

**Public Health Services Information Dissemination Platform: Case of
Machakos County**

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Group J

A Proposal submitted in partial fulfillment of the requirement for the Bachelor
of Business Information Technology at Strathmore University

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, this proposal contains no material previously published or written by another person except where due reference is made.

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Abstract

Provision of health information to the public is a crucial for the achievement of healthy life for everyone. However the current methods used to disseminate the public health information are faced with various challenges which leads to less people getting this information or even some people receive the information when it is already outdated. Platforms such as social media have challenges like identity misuse or invalid information dissemination on the social media leading to misunderstanding of the health information. This study aims at come up with a public health services information dissemination platform using USSD. Investigation of how public health services information is currently disseminated and technologies available to support dissemination and analysis of information are discussed. Research methodology process used in the research and the system design architecture of the developed application are also discussed in the proposal. During development the study will use agile software development methodology to come up with the USSD application as it allows for faster iteration and more frequent release with subsequent user feedback which allows faster and more controlled improvements. The functionality and usability of the system will be tested to help establish whether system and user needs are adequately realized. The system when implemented can help in the dissemination of public health services information to both people in high living lifestyle and people living lower living conditions. This will enable timely access of health services information, therefore improving quality of health sector in the country.

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List of Abbreviations/Acronyms

USSD -Unstructured Supplementary Service Data.

KNBS – Kenya National Bureau of Statistics.

WHO- World Health Organization.

KLRC- Kenya Law Reform Commission.

GSM - Global System for Mobile.

SMS - Short Messaging Service.

SS7- Signaling System 7.

MIS - Management Information Systems.

DWH - Data Warehouse.

MSC – Mobile Switching Center.

HLR – Home Location Register.

SMPP – Short Message Peer- to- Peer.

MAP –Mobile Application Part.

VLR- Visitor Location Register.

Chapter One:

Introduction

1.1 Background of the Study

Provision of health information to the public is a prerequisite for achieving Health for all and meeting the Millennium Development Goals. There is little evidence that majority of people seeking medical attention in developing world are any better informed than they were 10 years ago (Bailey, 2004). Lack of access to information remains a major barrier to effective and efficient public health service delivery in developing countries. Millions of Kenyans cannot afford to pay for health services at public or private hospitals, even though access to excellent health care is a constitutional right. Public health insurance has been available since 1966, but only 20% of Kenyans have access to some medical coverage. Kenya's population is approximately over 44 million, meaning 35 million Kenyans are excluded from access to quality health care (World Bank, 2014).

Public Information targets a wider segment of the population, exclusive of one to one and small group interactions (Berry, 2007). According to constitution of Kenya Article 35 every citizen has a right to access information held by the state. Therefore, residents of Machakos County has the right to access public health services information (KLRC, 2013). Information dissemination is often referred to as health promotion or counter advertising (WHO, 2002). According to Scanfeld (Scanfeld, 2010) , Social network is one of the methods that offer means of sharing health information. He further explains how social media can provide a venue of identity misuse or invalid information dissemination leading misunderstanding of the health information. Oxford University journals shows that more than 70 000 websites disseminate health information, in excess of 50 million people seek health information online (Cline, 2001). Information disseminated on the internet offers a wide spread of the information to the computer literate people. However people who lack knowledge to interact with the websites on the internet are not able to access the information. According to Bradshaw research most internet users are younger, more educated and earning a higher income (Bradshaw, 2010). This therefore calls for development of a system that will fit in less educated and low income earners. There are two categories of health information communication channels, active communication channel and passive communication channel (Bergman,

2009). Active communication channel such as newspapers, internet and interpersonal communication serve most people who are health information oriented. Passive communication channel such as Television and Radio serve people who may not be health information oriented.

Currently public health service information is disseminated using platforms such as websites, social media, newspapers, public campaigns, Radio stations, Televisions and banners in the areas the services are offered. These platforms have several shortcomings. First, most people accessing the public health services are in the average and lower living class. Some of these people do not have smart phones to access information on the websites or even they lack the knowledge to check the information on the internet (Oxford University, 2003). Second, the banners supposed to convey public health service information are torn down and in some instances get rained on. Thirdly, public campaigns do not reach a large group of people and even majority of the low earners people do not afford to buy newspapers to read where the health services information is advertised. On the other hand disseminating the right information to a particular region is a key problem, because organizations concerned with the dissemination do not have an effective way of knowing which service is needed most at a particular region.

Public information dissemination technologies such as media technologies have not been harnessed methodically to improve the health of those living in developing countries. These technologies empower those who use information by providing them with a selection of information to be accessed in their own time and by allowing them to put their own information on the platform (BMJ Group, 2000). According to the report for assessment of Health Information system of Kenya by Afri Afya, information dissemination and use of data had an overall score of 51%. This was due to lack of integrated systematize data collection and reporting tool. One of the recommendation Afri Afya gave the government was to allocate resources to support performance monitoring and evaluation (KNBS, 2008). In the World Health Organization resources one of the significant concern in Kenyan health sector identified by the Ministry of health is that the policy need to address the issues of access and intensity of use of health services (Nyong'o, 2009). Factors to consider while dissemination health services information are level of education, economic status, income level and employment. There is need to development a system that will fit in less educated and low income earners. Most of the current ways of disseminating health information such as internet favors educated and high income earners.

This study aims at the development of public health services dissemination platform, which will enable users to receive notification on available public health services information. The system also enables users to give their feedback on services provided and also give input on available services. Private organization will be able to input their free services at the time they are available such as free cancer screening. Using this dissemination approach public health service information will be available to all users including those with feature phones. Feature phones are low end mobile phones with limited capabilities in contrast to smartphones. A backend dashboard will be used to track which services users are searching. The dashboard will use an algorithm to analyze search inputs and make suggestions to administrators on what services are searched most at a particular location. This data will be displayed in real time charts. Organization concerned with disseminating public health services information such as the government will know which service is needed most at a particular area. This concept will help the government easily monitor public health services dissemination as recommended by Afri Afya during their study (KNBS, 2008).

1.2 Problem Statement

Public health services information is disseminated to inform people when, where and the location they can get a particular service. Due to the current ways of disseminating health services information such as the internet, a large percentage of people seeking medical treatment do not get this information at the right time. Little is known about access, sources, and trust of cancer-related information, or factors that hinder or facilitate communication on a population wide basis (ResearchGate, 2010). The government also faces the problem of disseminating the right information to a particular region.

There are several dissemination platforms that directly target the general population such as websites, social media, newspapers, public campaigns, Radio stations and use of banners in the areas the services are offered (Oxford University, 2003). However, these platforms have several shortcomings such as identity misuse or invalid information dissemination on social media leading to misunderstanding of the health information. Due to insufficient dissemination of information on public health services, citizens are charged for free services because they do not have enough information about the service (Kenya Transparency, 2011). These problems decrease the quality of public health services delivery in the country, because the public health

services information does not reach a large group of people seeking medical attention as intended.

The purpose of this study is to propose a USSD public health services dissemination platform which helps disseminate the information to a larger group compared to the current platform. The application enables users query the public services information available in their area of location. The user receive a notification on the available services. The system also enables users to give their feedback on services provided and also give input on available services. A backend dashboard will be used to track which services users are searching. This data will show which services are needed most at a particular region.

1.2 Research Objectives

1.2.1. General objective:

The main purpose of this study is to develop a public health services dissemination platform using USSD.

1.2.2. Specific objectives

- i. To determine the public health services information needs of the people of Machakos County.
- ii. To investigate how public health services information is currently disseminated in Machakos County.
- iii. To analyze technologies available to support dissemination of information.
- iv. To develop a USSD application for disseminating public health services information for Machakos County.
- v. To carry out testing of the USSD application with people in Machakos County.

1.3 Justification of the Study

There is a marked increase in the number of people unable to access public health services. According to Enos study, government services in many cases are no longer available. Growing disparities in access to health services have further undercut the living conditions of low-income earning citizens (Enos, 2005). The challenge in the current public health services dissemination platform is the limited number of people who can access the information. These platform has several shortcomings such as inability by large percentage of people to access information in the banners. It is also a challenge for most people living in lower class to access

information on the websites or even use smartphones. Some of these people have feature phones which have limited functionality compared to smartphones.

The proposed public health services information dissemination platform will reach a larger group of people seeking public health services information because of the ability to access the information using either low end mobile phones or smartphones. The platform will be available to all users including those with feature phones. The application enables users to query public health services information available in their area of location. The user receives a notification on the available services. A data analysis platform is also proposed to track which services are needed most at a particular region based on what users query most. Since the proposed solution works on both feature phones and smart phones, most Kenyans will be able to receive public health service information using this platform. The concept of tracking what people are searching will enable organizations concerned with disseminating health services information know which health services are needed most at a particular location. This will help these organizations disseminate the right services at a particular location.

1.4 Scope of the Research

USSD technology is used in this research to develop an application to disseminate information in health sector to a wider segment of the population, exclusive of one to one and small group interactions. Using the USSD technology public health services information will be available to all users including those with low end mobile phones.

The platform will help reach a large percentage of people compared to the current way of disseminating health services information because both low income earners and high income earners will be able to use the system. This is because USSD technology is applicable to both feature phones and smart phones users.

Chapter Two

Literature Review

2.1 Introduction

Kenya's 2012-2030 policy is to attain the highest possible health standards in a manner responsive to the populace requirements. The strategy aims to achieve this goal through supporting provision of quality, equitable and affordable health and interrelated services at the uppermost attainable standards to all those living in Kenya (Ministry of Medical Services, 2012). This research shows how public health services information is currently disseminated and the challenges faced by the dissemination systems. The research also discusses the technologies available to support dissemination and finally development and functional testing of a USSD application for disseminating public health services information.

2.2 Public Health Services Information Needs

The need for rapid access to information in public health is critical though development of such applications needs an understanding of concrete information needs of public health users. Public health information users need comprehensive, coordinated and accessible information so as to meet public health workforce. Main obstructions to information access comprise time, resource reliability, information overload and credibility of the information. There is a need for public health information intelligent system designed to reflect diversity of public health activities. These intelligent systems will also enable human communication and provide multiple access points to critical information resource (Revere, 2007).

2.2.1 A case of Information Needs in Africa

Health care workers in developing countries continue to lack access to practical and basic information to enable them to deliver effective and safe care. Many health care patients and family have little or no access to basic, practical information about health care services. Indeed, many have come to depend on scrutiny, instruction from associates and building experience empirically through their own treatment of successes and failures (BioMed Central, 2009) .

Important steps have been made towards meeting the information needs of health information seekers. However, little progress has been achieved because of the factors like failure of

international information for development which focus Internet-based approaches for higher-level health researchers and professionals.

One in six children are not living to see their fifth birthday and there is a massive increase in non-communicable diseases in addition to the huge HIV/AIDS burden. The "Health information poverty" in Africa is intensifying what is clearly a public health emergency on a massive scale including increasing numbers of people are living in poverty, and many continue to be denied access to basic health care services. Health workers have not been able to address this crisis because of lack of attention on understanding and addressing the public needs (Bukachi, 2009). It is only by addressing these needs that we can hope to achieve the Millennium Development Goals. A study on some of the Africa countries was performed.

Study from Egypt

A study from Egypt revealed that 90% of diabetic patients had meagre knowledge of the sickness, 80% had poor familiarity of complications/problems and 96% had poor knowledge of how to control/manage the illness. Minimal/poorest knowledge of the illness was highly recorded in patients of an elderly age and those with a lower educational level. The authors of Biomed Central suggest that more research is needed on the type, amount and channels of information that will have an impact on those sick with diabetes and their families (BioMed Central, 2009).

Study from Kenya

A study in Kenya identified insufficient national strategies as a ground of insufficient knowledge and practice. An observational study of health care providers looked at treatment of sexually transmitted diseases in Nairobi, Kenya. It found that only 27% of the observed patients with sexually transmitted diseases were managed appropriately. "Quality of STD case management was unsatisfactory except in public STD-equipped clinics" (BioMed Central, 2009).

Study from Nigeria

In Nigeria, a cross-sectional study involving 56 randomly selected district and primary health care facilities and one thousand repeatedly hypertensive patients established a substantial awareness and knowledge gap linked to hypertension and the complications the illness causes in both the health care providers and patients (BioMed Central, 2009).

2.2.3 Geographical information systems to important public health problems in Africa

Geographical information systems (GIS) technology is a tool of great inherent potential for health research and management in Africa. Public health practice requires timely information on the course of illness and additional health events to device suitable actions. GIS (Geographical information systems) are an innovative technology for engendering this kind of information. Around 5 million new HIV/AIDS infections are currently occurring annually worldwide with over 90% in developing countries (Sueur, 2002). One of the causes for the severity of HIV/AIDS epidemic in Africa is the inadequacy of STI services and the high frequency of other sexually transmitted infections (STIs).

Health systems in Africa face increasingly diverse and complex health problems due to rapidly growing populations and severe resource constraints. Improving the performance of health systems has been identified as a major global health priority. Health systems' performance makes an intense difference to the quality, in addition to the span of the lives of the billions of people they aid. If health systems are constituted and managed below par, life-enhancing interventions cannot be conveyed efficiently to those in need. Malaria and TB (tuberculosis) are examples of diseases that bloom in the absence of properly established, effective health systems. This is particularly related to Africa where health systems often perform poorly and are unreliable (Sueur, 2002).

2.3 Methods used in Disseminating Health Services Information

Information dissemination is often referred to as health promotion or counter advertising (WHO, 2002). According to Scanfeld (Scanfeld, 2010), Social network is one of the methods that offer means of sharing health information. The following are some of the methods used in disseminating health services information.

2.3.1 Websites and Computers

Websites give users access to thousands of pages of health information. However, the web allows anonymous authors to conceal commercial or other conflicts of interest. Use of websites does not help readers to distinguish between deliberate invention and genuine insight. Therefore improving the accountability of medical information on the internet will enhance its value (Wyatt, 1997). An advantage of publishing on the internet is that it allows regular or even

hourly updating, so that people using the World Wide Web get to be more up to date than paper sources.

Computers are being increasingly used in health communication via e-mail. Email are used to frequently communicate with each other. One advantage of computers, compared with written communications, is that they can be used interactively. People using computer health information system can input personal data and receive timely and appropriate responses and advice (Berry, 2007). Computers can give tailored and a personalized information whereas written information such as leaflets, posters, banners provide a generic information.

Challenges of Using Websites

Since internet philosophy declares that anyone can set up a web site there is a risk that, through ignorance or bias, the content of the site may not be accurate even though the initial sources of the information were reliable. Impicciatore research showed that parents searching for information about treating a feverish child might either get virtuous advice or be directed to administer aspirin hence placing their child at risk of Reye's syndrome, depending on the web site they visited (Wyatt, 1997). Clearly, widespread access to inaccurate and misleading information can pose a public health threat. Currently some commercial organizations have produced codes of practice for helping to ensure information quality and reliability, there is currently no obligation for information providers to use these (Berry, 2007).

2.3.2 Social Media

Social media refers to a set of online tools that are centered on and designed for social communication and interaction. (Bertot, 2012).

Social media include MySpace, YouTube, Facebook, Second life and Twitter are swiftly emerging as popular sources of health information particularly in young adults and in teens. Marketing using social media carries the advantages of low cost, rapid transmission through a wide community, and user interaction. Social media is interactive in that users are able to give their feedback about the posted information unlike a printed material (Vance, 2009).

Challenges

Government agencies are increasingly using social media to connect with the people they administer. These links have the potential to extend government services, solicit new ideas, and improve problem-solving and decision-making. However, relating via social media

introduces new challenges related to privacy, security, data management, accessibility, social inclusion, governance, and other information policy issues (Bertor, 2012). Other challenges include blind authorship, lack of source citation, and presentation of opinion as fact.

2.3.3 Televisions and Radio stations

According to Wang Research television provides public with important information about health related issues (Wang, 2007). Television can effectively increase public awareness health, and has a significant influence on people's decision making and thinking about health. The mass media may stimulate people to search for health information beyond their doctors.

Televisions and radio stations are passive consumption channels .They serve as most important health information sources for persons who are not health oriented. Media planning consequences are derived from the outcomes, signifying that prevention campaigns are better suited to be carried out by broadcast outlets with an entertainment orientation. Such stations offer appropriate sites for entertainment education (Taylor, 2007).Radios and Televisions enables health information to be conveyed to a larger group of people straight at their homes.

Many fictional television programmes that feature a particular health information often include a help line number at the end of the programme. A number of studies have shown that the organizations concerned often report a record number of calls immediately after such shows have been broadcast (Berry, 2007).

Challenges

Users may misunderstand what they see on a Television information communication. Therefore it is important for health policy makers to make users understand the pictures because it directly influences how the public understands and receives health law and policy matters. Users also need to understand the extent and nature of health information available to the public on television, as it directly affects their outreach efforts as well as their daily interactions with individual patients and their families (Wang, 2007).

2.3.4 Newspapers and Printouts

Newspapers and printouts are Active communication channel which serve most people who are health information oriented (Bergman, 2009).

Active communication means that written information has the potential to influence health behaviors in at least three different ways, in that it can influence (Berry, 2007):

The first way is that patients who want to follow the recommended treatment but need more information to do so. Secondly patients who have fears and misconceptions that need countering. Lastly patients who are dissatisfied with their care.

Thus, written information materials can be aimed at providing specific instructions, influencing beliefs, and generally increasing satisfaction.

This type of communication is usually one way process with the message going from the sender receiver. Written leaflets, brochures, advertising hoardings posters and magazines are also ways used in disseminating public health services information.

Challenges

Printed communication channel is less interactive compared to social media and websites way of disseminating information. This is because printed offers one way process with the message going from the sender receiver (Berry, 2007). Social media and Websites increases degree of interactivity because of the two way communication whereby users are able to give their feedback.

2.3.5 Schools and Workplace Campaigns

Berry outlined the following three key elements of health-promoting schools (Berry, 2007):

The first element was enhanced education for health through the formal curriculum. Another element was improvements in the physical and social environment for pupils and staff to work in, including attention to how the organization of the school encourages or inhibits healthy living. Expansion of school/wider community links was the third element Berry outlined.

In evaluating the success of health promotion and education in schools a systematic review was carried out, and concluded that school health promotion and education programmes can have a significant impact on children's health and behavior, although they do not do so consistently. They noted that most interventions were able to increase health-related knowledge and change behavioral intentions, but that changes in attitudes and health behaviors are harder to achieve.

Kenya has a population of about 40.5 million people of which 47.5% constitute the working population (KenInvest, 2015). Systematic reviews have shown that the introduction of health

education and promotion into the workplace has led to many successes but, as with schools, the effects have been inconsistent.

2.4 Technologies available to support dissemination and analysis of information

Information and communication technologies have not been hitched methodically to advance the health of the populace in developing countries (BMJ Group, 2000). These form of technologies sanction the users of information by providing them with a choice of data to be retrieved in their own time and by permitting them to place their own data/information on the web network. The present-day digital gap is further dramatic than any other inequity in either income or health. The superiority of health information available on the web is inconsistent hence unreliable, and the perceptibility of research is limited in the developing countries.

The way forward is to exploit the full interactivity of the technology, which allows rapid feedback and change to constantly mould data material into valuable knowledge

2.4.1 Digital Media

Digital media are defined as ‘the creative coming together of technology and business for human expression, digital arts, science, education, social interaction and communication. (Scally, 2014).

Newspapers have begun providing online newspapers in blogs and websites. Blog content typically comprises of views and comments, often in real time, that give consumers/clients the opportunity to offer their own thoughts and views. According to Schultz online offerings can lead to more traffic to newspaper Web pages. Non-monetary worth in terms of enhanced coverage and brand loyalty is also derived in online content (Schultz, 2009). Facebook pages or Twitter handles are also been used for health information campaigns. Digital media has essentially transformed the nature of the communications around health matters. From a passive one-way transfer of information, often from health professionals to the public, digital media has democratized those interfaces with open dynamic dialogue taking place, often at a very fast pace and at all times of day (Scally, 2014).

2.4.2 Smartphone Technology

Smartphones are mobile phones with functionality just like that of a computer that allow users to run software applications and link to data networks and the Internet. At least 300,000 software applications such as social media Apps have been developed for smartphones. These

Applications are used to communicate health information to the public, health research, education, reference, and patient care.

2.4.3 Meta-Analysis

Meta-analysis is a statistical technique for merging the results from autonomous studies. This analysis is most often used to assess the clinical effectiveness of healthcare interventions; it usually analyses by merging data from more than one randomized control trials (Crombie, 2009). Meta-Analysis advantages include: to increment the statistical power by increasing the number of observations, and to improve the estimations of the outcome size of an association or an intervention. Another advantage of Meta-analysis is it now offers the chance to disparagingly gauge and statistically pool results of comparable studies or trials. One of the challenges of using meta-analysis is bias when Literature Review is unsystematic with only a portion of it relevant to the study.

2.5 USSD Technology

The mobile communications technology has quickly become the world's utmost common method of transmitting data, voice and services in the developing world (Sinde, 2014). They have a potential of being the best media for broadcasting of information since mobile services are widely available and inexpensive. Mobile phones are less repressed by old-style access barriers that deter the extensive use of several other technologies of communication. These old-style access barriers include the socioeconomic status, geography, infrastructure such as literacy and electricity.

Unstructured Supplementary Service Data (USSD) is a Worldwide System for Mobile phones (GSM) communication technology that is helpful when it comes to sending text between an application program in the network and a mobile phone. USSD is similar to SMS (Short Messaging Service), but unlike SMS, USSD communications take place during the session only. With SMS, the text messages can be sent to a mobile phone and stored for a number of days if the phone is not within range or activated (TechTarget, 2007). USSD has real time and instant messaging capability therefore it offers better performance and is much cheaper than SMS for two-way transactions. Table 2.1 below shows comparison between USSD and SMS features (Sanganagouda, 2011).

Table 2.1: USSD versus SMS

Features	USSD	SMS
Use of signaling channels	Yes	Yes
Type of functionality	<p>USSD information or data is sent straight from a sender's GSM phone to an application platform handling the USSD service</p> <p>USSD is real-time and session- oriented</p> <p>USSD service can also involve a menu-based continuous session</p>	<p>SMS uses a store-and- forward technique to deliver text messages</p> <p>SMS service is of a single instance type and can't involve a continuous session</p> <p>A text message is originally sent to a dispatcher's SMSC that then tries to deliver the text message to the recipient</p>
Per message length (7 bit character)	182 alpha-numeric characters	160 alpha-numeric characters
Message storage in mobile	Incoming messages cannot be stored and are Flash in type.	Incoming messages can be stored
Average duration for each transaction	2 Sec	7 Sec
Analogy	Web browsing, telnet	E-mail
Fast-dial keys in mobiles to operate the service	Yes	No
Operating costs involved	<p>Messages are sent straight from a GSM phone to the USSD environment without using SMSC, so USSD transactions are much economical</p> <p>SMSC is not involved</p>	<p>SMSC and other related transit trunks are involved in transmitting SMS, making it costlier</p> <p>SMSC is involved</p>
Ease of use	<p>Subscriber does not have to create a message. It is as simple as dialing a regular number</p> <p>Some software systems will also permit menu shortcuts where the subscriber can add the menu item selection after the separation character, an asterisk (*)</p>	The Subscriber needs to type the message and then send it
Interface	SS7	SS7

2.5.1 USSD Architecture

USSD transactions can be started by either the subscriber or the network. Figure 1 shows the USSD network architecture.

The USSD architecture basically comprises (Sanganagouda, 2011) :

The network part that which includes the Home Location Register (HLR), Visitor Location Register (VLR), and MSC. Another component is Complex logic to support multiple applications within a single USSD platform. SMPP (Simple Messaging Peer-Peer) interface for applications to enable services is the third component. Finally the USSD Gateway and all specific USSD application servers.

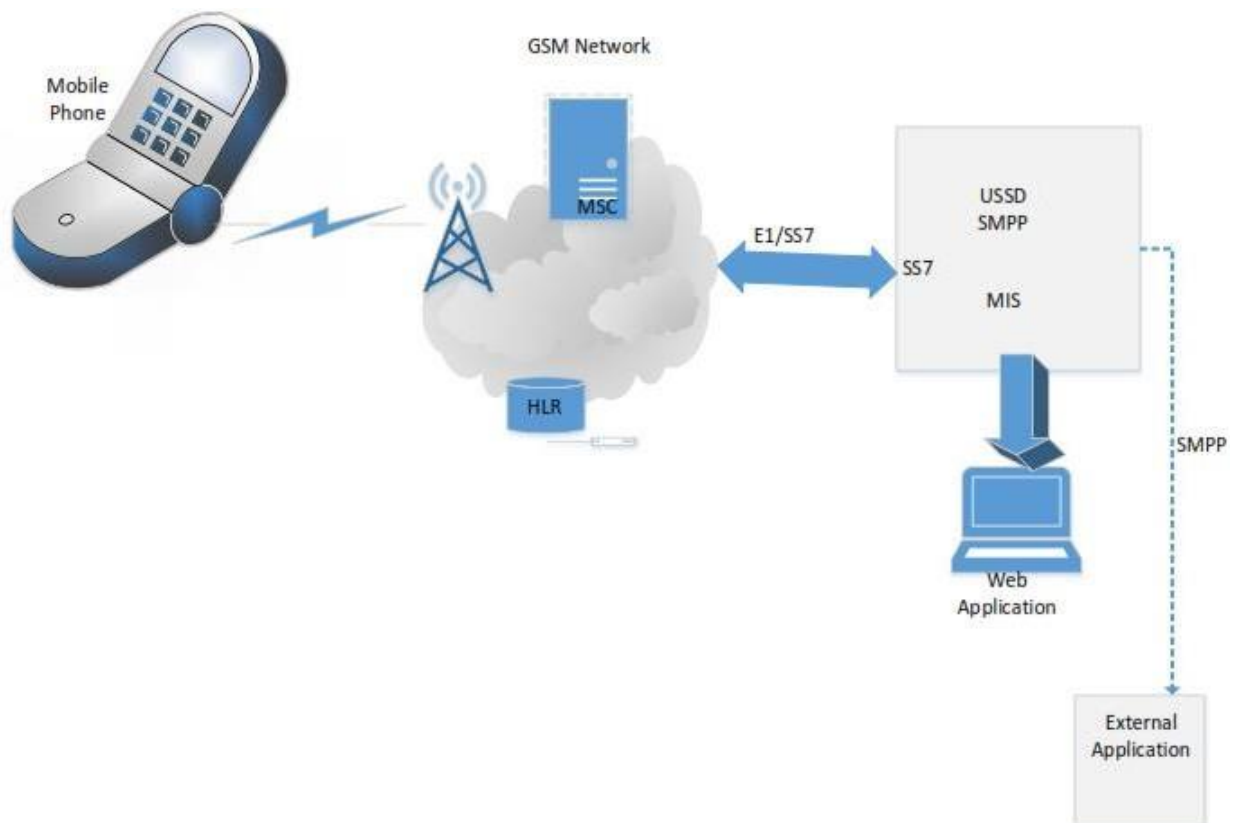


Figure 2.1 Architecture of USSD Implementation

USSD center (USSD Gateway) is entirely open and can be incorporated with any telecom system/device and the internet. These structures enable rapid deployment of new services and inspire existing messaging applications to leverage the USSD technology.

Additional elements of the USSD architecture comprise: Data Records (CDRs), a rating platform/billing system to rate the post-paid Call, Management Information Systems (MIS), IN for pre-paid billing, Data Warehouse (DWH) systems for reporting and reconciliation. Data Records (CDRs) generated at USSD Gateway can also be used for these purposes.

They may be interconnected with SMSC that can be used to send notification or special SMS to users

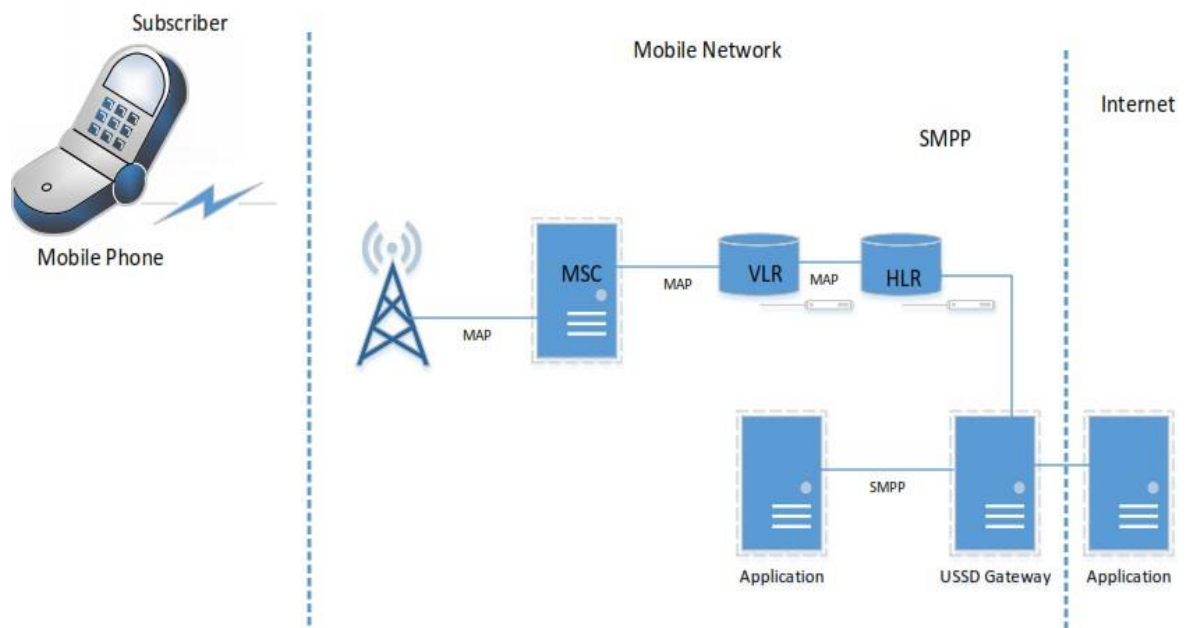


Figure 2.2 Elements of the USSD Mobile Network

Table 2.2 Comparison between Digital media and USSD

USSD	Digital Media
It works on almost all GSM phones from the old handsets to new smartphones	It works on phones which are connected to the internet.
USSD allows faster communication between users and network applications because messages are sent directly to the receiver allowing an instant response.	In cases where internet connectivity is slow, the responsiveness of what user searched is affected.

2.6 Need for USSD

USSD has numerous benefits as a bearer technology, such as:

USSD provides a cost-effective and flexible mechanism for offering numerous interactive and non-interactive mobile services to an extensive subscriber base. Another advantage of USSD is that it supports menu-based applications facilitating more user interactions. Thirdly USSD is neither a SIM-based nor a phone-based feature. It is usable on practically all GSM mobile phones (from old handsets to new smartphones) (Sanganagouda, 2011).

With USSD, messages can even be initiated during calls, allowing concurrent voice and data communiqué. USSD supports more rapid communication between network applications and users because messages are sent directly to the recipients' phone ensuring there is a prompt response. Lastly USSD services available on the home network can also be accessed during roaming and unlike SMS, there are no charges for this.

2.7 Proposed System Flow

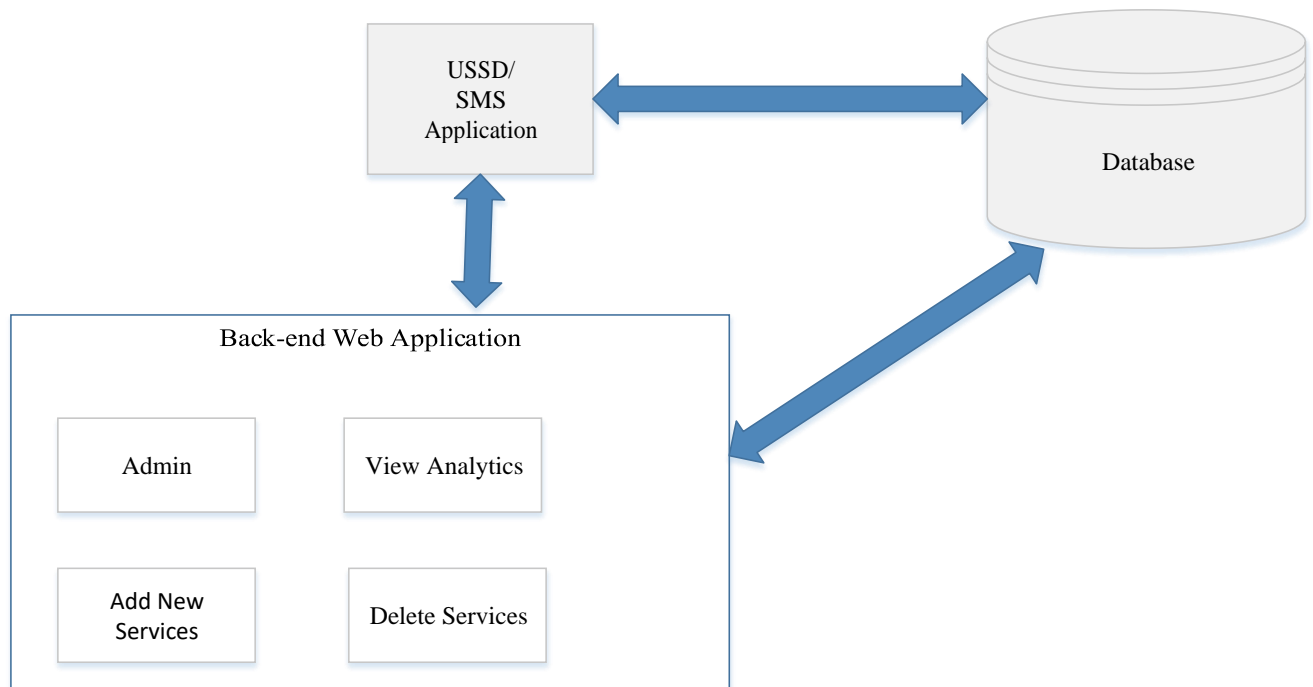


Figure 2.7 Proposed System Flow Diagram

The proposed system in figure 2.7 involves a front-end which is the USSD application, a back-end web application and a database.

2.8 USSD Testing Approaches

Functional testing is a type of black box testing that authenticates that individual functions of the software application operate in conformance with the specified requirement. Black box testing is not concerned about the source code of the application. All individual functionality of the system are tested by inputting applicable data, validating the output and comparing the actual outcomes with the expected results (aptest, 2013).

Functional testing involves checking of user interface, Database, APIs, security, web applications and functionality of the software system in test phase. The testing can be done either manually or using automation. The following are the type of functional testing:

2.8.1 Usability Testing

Usability testing entails testing; validation of interactive features on each interface (screen), for example text inputs, buttons etc., Validation of navigation flow, Ease of navigation, responsiveness and user friendliness (Belatrix, 2015)

2.8.2 Smoke Testing

The purpose of smoke testing is to make sure that changes in the program code do not cause catastrophic errors or destabilize the overall build. Smoke testing requires close collaboration between relevant stakeholders (developers and testers), since its focus is on changed code and dependent components (Belatrix, 2015).

2.8.3 Regression Testing

Regression testing ensures that the application does not negatively impact previously migrated objects/modules. Re-tests are done on the application to ensure that a fix did not cause another portion to break that was previously working (Kumar, 2012).

Chapter Three

Research Methodology

3.1 Introduction

The research is aimed at finding out the challenges with the current public health services dissemination platforms and to come up with an effective and efficient way of disseminating public health services information. This chapter describes the methods used for conducting the research and their viability. Target population, the sample to use in the research, data collection procedures and analysis of the results obtained are also discussed. Furthermore, the chapter analyses the methodologies to be utilized in system architecture, system analysis, system design, system development, implementation and testing.

3.2 Agile Software Development Methodology

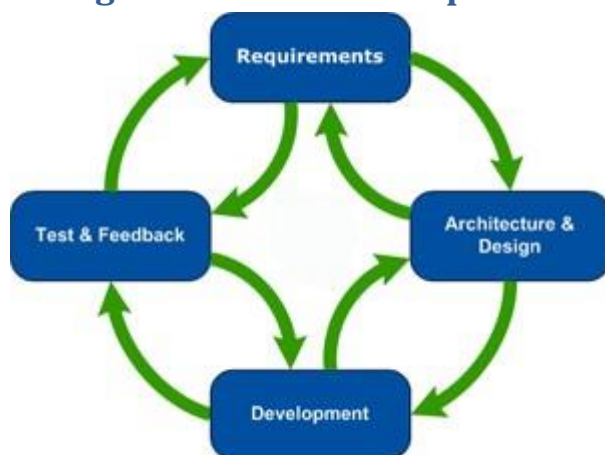


Figure 3.1 Agile software development

Agile software development method allows for faster iteration and more frequent release with subsequent user feedback. Agile processes allows release schedule and user feedback opportunities this allows faster and more controlled improvements (CPrime, 2014).

Figure 3.1 shows the steps to be followed in the research to achieve the set objectives. The first step is requirements analysis which will involve the collection of the intended product specification or features and specifying what it should do or how it should do it. The second step is architecture and design which will include defining the architecture and design of the system. Development of the system is the third step which involves implementation of the

system. Test and feedback is the fourth step which allows the product improvement. The developed applications will be tested independently at every development iteration. The data flow between the different components will also be tested to ensure complete test coverage. Testing the application will be done to make sure that the needed functionalities are working as required.

3.3 Research Design

The research will use both qualitative and quantitative research methods, qualitative research aims to get a better understanding through firsthand experience, truthful reporting and quotations of actual conversations. This will be used to understand the current platforms and process of disseminating public health services information. The quantitative research will be used to see the number of people who would like use the new system or thought it was a good idea (California State University, 2012).

3.3.1 System Architecture

USSD architecture which will be used in developing the application basically comprises; the network part that which includes the Home Location Register (HLR), Visitor Location Register (VLR), and MSC. Another component is Complex logic to support multiple applications within a single USSD platform (Sanganagouda, 2011). SMPP (Simple Messaging Peer-Peer) interface for applications to enable services is the third component. Finally the USSD Gateway and all specific USSD application servers. The architecture will be implemented in the research with a USSD application with Africa's Talking gateway providing SMS services. A back-end web application will be used to integrate with the USSD application to analyze users' requests. MySQL database will be used in development of the application.

3.3.2 System Analysis

There are 3 approaches in information system development area; process-oriented, data-oriented and object-oriented approaches. Unlike its two predecessors that focus either on process or data, the object-oriented approach combines data and processes into single entities called objects (University of Missouri, 2001).

Object-oriented Analysis (OOA) concept will be used in this study. OOA increases the understanding of problem domains because OOA promotes a smooth transition from the

analysis phase to the design phase and provides a more natural way of organizing specifications.

The project will focus on use-case modeling and class modeling to explore how system analysis are conducted under different methods. Use-case modeling will be developed in the analysis phase of the object-oriented system development life cycle. Use-case modeling will be done in the early stages of system development to help developers gain a clear understanding of the functional requirement of the system, without worrying about how those requirements will be implemented (University of Missouri, 2001).

A use-case model consists of actors and use cases. An actor is an external entity that interacts with the system and a use case represents a sequence of related actions initiated by an actor to accomplish a specific goal (Hoffer, 2001).

3.3.3 System Design

Object-oriented design (OOD) techniques will be used to refine the object requirements definition identified during system analysis and to define design-specific objects. Design class diagram will be used for general conceptual modeling of the systematics of the software, for detailed modeling to translate the models into programming code and for data modeling (Sparks, 2001) .

The project will adopt a design class diagram to hold classes which contain the main objects, methods and interactions of the software. Entity Relationship Diagram (ERD) will also be used ,which is a graphic that illustrates the relationships between people, objects, places, concepts or events within a system, enabled the research to define business processes and to develop relationships between entities and their attributes in a relational database (TechTarget, 2000).

3.3.4 System Implementation

Php will be used to develop USSD Application. The Web backend dashboard will use Php and HTML 5. MySQL which is a relational database management system will be used. MySQL is preferred because it is open source and cross platform. PHP is chosen because it is fast and platform independent (Sakshay, 2013). HTML5 is the markup language that will be used to structure and present content in the web backend dashboard.

3.3.4 System Testing

Usability testing will be done to test the functionality of the system. Usability testing entails testing; validation of interactive elements on each screen (e.g. buttons, text inputs etc.), Validation of navigation flow, Ease of navigation, responsiveness and user friendliness (Belatrix, 2015)

3.4 Target Population

The research will focus on Machakos County. The target population will be users seeking public health services information and they will comprise Machakos residents over 18 years.

3.5 Data Collection Procedure

The data collection procedure to be used are sample survey procedures employing questionnaires, interviews and observations. Interviews will be carried out to gather information about the system and user requirements from the respondents of the research. The research adopted interviews since more information and in greater depth can be obtained through this method (Kothari, 2004). Questionnaires will be used to gather system requirements from the users. Observation protocols will be used to understand the operational procedures on the current information dissemination approaches.

3.6 Data Analysis Procedure

Content analysis will be used to analyze the research data. Directed content analysis will be used to validate study objectives, user and system requirements. Research objectives, system and user needs helped to determine the initial coding scheme. A directed approach analysis starts with a theory or relevant research findings as guidance for initial codes (Hsieh, 2005). Data that cannot be classified are identified and analyzed later to determine if they represent a new category or a subcategory of an existing code. This method was employed since initial classification will not bias the identification of relevant application objectives and needs. In addition, the methodology helps focus the interview questions thus simplifying data analysis.

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