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Automated Personal Clinic Services in Uganda – Software Requirement Specification

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Abstract

Software Requirement Specification for Personal Clinic Services enhance the availability and accessibility of traditional clinic, health care services are offer without limits or physical boundary, it is a web-based mobile Chatbot in google assistant that help patients to find closest clinics and hospitals in Uganda, offers medical prescription and other forms of medical assistances. It consists of three (3) parts which are Chatbot, Google home device and web portal. The google assistant guide was employed in the design using predefined procedures as Google application, Google app tool, PHP (Hypertext Preprocessor) which by default comes as handy tool with every android and it requires internet and Global Positioning System (GPS) connection. Few datasets were trained for machine learning using supervised learning category and other coding were done online. Personal Clinic prototype was simulated to provide basics of health care services to the prospective clients, doctors within the patient's locality are contacted for further medical assistance whenever the need arises. Most of healthcare challenges would be solved and life expectancy would increase with greater capability to live healthier, longer and reduced the risk of patient harm.

1. Introduction

Accessibility of health care facility in Africa is a major challenge most especially in rural communities, a clinic is meant for outpatients (treating without overnight stay or that patient which do not require bed) but care, it can be privately owned or publicly funded (government-owned) and must cover primary health care needs of the populace within their neighbourhood which can be polyclinic, general outpatient clinic, special clinic for specialty in health related provision such as fertility clinic, antenatal clinic, ambulatory surgery clinic and so on. In Africa, the functionalities of clinic varies from country to country but in Uganda, it often offer primary health services without major surgical care, post-primary health services or outpatient services. A clinic is where general medical practice run by one or many general practitioners are offered, clinic offers and provides medical care to adults of all ages. The automated personal clinic service will avail the communities, rural areas and its inhabitant health care that is affordable, accessible and qualitative by satisfying the needs of the health seekers.

The total population of Ugandans is estimated to 32 million with population growth rate of 3.4 percent vis-a-vis the following factors high fertility rate, short birth intervals and high teenage pregnancies [11]. The life expectancy at birth was 58 years as of 2013 [9]. As of 2015, the probability of a child dying before reaching age five was 5.5 percent

that is 55 deaths for every 1,000 live births [10]. In 2015, an estimated 1.5 million people in Uganda were infected with the deadly HIV and its prevalence rate was 7.2 percent. The following were most prevalent causes of death in all ages in Uganda HIV/AIDS, Malaria, Respiratory infections, Diarrheal diseases, Tuberculosis, Cerebrovascular diseases, Heart diseases and so on and hence the reason for automated personal clinic services in Uganda.

The health system is supposed to be all activities that promote, maintain and restore total health to any individual

but Ugandan health care system aim to achieve and maintain sound health for its people although this have not been attained due to emerging and unbridled challenges thus far. Health Care Delivery is done through District health structure (also known as primary health centre), it offers required health need for all the inhabitants of a district except when referral arises that Regional Referral Hospital are consulted. The health care services is done through decentralized framework as shown in figure 1
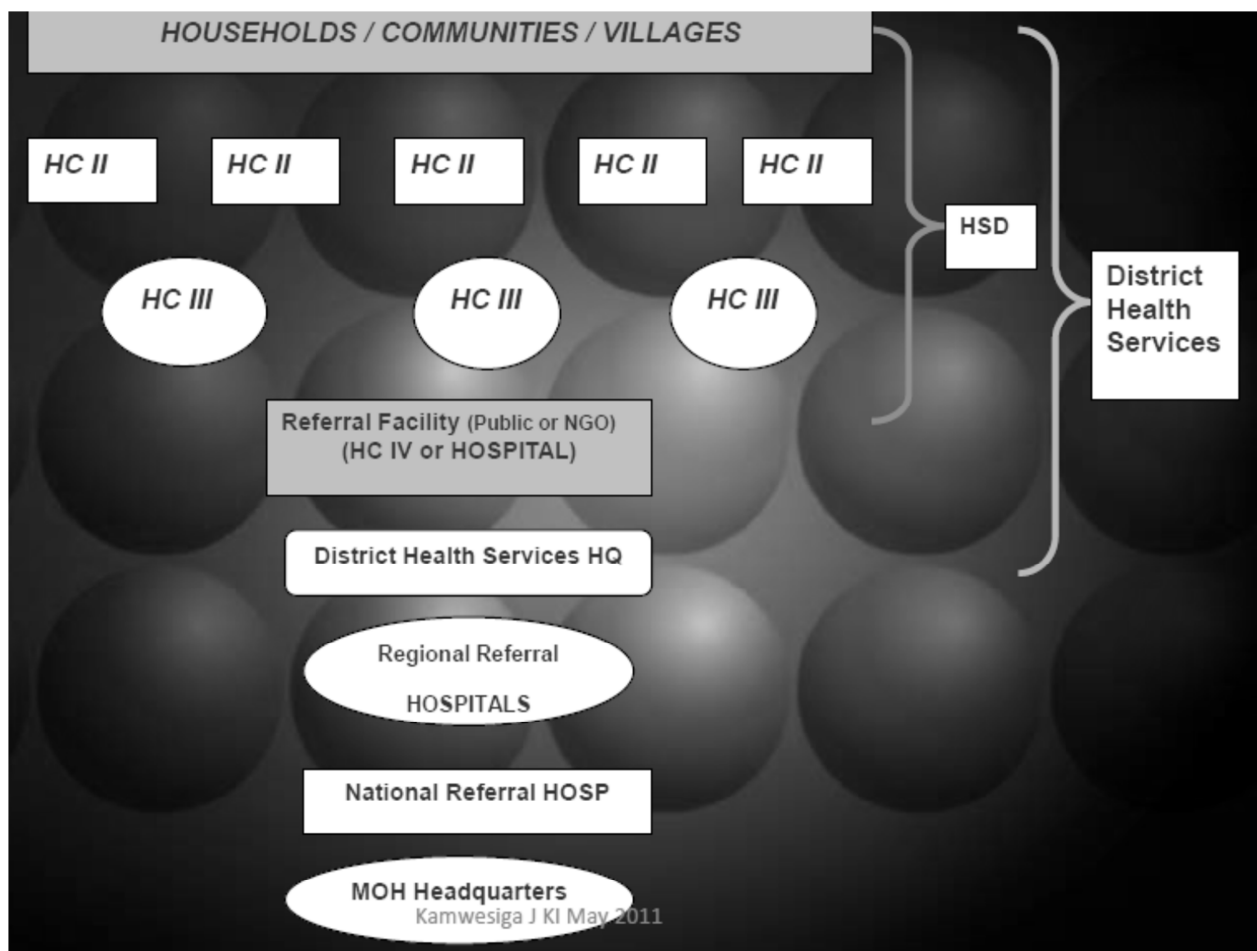

Figure 1. Decentralized Health care framework in Uganda (Kamwesiga, 2011).

The following were stakeholders in the decentralized health care framework, they are Village Health Teams which are grass root health service provider, some are volunteer, others are on stipend and few are government employed. They are first contact for anyone living in a rural area. According to Ugandan health policy, there are Health Centre II, these are parish health centres serving a few thousand people and are domiciled in every parish. There are Health Centre III that is found in every sub-county which comprises of at least 10 medical personnel with laboratory and Health Centre IV (District Hospital) that serve county with more personnel, emergency ward and other facilities. Regional Referral Hospitals are available for specialty such as dentistry, psychiatric, orthopedic, etc. Moreover we have

National Referral (Teaching Hospital) which houses the best medical consultants, surgeons, pathologists, radiologists and other paramedics. By considering medical personnel to patients or the entire populace of Uganda it was observed that adequate provision of health care services can only be augmented with SRS for Personal Clinic because of shortage of medical personnel and ratio of doctors, nurses, midwives, dentists, laboratory technician and other health workers to populace [8]. It was observed that the ratio dwindle per year hence the motivation for this research work.

1.1. Structure of Health System

Ugandan Health System runs on national and local basis with non-profit making idea and almost 80% are religiously

owned. The for-profit health providers are informal drug stores, privately-owned clinics, etc. The health system is divided into national and district-based levels and there are national referral hospitals, regional referral hospitals and semi-autonomous institutions including Uganda National Health Research Organization (UNHRO) at national level. The district level consists of Village Health Teams (VHT) and level II Health Centre up to level IV Health Centre which are governed by District Health Management Team (DHMT). Health Unit Management Committee (HUMC) composed of health staff, civil society and community leader [8], [11].

1.2. Description and Overview

Description and overview of Software Requirement Specification (SRS) for personal clinic is illustrated with the complete procedures for its development, system constraints, interface and interactions with other external chatbot [1]. All what are required for this project are cataloged including functional and non-functional requirements. System functionalities are covered in the SRS overview and the interactions with other systems are emphasized [2], [3].
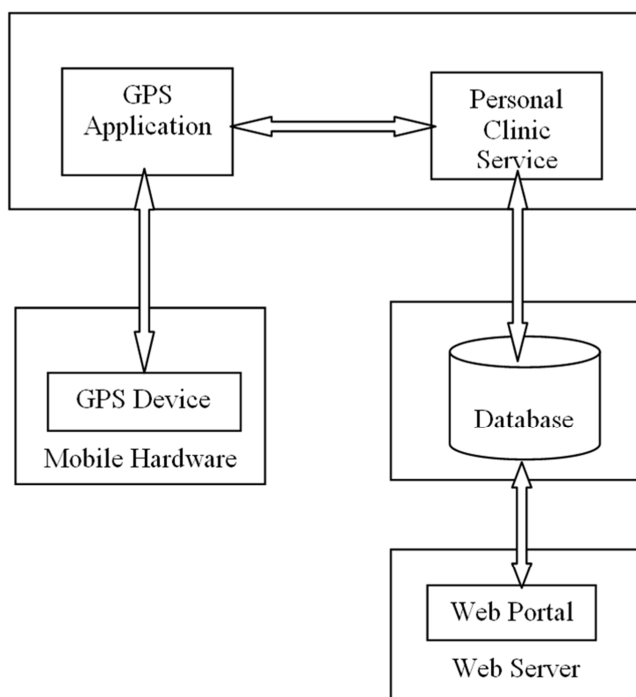

Figure 2. Block Diagram for SRS.

As depicted in figure 2, it is data-centric product which will require where to keep the data, hence need for both the mobile application and web portal to communicate with the database, the mobile application will only use database to get required information while web portal will add and modify the information while all the communication will be done over the internet.

1.3. Purpose and Scope

Personal Clinic is a web-based mobile chatbot in the Google assistant that offers wide range of health care services to its clients 24 hours in week within their respective locations without any form of barriers, the services includes out-patients medical assistance, prescription and other clinical aids and any prospective user of personal clinic are helped to find the closest clinics, hospitals and offer medical prescriptions based on the user's current position or location [4, 5, 7]. Internet and Global Positioning System (GPS) connection are required to fetch and display results, all system information is maintained in a database which is located on a web-server. The software also interacts with the GPS-Navigator software which is expected to be in an already installed chatbot on the user's mobile phone. The chatbot has the capability of representing both summary and detailed information about the selected services.

2. Research Objectives

A thorough review of conventional clinics were carried out and appraised so as to support need for this research. The objectives of the research are to

a. design personal clinic services on any user platform for patients in Uganda.
b. implement the SRS of personal clinic services.

3. Methodology

This section will give an overview of the whole system. The system will be explained in its context to show how it interacts with other systems and introduce the basic functionality of the system. It will describe what type of stakeholders that will use the system and what functionality is available for each type. At last, the system is presented with its attendant constraints, strengths and assumptions.

3.1. Product Perspective

This system has three (3) parts broadly which include mobile chatbot, Google home devices and web portal. The mobile chatbot is computer program used in conversation, it is designed to simulate how human would behave during conversations or dialogs. It has been deployed in Natural Language Processing systems with practical purposes in customer service or information acquisition. Chatbot will be used to find the services and view information about medical practitioners, locations and their health care services while the web portal will be used for the same purpose and the same applies for the Google Home devices. The mobile chatbot will need to communicate with GPS chatbot within the mobile phone, which in turn communicates with a physical GPS device to find the location of the user. The GPS will provide navigational system involving satellites and computers so as to determine the latitude and longitude of a prospective user or patient on earth and invariably offer the mobile chatbot with locations of the user, the hospitals or related health facilities and the distance between them with maps which are displayed on the map by chatbot. The functionality provided by the GPS will be embedded in the chatbot for users to be able to use the functions in the chatbot, since this is a data-centric product hence need to

store the data arises and storage capability will be made available in the Google Data Centers as the whole system is hosted on Google servers and for that, a database will be used. Both mobile chatbot and web portal will communicate with the database, however in slightly different ways.

3.2. Product Functions

Mobile chatbot will help users or patient to search for specific disease prescriptions, hospitals, clinics and pharmacies. User request and other criteria will determine the result which will be based on the user inputs. There are several search criteria including voice search and keyboard type-search, in some options, a custom selection of available options.

3.3. User Characteristics

There are three (3) types of users that interact with the system viz:
 (1). Users on mobile platform
 (2). Users on web portal
 (3). Users on Google Home devices

Each of these three types of users has different platform hence they have their own requirements and specifications. The mobile application and web users can only use the application either by voice or text which means that the user has to search for what they desire, choose a service from that search and then navigate through it. For users to get relevant search result there are multiple criteria the users can specify and all results that match will be displayed. Google Home users can only use voice search functionality to search for services as the device has no interface for user interaction through text.

3.4. Constraints

The whole system is constrained by the system interface to the GPS navigation system within the device. Since there are multiple system and multiple GPS manufacturers, the interface will not likely be the same for every one of them. Also, navigation features can afford different variations in what each of them provide. The internet connection is another constraint for the application, stable and uninterrupted internet connectivity to fetch data from the database over the internet is mandatory hence internet is crucial and indispensable for the application to be implemented. Both the web portal and the mobile application will be constrained by the internet speed.

3.5. Scope and Dependencies

In this research, this application can only be used on mobile phones, computers and Google Home devices with better throughput and high performance. Storage and proper resource allocation of hardware is required for its efficient implementation for example, if the phone does not have enough hardware resources such as computational power, storage for the application, there may be scenarios where the application does not work as intended or does not work at all.

4. Specific Requirements

This section contains all of the functional and quality requirements of the system. It gives a detailed description of the system and all its features. Detailed description of inputs and outputs of the system are provided. It gives a description of the hardware, software, communication interfaces and provides basic prototypes of the user interface.

In figure 3, the users get started after his/her identity is supplied and there are options before proceeding to indicate whatever clinical services required, for instance if the user suffers from Malaria, Doctors, Hospitals and Diagnostics options are explored and other subsequent inputs about the illness are being asked, then the Personal Clinic responds with specific prescription and directs the user to see a physician for other prescriptions. In figure 4, the user asks for a doctor within their vicinity and the Personal Clinic gives them a doctor's contact and location depending on where user is, it does not only have doctors but specialist depending on the user's health challenges, furthermore figure 5, offers all the list of hospitals with the available specialists in any particular hospital while figure 6 show all the hospitals with the ranges of health cases they can handle.
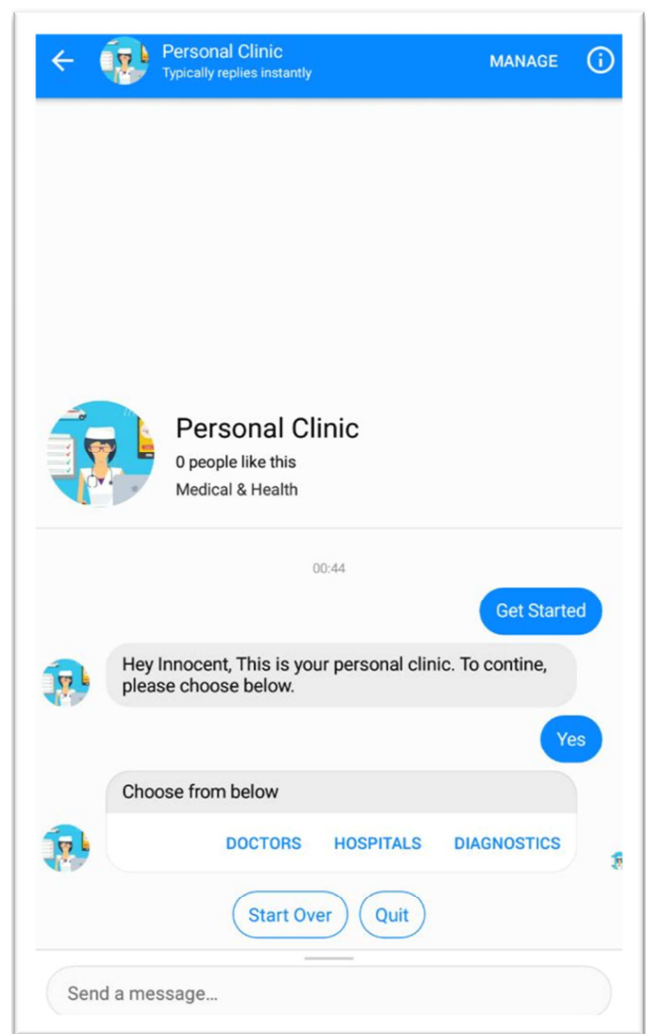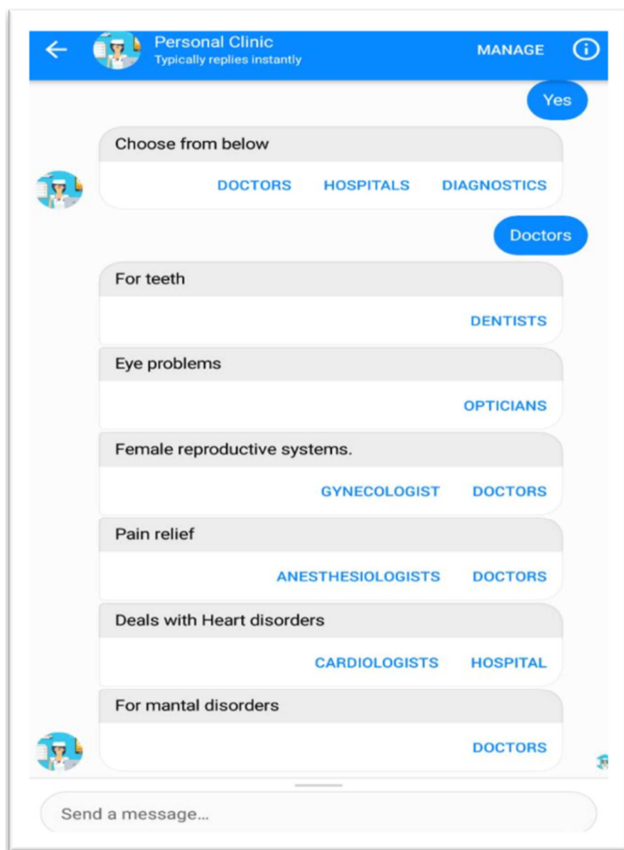

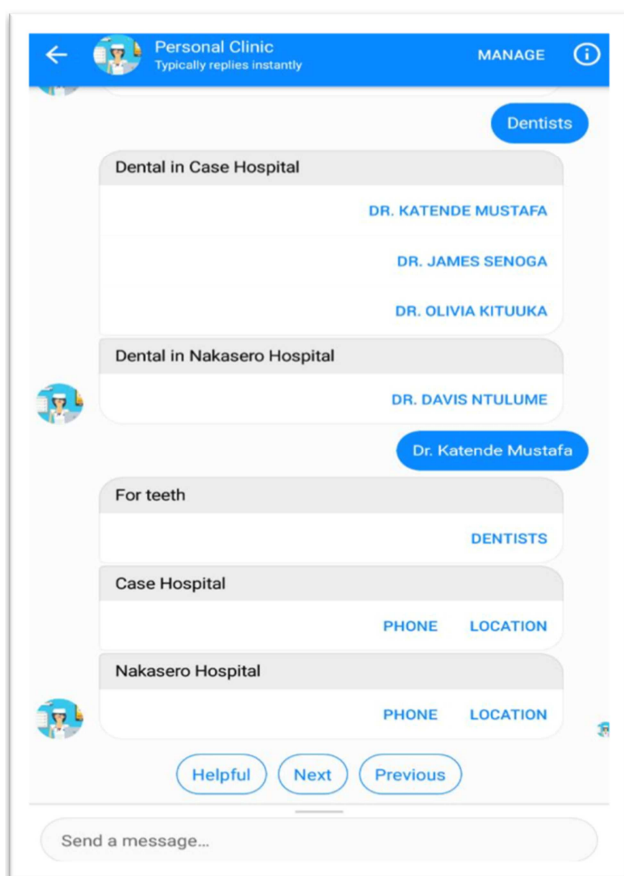*Figure 3. External interface Requirement.*

Figure 4. Personal Clinic responses.

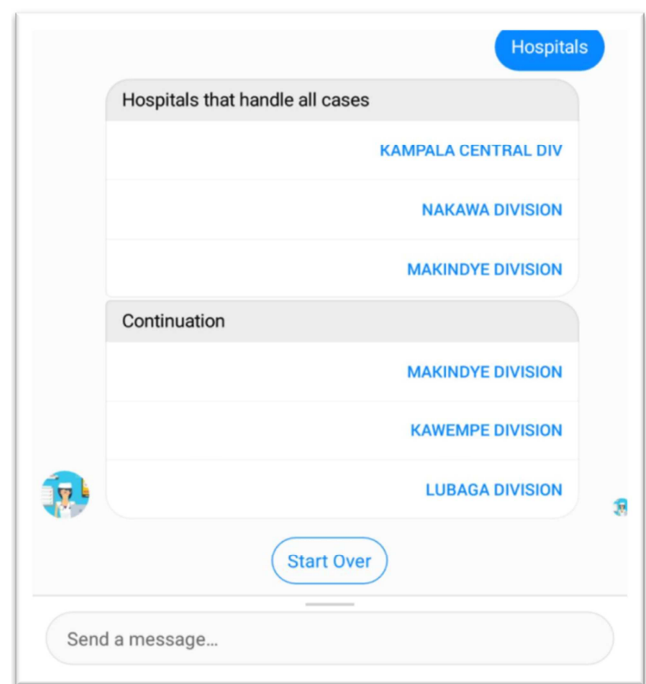*Figure 5. Personal Clinic list of hospitals with available specialists.*

Figure 6. Personal Clinic list of hospitals.

5. Conclusion

This research work was developed and implemented, SRS for Automated Personal Clinic on any three (3) platforms were done. The aim and objectives were achieved by providing clinical services to patients without border. This software accommodates high number of users from different locations in Uganda without redundancy and high performance mobile computing are catered for with embedded fault tolerant system to prevent both expected and unexpected errors which consequently increase the usability and acceptability of SRS for automated personal clinic. Health Care Delivery of clinics would be enhanced via mobile technologies and various health challenges were significantly improved on.

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