Mother Infant Nurturing Application

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***Abstract* - This paper proposes a pregnant mother and infant monitoring system, which integrates current personal digital assistant (PDA) Samsung Galaxy Tab and Wi-Fi technology connected to hot-spot via iPhone. Geo location of patient is tracked by Global positioning System (GPS).Automatically sends an SMS to the attending health professionals stored in the contact list, which mentions about reason and level of the alarm. Vital sign measurements through medical gateway interface are displayed on PDA. Health information of patients is recorded in the system.**

Keywords— ANC- anti natal care, ANM, Geo-tagging, vital signs, PHC –primary health centre.

I. INTRODUCTION

More and more rural pregnant woman should undergo special examination or therapy. The key success to all critical care is the continuous monitoring of vital signs such as blood pressure, oxygen saturation etc. and by taking track of immunization, vaccination and providing proper advice by primary health centre authority's to the pregnant woman. If any critical case arises for pregnant woman or new born child an alarm message indicating the reason and severity of the vital sign problem is sent to medical higher authority hierarchies based on the level of critical case. To enhance the medical quality Doctor can save more time when he/she gets the patients' physiological information directly through PDA via server. Geo-tagging of location is done by enabling the GPS, so that the current location of pregnant woman can be easily updated on server. The structure of Geo-tagging of location is illustrated in Fig. 1. An application is developed to make this process automated in Android.

Recently, the fast development of mobile and tablet technologies, including increased communication bandwidth and miniaturization of mobile terminals has accelerated developments in the field of mobile telemedicine. Wireless patient monitoring systems not only increase the mobility of patients and medical personnel but also improve the quality of health care. With respect to the remote monitoring of patients, many groups have demonstrated the transmission of vital bio signals using global system for mobile communication (GSM) technology.

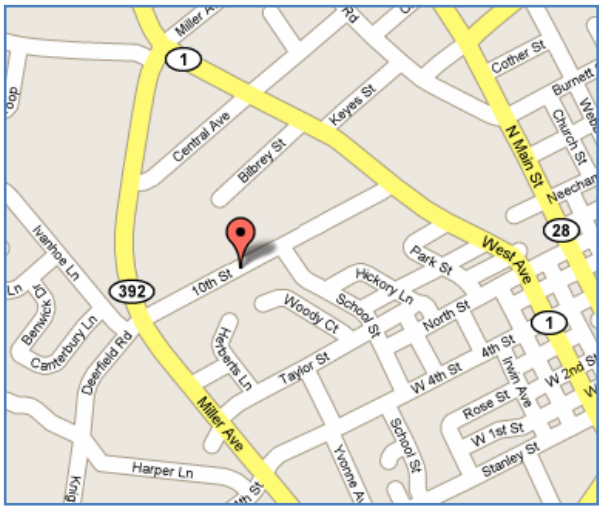

Fig 1: Geo-tagging of location by Google map

II. SYSTEM DESCRIPTION

The architecture of the system is shown in Fig 2 .The system is client- server architecture with a medical gateway interface and at the backend with data management. The application is comprised of activities. Each user screen is implemented as an activity. The application uses the application framework features such as location, content etc., The communication is implemented through the HTTP POST method supported by the asynchronous task class methods. The JSON [JavaScript Object Notation] object is used to format the content to be sent to server using the JSON PUT method. On receipt of information from server the JSON Parser is used to get the information fields back.

The client side application contains the following modules:

A. User Authentication

With the development of mobile communications networks, more and more users can go through mobile devices to connect the Internet and user authentication is used to identify whether the user is legal or not, to prevent hackers. Password authentication is through user ID and password to do the verification. We can divide password verification into two categories, namely system needs to store the password in table and the other one is system does not need to store passwords in table. The first system includes direct-storage password method, one-way which has been followed here. Verification Phase: During this phase, server will verify the user's information, such as accounts, passwords only legal ANM user can access to this system.

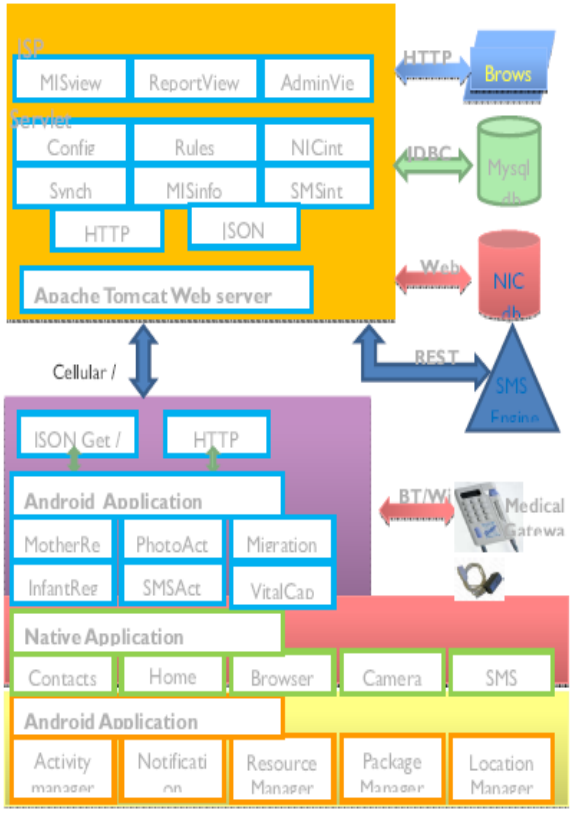

Fig 2: Architecture of MIN Application

B. Registration Phase

After the approve of login, the ANM user has the permission to access the system. The ANM gets into registration phase to fill in the basic details of new pregnant woman here mother id has been made mandatory on submit of information it will be updated in client's SQLite database.

C. ANC Activities

ANM user should enter the ANC [Anti Natal Care] details of each individual pregnant woman. Based on the lmp [Last Menopause State] date of the pregnant woman all the 9 months of pregnancy dates, ANC dates, vaccination and immunization dates is calculated. ANM user should enter the ANC details of each individual pregnant woman Total duration of pregnancy are 281 days. Here month value is taken as 31 days .Pregnancy is detected after 45 days of lmp date.

Edd [Expected Date of Delivery] = (lmp date + 281 days)

Month9 = edd -31 days

Month8 = edd – 31 days *2

Again based on the month calculation, according to the pregnant woman's current month vaccination such as HB, urine albumin, RTS/STI, Haemoglobin, fetal heart rate, RBS vital measurements is taken. All these calculated dates will be present in both SQLite database in client and MYSQL 5.0 database in server.

D. ANC Adhoc & ANC Mandatory

ANM should conduct all vital sign measurements such as HB, Scanning, RTI/STI, Urine Albumin, HIV, BP, weight, Malaria etc. There are certain measurement which should be mandatorily conducted such as scanning, HIV, RTI/STI etc. since it very critical requirement for pregnant woman during her pregnancy, while others such as weight checkup, BP measurement can be done in adhoc way in this case all pending works to be done can also be identified.

E. Advisory

If the pregnant woman needs any advice such as dizziness, vomit sensation, appetite, advice about food & cleanliness etc., during the tenure of pregnancy, then the pregnant woman can intimate the ANM. ANM will update the pregnant woman's query by filling the advisory form. Medical authorities based on the query, answers them either through mail, video chat etc., If it's a video chat then the medical professionals will intimate the date & time to ANM, so that proper guidelines can be given to expectant mother without any disaster.

F. Photo Activity

ANM user can take the photo of pregnant mother in PHC in case of foot swelling or any other ailments and update to the database, so that the medical higher authorities can respond to them in case of serious emergency, so that correct scenario about pregnant mother will be updated.

G. Mother Migration

If the pregnant woman moves to any other place during the tenure of pregnancy, then based on the unique mother id given by the ANM to the mother, the mother can be tracked in case the mother moves to different place and contacts other ANM in different place. From this scenario the immunization, EDD and vaccination of pregnant woman can be kept tracked, without any loose of mother's up to date information.

H. Synchronize

All the data (registration, adhoc, ANC), image etc. which is stored in the client database should be updated to the server database, so that it will be helpful for future reference, report generation etc. This is done by the help of synchronization.

I. Vital Sign Measurement

Vital sign measurement for BP is done by a zoa medical gateway interface which displays the measurement on Android tablet with both systolic and diastolic measurement. A module is developed to capture this measurement on tablet on click of start button. We provide the zoa machine with IP address to transfer data to tablet

In server side application a dashboard is created which contains the following modules:

A. Details of Specific Mother

In the dashboard details of specific can be obtained based on the unique mother id. This is done by querying the master table at the server end.

B. Location Based Mother Details

Based on the location hierarchy expectant mother search is done. All pregnant woman in particular location can be obtained based on this filter method. The filtration hierarchy is taken as state, district, taluk, PHC. From this search hierarchy list of all pregnant women can be obtained who has registered in particular location.

C. Photo Evidence

Based on mother id search we can retrieve all the photos present in dashboard link, this is done by updating from the client sqlite database to the server database, which was taken in the android client application. This helps for the medical authorities to get the clear idea of expectant mother's condition.

D. High BP/Sugar/Anaemia/Mortality/ Delivered cases

Based on location of pregnant woman all statistics of high risk cases and general cases of BP, sugar, anaemia is listed. The medical higher authorities can check for the report based on their needs.

E. Set Rules for Vital Sign Measurements

Based on the medical advice by professional doctors rules are set for vital signs, so that if a measurement exceeds or deceeds certain range then it is considered to be abnormal to the patient.

Table 1 gives vital sign and their measurement range

Serial No	Vital Signs	Measurement
1	HB	Less than 10
2	BP: Systolic Diastolic	Greater than 90
3	RBS	Greater than 160
4	Urine Albumin	3-5 Normal

Table 1: Vital signs and measurement

F. Alarm SMS

If the vital signs exceeds the mentioned measurement or in case of any disease such as HIV, malaria then an alert alarm sms is sent to medical higher authorities hierarchy based on the level of severity as shown in Table 2.

Serial No	Severity	Abnormalities	Medical Professionals
1	Level 1	BP,RBS,HB	HN
2	Level 2	RTI/STI, Urine Albumin	HN,MO
3	Level 3	Malaria	HN,MO,THO
4	Level 4	HIV, Baby Aborted	HN,MO,THO,RCHO
5	Level 5	Mother death , Still Birth	HN,MO,THO,RCHO, DMO,DHO

Table 2: SMS sent to Medical Professionals based on Abnormalities

HN: Head Nurse

MO: Medical Officer

THO: Taluk health Officer

DMO: District Medical Officer

DHO: District Health Officer

PHC: Primary Health Centre

RBS: Random Blood Sugar

HB: Haemoglobin

ANC: Anti Natal Care

ANM: Auxiliary Nurse Midwife

RTI/STI: Reproductive tract infection

Sexually transmitted infection

EDD: Expected Date of Delivery

III. CONCLUSIONS

The proposed system has the ability to detect and provide immunization to the pregnant women in rural area by capturing the required vital sign measurement and displaying it on android application. This application helps to send sms alarm to medical hierarchy authorities in case of severity, also many added advantages features has been added for value added purposes of this application. Many report generation for vital measurements have been generated at the server side, in order to maintain record for future references.

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