

Development of Extension Procedures to Enhance web-based e-Government System with SMS Mobile Based Service

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Abstract: Tanzania is among the African developing countries that has embraced e-government in recent years. The continual rises of wireless mobile technology bring an attention to enhance e-government systems by extending some of the services to be accessed and delivered via a mobile phone. Due to lack of standard extension procedures each government institutions extends according to developer's technical knowledge. The main objective of this paper is to develop extension procedures for enhancing web based e-government systems with a mobile service. In this study both exploratory and prototyping methods were used. Exploratory method was used during data collection. Prototyping was used during design and development of m-government service prototype. Web based e-Government systems in fourteen (14) Government departments, Ministries and Agencies were analyzed to identify a system for enhancement. Wananchi portal, under the Ministry of information, culture art and sports was selected. The selection criteria were the system that has direct interaction with citizens. During design and development of m-service prototype, several extension procedures and their interactions were observed and recorded; six (6) procedures were found relevant. Therefore, this paper proposes a six steps extension procedures from web based e-government to m-government. Clear understanding of the extension process will reduce development time and cost. Extending web based system with mobile services means extra services and hence more revenue to network and service providers. To the government, it means an added/alternative channel to service her citizens, and to the citizens, means readily accessible and responsive Government

Keywords: e-Government, m-Government, framework, web-based system, mobile service, Rapid Applications Development (RAD).

1. Introduction

Electronic Government (e-Government) is the use of Information and Communication Technologies (ICT) by a Government to deliver services to her citizens, in order to improve government services. The advantages of e-government are that it enhances transparency, openness and generates accountability and responsiveness in the system to reduce service delivery time and lastly to improve quality services to the audience [1]. Hence, the e-Government is intended to improve Government activities and service delivery to citizens. Tanzania is among the African developing countries that have embraced e-government. According to [2], Governments around the world are now integrating the use of mobile devices and wireless technologies to create what is described as mobile government (m-Government). The m-Government is a subset of e-government that utilizes mobile

technologies such as mobile phones, Personal Digital Assistants (PDAs), Wi-Fi enabled devices, Bluetooth and wireless networks in delivering services to its citizens. M-Government provides better options in offering public service such as information to citizens compared to e-government. This is due to the nature of mobile devices and wireless technology being portable and therefore available anywhere, anytime and from any Internet enabled devices [3]. With more than 6 billion mobile telephone subscriptions worldwide in 2012, and with more than four-fifths of the world's population covered by mobile telephone networks, m-Governments can make public services available and accessible anywhere, at any time, to almost anyone [4]. According to [5], the continued growth in mobile wireless access ensures a wider audience reach and as the mobile devices market is maturing, its penetration will accelerate faster at a lower cost. Some organizations within a government opt to implement m-government to supplement e-government services. This sometimes happens based on the management knowledge towards m-government, facilities they have to host the service, skilled man power to implement the m-government projects, business (services) demand or sometimes order from other government organs. Due to lack of standard extension procedures, each government institutions can extend its e-government system to m-government according to developer's knowledge. This might lead to challenge in interoperability of system within the government organs; therefore the aim of this study is to develop extension procedures to enhance existing e-government services with SMS mobile service.

In Tanzania, number of people having access to mobile phones is increasing rapidly. The telecommunication regulator in Tanzania, [6] shows that about 78% (39,953,860) of the population are mobile subscribers. Hence the customer base to m-Government services is satisfactory. Enhancement of e-government with m-government requires researching on the extension process between e-government systems and m-government systems. It also requires investigation of all the obstacles that can affect the extension process [7]. If these obstacles are not taken into consideration it might be the cause of difficulties during extension. There is therefore, a need to have a framework that shows extension procedures from e-Government to m-Government. The extension framework will act as a guidelines/reference benchmark to be followed when enhancing a web based e-government system with m-government services.

2. Objectives

The main objective of this paper is to develop extension framework for enhancing e-government systems with a mobile service. Specifically, the paper presents:

- Identified government offices whose web based e-government services can be extended to be accessed via mobile phones (m-government services).
- Design and development of an extension of a web based e-government system with a mobile service (m-government).
- The proposed extension framework for extending a web based e-government system with an m-government service.

3. Methodology

In this study, exploratory research design was used in order to gain background information and to concisely define the research problem. Exploratory research design is useful when there is no past data or where there are only a few previous research studies available for reference, which is the case with this study as well. People who had knowledge and experience related to this study were consulted through unstructured interviews to contribute their insights towards answering research questions, and achieve the stated objectives. Prototyping was also used during design and development of an m-government prototype service. A rapid application development method was used to design and develop

a prototype where important part of the system were build first to capture the user requirements. In this study both exploratory and prototyping methods were used. The exploratory methods which were unstructured interview and focus group discussions were used during data collection. Multiple focus group discussions and unstructured interviews were held with three (3) eGA officials (Wananchi Portal Project Coordinator and 2 developers), while in the Ministry of Information, Culture, Arts and Sports, 2 officials (Director of Information and an ICT Officer) were involved in the discussions to familiarize how the web based Wananchi portal e-government service works.

4. Technology Description

4.1 Rapid Application Development

Development of a mobile service to enhance Wananchi portal, a web based e-Government system, used the Rapid Application Development model shortly known as RAD. RAD is widely known for producing a rapid prototype based on the user requirements, as shown in figure 1. Users are given access to the prototype in order to get their feedbacks which are used to refine features of the system, before proceeding to the actual implementation. RAD reduces development time by producing a draft prototype within a short period of time to fine-tune user requirements.

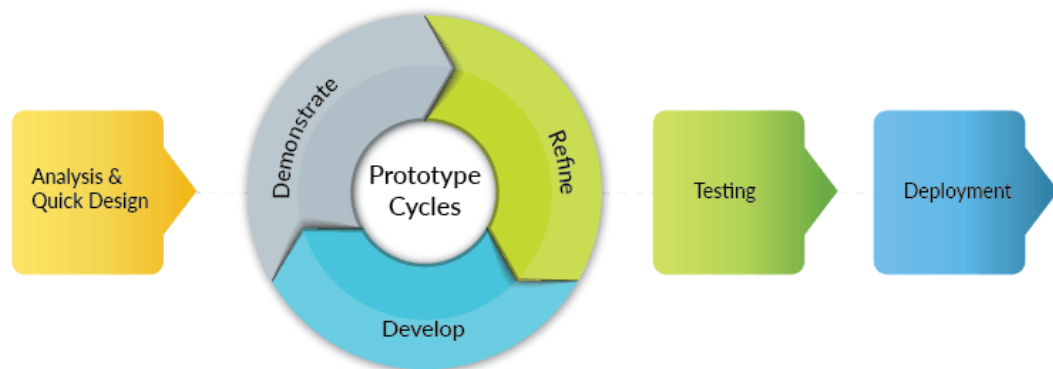


Figure 1: Rapid Application Development (Source: Testing Excellence 2018)

Other technologies used in this paper are Apache web server; MySQL, the backend relational database management system; PHP, a server side-script language, HTML5, for software development as a markup language; CSS3, for style and layout design of the SMS platform, and Ozeki, an SMS Gateway.

5. Developments

5.1 e-Government Service to be Extended

Web-based e-Government system in fourteen (14) Government departments, ministries and agencies were analyzed in order to select a system for extension to m-Government. Wananchi portal owned by the Ministry of information, culture art and sports was selected. The selection based on the criteria that the system allows direct communication/interaction with individual citizens.

5.2 System Architecture

The mobile version of Wananchi Portal (SMS Platform) was designed specifically to extend the web version of the Portal, for citizens to be able to use mobile SMS to communicate with Government officials. The system architecture is as shown in figure 2.

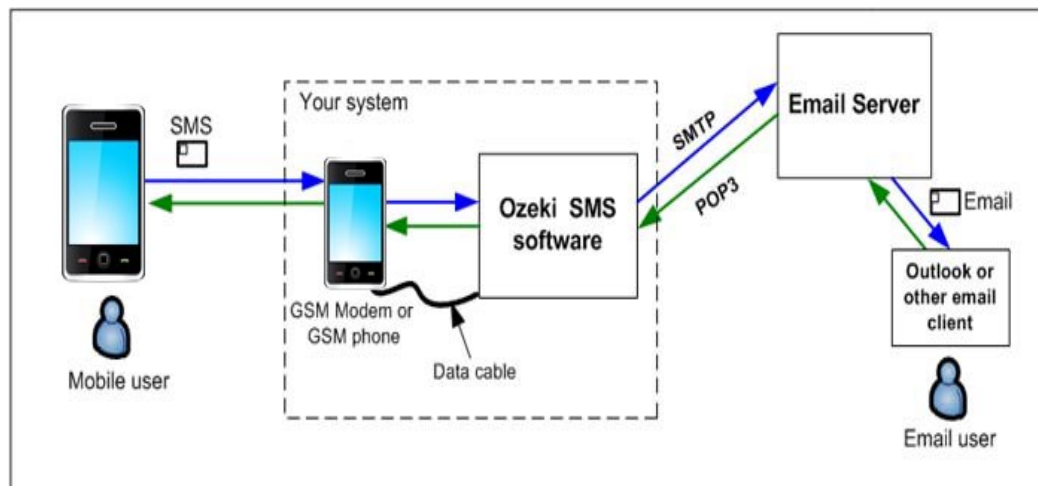


Figure 2: System Architecture of the Mobile Version of Wananchi Portal (SMS Platform).

Figure 2 shows architecture of an m-Government prototype system. The mobile user, known as the citizen is an external user that sends an SMS message from a mobile phone to the system. The system includes a GSM modem or GSM phone attached to computer worked as a server with a phone-to-PC data cable. This computer runs the Ozeki NG - SMS Gateway program. This program controls the GSM modem, thus being able to send and receive SMS messages. It also includes an E-mail user here known as government official. This is an automated user that can send and receive e-mails as an e-mail client of the system. It used an SMTP server to send, and a POP3 server to receive e-mails. The e-mails were sent to or received from an external (government official) e-mail user. The e-mails received from the external (government official) user were sent out by Ozeki NG - SMS Gateway as SMS messages over the GSM network to an external mobile user (citizen).

A mobile version of Wananchi Portal (m-government service prototype) was successful design, developed and twenty people participated during the testing of the prototype service. The extended service, a mobile SMS platform was tested allowing citizens/users to send SMS to the system; the received SMS is channeled as an email to government official. The email received by the government official is acted upon and the feedback is sent back to the gateway as an email and then converted back to SMS that is sent to citizen.

6. Results

6.1 Prototype of a Mobile Version of Wananchi Portal (m-Government Service)

The prototype of an m-Government system developed by extending a web based wananchi portal system allows citizens to send SMS to request information from the Government. SMS sent are received as an email, where a Government official responds by replying to that email, in which the prototype system will convert the sent email to SMS and forward it a mobile phone of a respective citizen. A user has flexibility either to compose an SMS, or view received responses from previous sent requests. The government official will receive

the sent SMS as an email, and then respond via email. The system will convert the sent email to an SMS and forward it to the citizen.

6.2 Extension Framework to Enhance e-Government System with m-Service (m-Government)

During design and development of m-service prototype, several extension procedures were observed and recorded. Figure 3 shows procedures to be followed when extending an e-government system for its services to be offered through mobile devices (m-government).

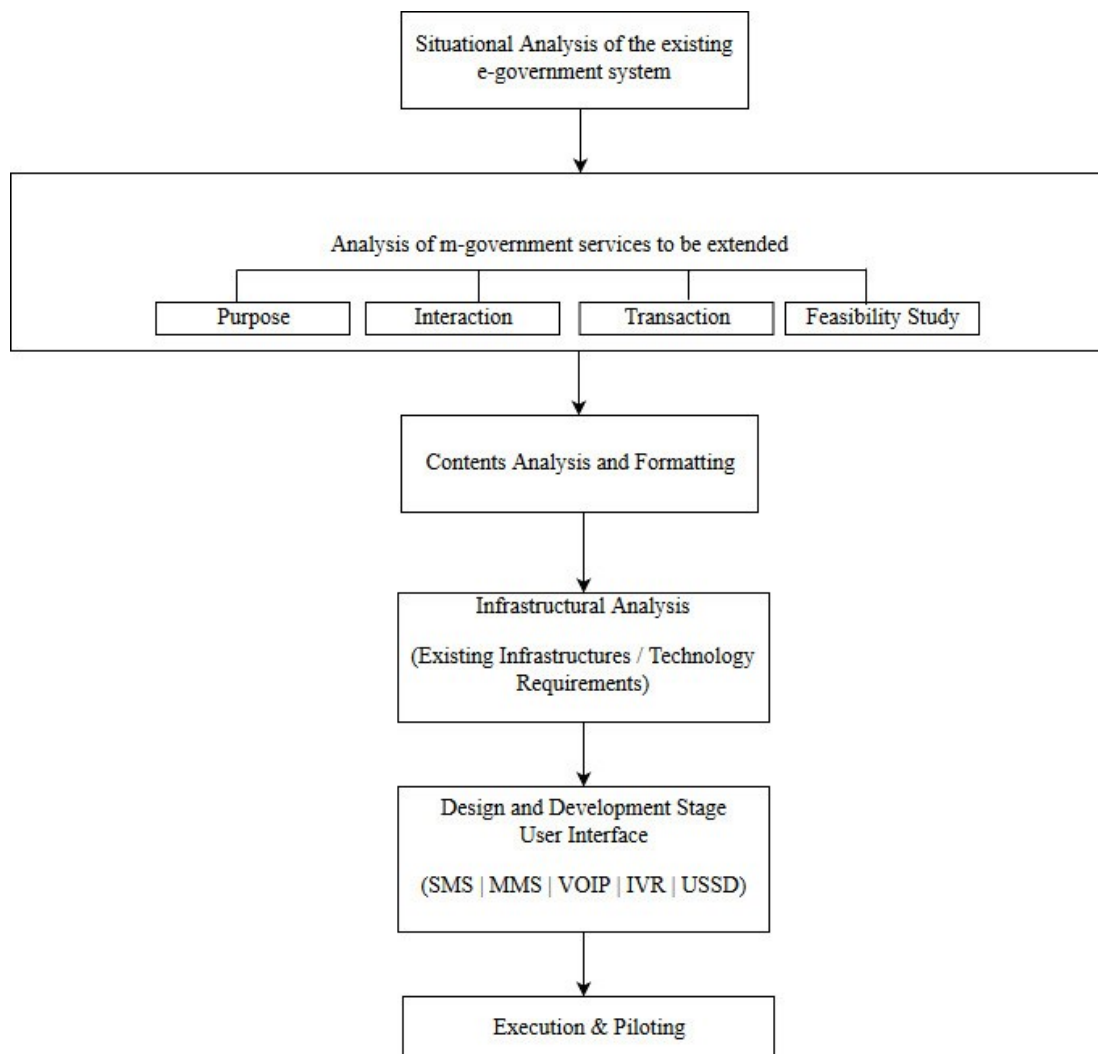


Figure 3: Proposed Extension Framework from e-Government to m-Government

Each step in the extension framework is explained in the following sub-sections:

Situational Analysis of the Existing e-Government Systems

At this stage it is very necessary to analyse the existing e-government system and study what the system does and what is needed to be done before extension. This will help to understand system behaviours and their integration mechanisms. It is also crucial at this stage to identify gaps and problems that are involved with system performance. Hence, this stage gives the background of how the system was designed and how it can be extended into a mobile system.

Analysis of e-Government Services to be Extended

It is very important at this stage to identify what kinds of services have already been delivered so as to concentrate on making the services be directly delivered to citizens mobile phones. There are various issues that should be considered. The issues in question are purpose, interaction, transaction type, and acceptance. Purpose is the intention for which the mobile service is to be offered is very important so that resources can be assigned properly. These intentions can either be related to communication, democracy or administration. Interaction refers to who these services are going to be offered. This mainly concentrates on participation of various categories of people depending on their positions. The participation can either be between Government to Citizens (G2C), Government to Business (G2B) or Government to Government (G2G) and each category might have its own way of participating on the same service. Transaction refers to informational, service or operational transactions. Informational transactions involve publishing of information to citizens, which is usually a one way communication. Transactional services, involves two parties during the communication (Bi-directional). Operational transaction is the kind of the operation that is normally taking place within the government authorities. Acceptance is also very important to be put into consideration during takeoff so that the service be used by the intended customers.

Content Analysis and Formatting

At this stage, contents to be uploaded into mobile version needs to be organized and formatted so as it can meet the mobile requirements. This is the approach of analysing textual data in a more standardized format. Huge contents available in web platform needs to be standardized into a less words that can easily be understood and presented in a mobile phone without losing the intended meaning. This is one of the necessary stages to be adhered since it gives chances for citizens to access contents which are well formatted and can be read easily and fit into a small mobile phone screen.

Infrastructural Analysis

The information technology infrastructure must be at a satisfactory level. The physical infrastructure refers to the technology, equipment, and network required for implementation of m-Government. Institutional arrangements and software to develop an m-government service are also very important. Mobile communication networks are the key technology for any mobile service delivery as they are responsible for any data transmission from or to mobile end devices. The technology and the speed of the mobile internet have strong impact on the use of any m-government system. At this level various infrastructure need to be analysed to ensure that the extended m-government application run smoothly without breakdown. Mobile devices and technologies are two most important infrastructures that need to be analysed critically.

Design and Development Stage

The enhancement of a web based e-government service to non-web based m-government service such as short text message service (SMS) needs a lot of considerations for the interface, frontend and backend systems to be used during development. This is because interface, frontend and backend systems will determine ease of use and service performance. The design and development of m-Government service in this paper has to comply with features that have been defined by the [8] that are necessary to be adhered once deploying non-web based government services such as SMS in Tanzania.

Execution and Piloting

At this level government needs to involve other parties such as citizens, businesses and government workers on the use and deployment of m-government services. They are the customers of m-government; therefore, they need to be encouraged to become co-designers of solutions by providing their opinions on how the system should be to fit their demands.

During the extension of e-Government to m-Government system, several steps and procedures were observed to extend a web based service to sms, there were other useful features that were found necessary to be addressed. These features are useful as they will alert the Government and developers to formulate policies and infrastructure that are necessary to accomplish the adoption and use of m-government systems. These features are Interoperability, Security, Openness, Flexibility, Scalability, and Quality of Service.

7. Business Benefits

Currently, accesses to e-government services are limited to the access to internet connected computers (Desktops or Laptops). Hence, limits number of people who are able to benefit from e-government services. Statistics shows that number of people/ citizens in Tanzania that have access to mobile phones is about 77.5% (39,953,860) [6] out of 51,557,365 as projected by National Bureau of Statistics in the year 2017 [10]. Therefore enhancing e-government service to m-government will benefit a large population than those currently served by Internet dependent e-government services. Furthermore, this study will help developers and other affiliated organizations to understand the processes of enhancing existing web based systems with a mobile service (extending e-Government to m-Government). Clear understanding of the processes will reduce development time and cost. Extending web based system with mobile services means extra services and hence more revenue to network and service providers. To the government, it means an added/alternative channel to service her citizens, and to the citizens, means readily accessible and responsive Government.

Furthermore, [9] outlined that one of the factor for failure of m-government implementation is lack of coordination, this means that when the extension process is not well coordinated might lead to failure of m-government take off. In a circumstance where by developers of the m-government systems are members of the government agencies where the system is designed for are not well coordinated in a sense that, only few team members are aware of the development technologies used, and extension is done based on user experience only (one man show), once the developer quit the job there is no continuity support of the system which pave the way to total failure.

8. Conclusion and Recommendations

According to current trend the rise of the mobile devices such as mobile phones it was necessary for the government to review their service delivery mode and see how they can tap into technological advancement. It is argued that the use of mobile phones has a high potential for efficient service delivery compared to other devices such as computers and laptops, hence there was a need for that extension procedures to ensure that m-government system are successful extended, and people are reached through the device which they are using most. The study shows that, there are several services that can be offered through a short message service (SMS) of a mobile phone, simply because SMS is widely used by different categories of people, hence it is easy to be adopted by all, easy to run and does not need a lot of technicalities to client side than it would to other mobile services such mobile applications and the like. The study succeeded to develop extension procedures that can be used during extending a web-based e-government system with an SMS mobile service, i.e extension of e-Government to m-Government. During the m-government prototype development, several extension procedures were captured and proposed to form an extension framework from e-government to m-government.

However, rise of the smartphones and mobile applications shows another alternative way on how citizens can be serviced by their government through various agencies, departments, and organs to make sure that service delivery is at the optimal point and technology is well

utilised. It is therefore recommended that further studies can be carried to find out how best e-government systems can make use of vast smartphones availability to improve service delivery to citizens.

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