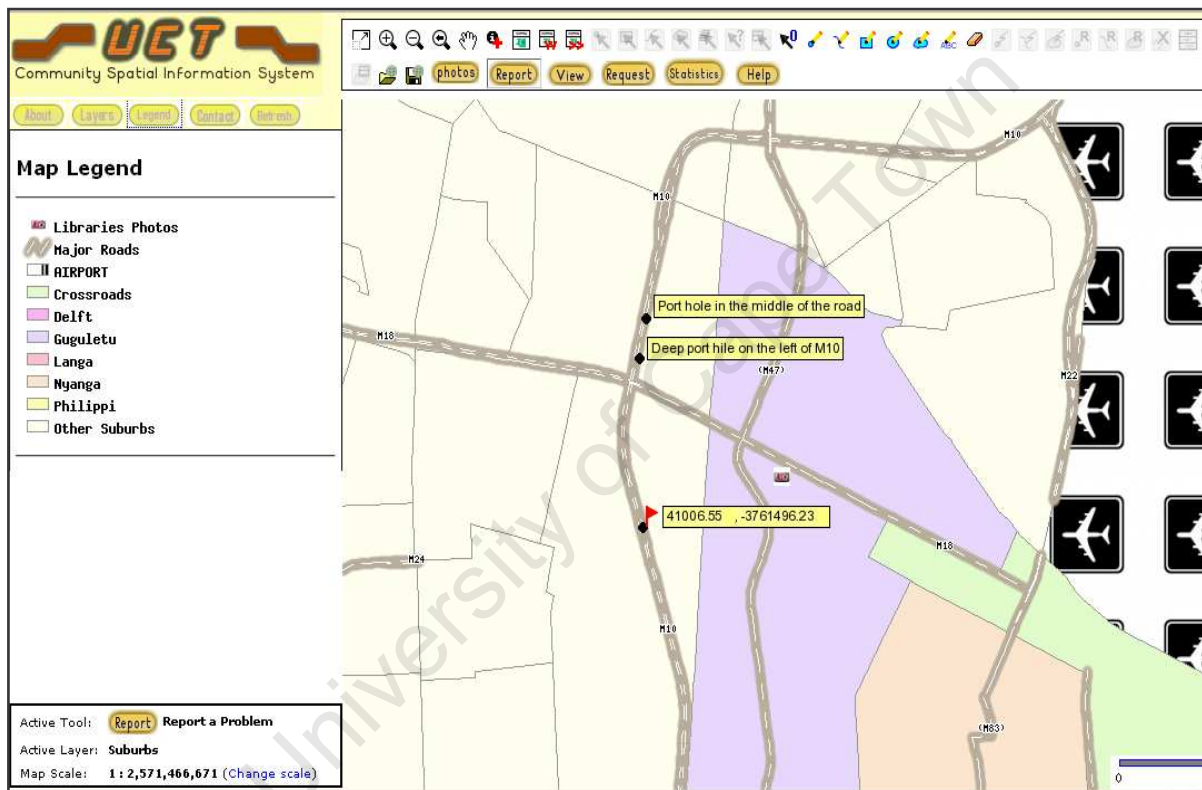
9. Choose the where you want to save on the local hard drive or any storage device.



10. The saved file will have the *.fsf* extension and it can be uploaded any time if you want to review it or edit it.



11. The following screen shot shows the complete digitized potholes along the M10 freeway

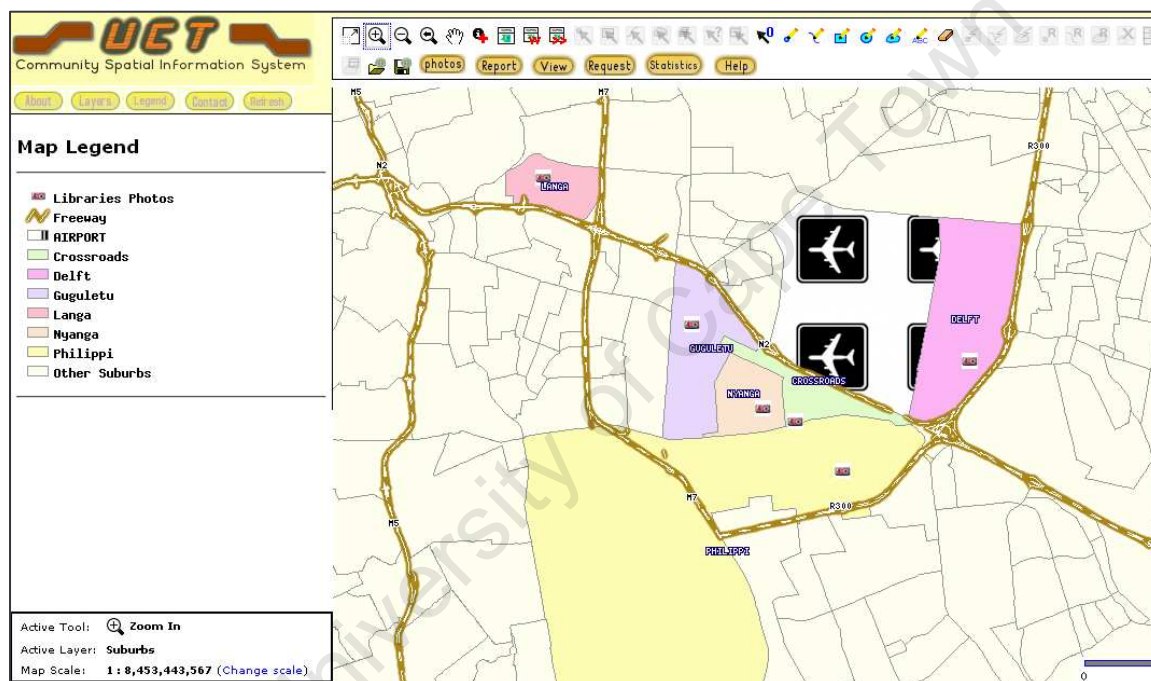


## Reporting portholes using the system.

1. Click on the *Report icon* **Report** of the toolbar. Please check if the icon is active on the bottom panel.



2. Click or drag the mouse on the area you want to report the porthole. The target informal settlements areas for this research study have been named and colored differently. Please match the colors on the map legend and the corresponding map.



3. After you have finished clicking on the map or dragging the mouse on any area you want to report from. The following diagram shows the *names of the target area the left panel that was clicked*.



4. Choose the name of the target area on the left panel and fill the form below,

- i. Choose the *category* of the problem you are reporting in this case, *Potholes as highlighted*.

### Reporting a problem

- All the details you provide here will be sent to the **City of Cape Town**. We show the subject and details of the problem on the site, along with your name provided it has been entered below
- Please fill in the form below with details of the problem, and describe the problem as precisely as possible in the details box and finally load and multimedia if available.

Problem details

Category: -- Pick a category --

Subject: -- Pick a category --

Details:

- Abandoned vehicles
- Bus stops
- Car parking
- Dog fouling
- Flyposting
- Flytipping
- Graffiti
- Parks/landscapes
- Pavements/footpaths
- Potholes**
- Public toilets
- Road traffic signs
- Roads/highways
- Rubbish (refuse and recycling)
- Street cleaning
- Street lighting
- Street nameplates
- Traffic lights
- Trees

Multimedia (Maximum file size: 5MB)

Please note :

- You are allowed to use any of the South African official languages.
- Please be polite, concise and to the point.
- Please do not be abusive - abusing the CSIS system devalues the service for all users.
- Writing your message entirely in block capitals makes it hard to read, as does a lack of punctuation
- Remember the Cape Town CSIS is primarily for reporting physical problems that can be fixed. If your problem is not appropriate for submission via this site, remember that you can contact [City of Cape Town](#) directly using their own website.

First Name :  (optional)

Last Name :  (optional)

Email :  (optional)

Phone :  (optional)

- ii. Fill the subject field

Subject :

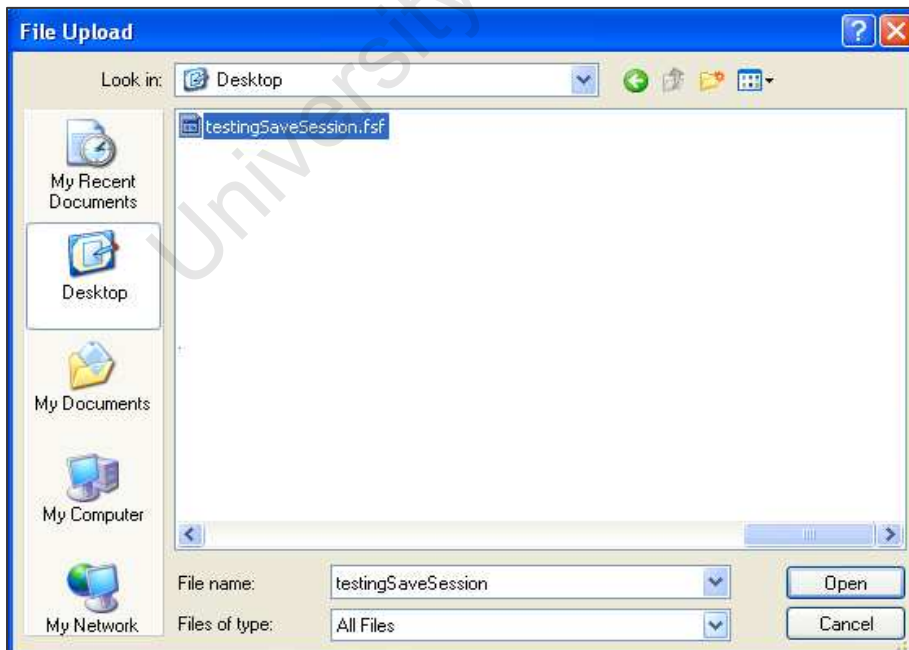
- iii. Please detail the problem, describing it as accurate as possible

Details:

- iv. Add multimedia, you can add document, photos and map session, in this case we are going to add a map session file *testingSaveSession.fsf* that was created on the first section.



- v. Click the browse button and locate where you saved the *testingSaveSession.fsf* file.



- vi. Complete the last section to include you details, please **NOTE** that this section is Optional, its up to user to fill up his/her information.

Fist Name :	<input type="text"/>	(optional)
Last Name :	<input type="text"/>	(optional)
Email :	<input type="text"/>	(optional)
Phone :	<input type="text"/>	(optional)

5. The diagram below shows a completed form

### Reporting a problem

- All the details you provide here will be sent to the **City of Cape Town**. We show the subject and details of the problem on the site, along with your name provided it has been entered below
- Please fill in the form below with details of the problem, and describe the problem as precisely as possible in the details box and finally load and multimedia if available.

Problem details

Category:  (dropdown)

Subject:

Details:

There are potholes on M10 which need to attended, please look at the attached map session for their location because they have been there for almost 2 weeks, thanks.

Multimedia (Photo, Documents and Map Sessions)

Fist Name :  (optional)

Last Name :  (optional)

Email :  (optional)

Phone :  (optional)

Please note :

- You are allowed to use any of the South African official languages.
- Please be polite, concise and to the point.
- Please do not be abusive - abusing the CSIS system devalues the service for all users.
- Writing your message entirely in block capitals makes it hard to read, as does a lack of punctuation
- Remember the Cape Town CSIS is primarily for reporting physical problems that can be fixed. If your problem is not appropriate for submission via this site, remember that you can contact [City of Cape Town](#) directly using their own website.

6. Please submit the form

7. Confirmation,

Thank you for completing the form.  
Your report has been successfully sent