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IMPLEMENTING A WEB-BASED IMMUNIZATION SCHEDULE REMINDER FOR POSTNATAL SERVICE DELIVERY

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Abstract

The mortality rate of infants under the age of five is still relatively high in many sub-Sahara African countries like Nigeria. Immunization remains the most crucial and cost-effective public health intervention scheme for protecting children in this region from vaccine-preventable diseases. Immunization, however, is only effective if the nursing mothers keep strict appointment schedules. To this effect, information technology can be leveraged to help in this regard. This paper thus implements a web-based immunization schedule reminder for postnatal service delivery. In order to realize the system, a component-based development approach was used to extend an existing electronic medical record to include the immunization schedule reminder. The

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resulting system is able to reduce child mortality by reducing the rate of missed appointment schedules.

I. Introduction

The mortality rate of infants under the age of five is still relatively high in many sub-Sahara African countries like Nigeria [1]. This can be attributed to a number of factors such as poverty, lack of education and in recent times vaccine hesitancy [2]. It is expected that regular and scheduled visits be made to antenatal clinic before delivery and postnatal clinic after delivery. Antenatal visit is observed religiously to a large extent but this practice is often discontinued after delivery hence the high mortality rate especially at the postnatal stage [3, 4]. Most killer diseases such as typhoid, poliomyelitis, diphtheria measles and chicken pox that lead to under-five mortality are vaccine preventable diseases [5]. As a result, immunization remains the most crucial and cost-effective public health intervention scheme for protecting children in this region from death through these vaccine-preventable diseases so as to attain the United Nations (UN) sustainable development goal of good health and well-being [6].

In different countries, the immunization schedule is regularly reviewed in order to adequately protect against childhood killer diseases and nursing mothers are tasked with remembering the time schedule for their babies. This can be daunting as women are often saddled with a number of responsibilities that may lead to their forgetting the scheduled date for their children. In this regard, information technology can be leveraged to issue reminders to the mothers [7]. Although a number of propositions exist in literature in this regard, this paper presents a solution that adopts a component-based development approach. The goal of component-based software development is to engage the integration of loosely coupled components to realize a working system or software product and this holds great promise in the health domain [8]. The component-based development approach also has the following advantages which include [9]: (i) component reusability rather than component re-implementation, (ii) reduced cost of software development owing to services rendered by component model, and (iii) rapid time to market since development does not start from scratch.

The aim of this paper is thus to implement an immunization schedule reminder for postnatal service delivery using component-based software development approach. The rest of this paper is structured as follows: Section 2 presents the review of related works. In Section 3, the methodology is presented. Section 4 discusses the implementation of the system as a web

application. Section 5 discusses the results obtained and Section 6 concludes the paper.

II. Related Work

The literature shows that most of the technology intervention approaches have been mostly mobile-based [10] as a result of the increasing adoption of mobile devices in the sub-Sahara African region.

The study in [11] develops repository mobile immunization reminder system (RMIRS) for nursing mothers with the use of a modem in order to remind mothers of their children's immunization date. The system works by first collecting the nursing mother's information and storing such on a remote database. The system calculates the timing of immunization dates for each mother and stores the same alongside the mother's phone contact. On a daily basis, the system checks the records and sends Short Messaging Service (SMS) reminders to mothers. Although similar is the function of our proposed system, the repository mobile immunization reminder system remains standalone. On the other hand, Mobile Med Alert [12] is a mobile technology based system that helps outpatients in complying with drug regimen by providing reminders at dosage times through the use of the SMS.

A mobile application for use by rural caregivers for timely pregnancy related information management and to provide relevant pregnancy and childcare related advices was presented in [13]. This is made possible through an expert system module in the application. The application demands minimal medical expertise on the part of the caregivers and so early assistance can be provided even before a trained medical practitioner is made available to the patient. Similarly, Text4baby [14] is a national text messaging health information service in the United States that aims to provide timely information to pregnant women and new mothers to help them improve their health and the health of their babies.

In addition, MoTeCH [15] is a system that can be utilized in supporting community-based primary health care using mobile technology. The system adapts and integrates existing software applications for mobile data collection, electronic medical records, and interactive voice response to bridge health information gaps in rural Africa. MoTeCH is also able to calculate the upcoming schedule of care for each client and when care is due, notifies the client and community health workers responsible for that client. MoTeCH also automates the aggregation of health status and health service delivery information for routine reports.

III. Methodology

The methodology adopted in this paper is the component-based software development approach. An existing electronic medical record (EMR) was extended to incorporate the immunization schedule reminder module. This module consists of postnatal scheduler, database, Google Calendar API, SMS Server and Reminder components. Figure 1 depicts the architecture of the resulting system.

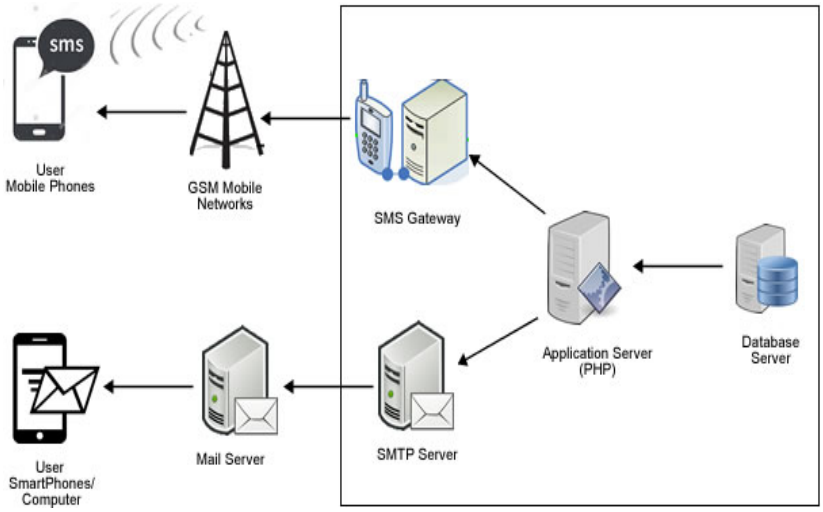

Figure 1. System architecture.

From Figure 1 we see the Database Server, which holds the records of patients from the EMR system. It is this database server that is queried using server-side scripting language (PHP) to gather the data of nursing mothers who are to be sent reminders via the bulk SMS Gateway on a daily basis. The reminder messages can be sent either as SMS, email or both.

IV. System Implementation

The system was implemented as a Web-based application. The user interface was created using HTML/CSS and PHP which was used as the server side scripting language. Figure 2 shows the interface of the EMR system that was extended while Figure 3 shows the scheduling calendar.

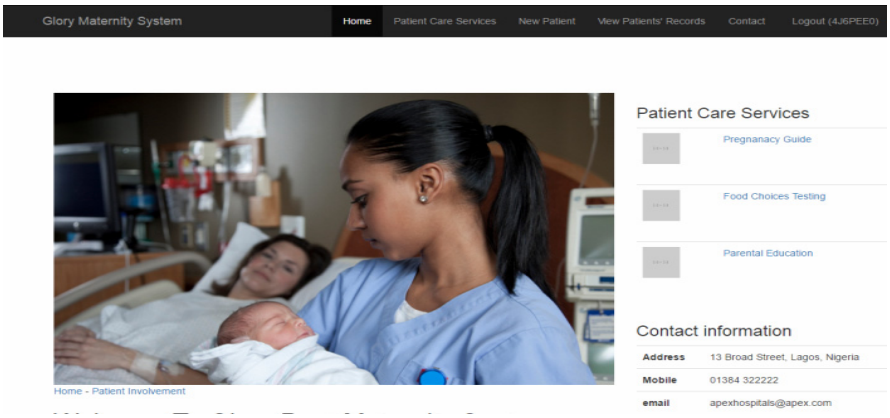

Figure 2. The home page of the extended EMR system.

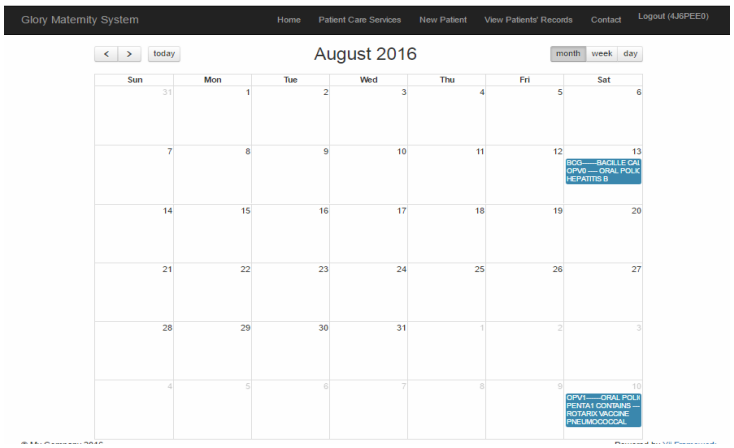

Figure 3. The automation calendar of the baby's immunization schedule.

In Figure 3, dates highlighted are days when a reminder is to be sent while those not highlighted are days when no reminder is to be sent.

V. Discussion

The application developed in this study is web-based and is to be managed by a Hospital's information officer. It can easily be deployed in a hospital where there is an existing EMR system. However, that does not deter a hospital where this is absent. The application developed in this study closely resembles the RMIRS [11] in functionality except that the system in [11] is not able to send emails like ours. Also, our system is similar to Mobile Med Alert [12] in functionality except that Mobile Med Alert reminds an outpatient to take his/her drugs while our system reminds a mother of the immunization

date of her child. The system in [13] as well as Text4baby [14] do not implement any form of reminders and are concerned mainly with disbursing expert information on general health tips for pregnant and nursing mothers which makes them both unlike our system. In addition, MoTeCH [15] was developed as a kind of mash up application comprising of various components that come together to achieve a goal. However, MoTeCH is broad in scope while ours is specific to postnatal service delivery.

VI. Conclusion

The web-based immunization schedule reminder for postnatal health service delivery would be of tremendous benefit to obstetricians and nurses – midwives to add or edit the postnatal records of their patients, as a result eliminate manual method. It would allow mothers to have updates of their children's immunization scheduled dates. Routine immunization must be prioritized at every level of government. Perhaps, immunization card could be used as a prerequisite for pre-school enrolment in order to identify those children who are not vaccinated. Usability testing of the system is planned as future work. Also, field test will be conducted in a number of hospitals to determine the impact of the system on child mortality within the region.

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