Assistive Technology for Pregnant Women Health Care: Rural, Mobile Ultrasound Scan System (using ASTME1384 - 07 Standard)

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Abstract: Human resource is the backbone of developing and under developed nations. In developing nations like India, rural areas are more when compared to the cities. People in rural areas are not really concerned about their health, because of unavailability of hospitals in the nearby areas and also they need to travel long distance even for small injuries and routine checkups. Pregnant women from rural areas don't do their regular checkups at the early stage of pregnancy. Routine checkups can avoid birth of handicapped children and also helps in reducing fetal mortality rate to a very large extent. In our system, ultrasound scan of the pregnant women is performed and along with that, some vital parameters of pregnant women, like temperature, heartbeat rate, pressure, ECG are measured and are stored in a memory card. The mobile application can access this information and can check for emergency condition. Thus if any critical condition exists, it prompts the health care worker to send SMS to the Doctor with patient's details. A windows desktop application, access the information stored in memory card and displays result analysis report, video of ultrasounds scan with multiple videos on single screen and allows the doctor to generate report of the latest checkups and stores this information both in memory card and local server for later purpose.

Keywords: EHR Electronic Health Record, vital parameters-temperature, blood pressure, body temperature, ECG

I. INTRODUCTION

It is the responsibility of a nation to provide food, education and medical care to its citizens. Fulfilling this can promise effective efforts by the human resource for the nation's development. Efforts should start right from providing timely and quality health assistance to pregnant ladies which will lead to the birth of healthy children. Here comes the need of technology which helps to take care of them. People in rural areas are not aware of proper medications and technological advancements to alleviate complications during pregnancy period. For instance, pregnant women should perform ultrasound scan at least 2 times during pregnancy period to know more about fetal growth. Moreover, proper and timely checkups can ensure safe delivery. Women in rural areas lack knowledge about importance of proper medication. Medical expenses are also unaffordable to them. Even though ultrasound scanning systems are available in market, it is highly expensive. Since, the proposed system is targeting the rural areas of developed and under developed nations, expensive medical devices are not affordable. In our system, ultrasound scan is performed during each month and along with that some vital parameters of pregnant woman, like temperature, heartbeat rate, pressure, ECG are measured. In order to perform ultrasound scan, the probe which is also portable and not that much expensive can be used. Gadgets attached to the body of pregnant woman helps in reading it. We require the service of an experienced health care worker to store these values into a memory card for further reference by the doctor. She/he should be proficient to perform the ultrasound scan since efficiency of scan depends on his ability. He/she is provided with a mobile, with an application to read these values and notify critical condition thus helping him to inform doctor.

II. PROBLEM DEFINITION

Every day, approximately 800 women die from preventable causes related to pregnancy and childbirth. 99% of all maternal deaths occur in developing countries. Maternal mortality is higher in women living in rural areas and among poorer communities [6].A quarter of world's neonatal deaths (one million) each year take place in India, mostly at home (65.4% of all births and 75.3% of births in rural areas occur at home). Issues of availability and accessibility of maternal and child health care and nutritional programs are important in this context. Though India has made an appreciable progress in improving the overall health status of its population but it is far from satisfaction. The pace of decline of infant and child mortality on one hand and maternal mortality on the other hand has been quite low. Improved utilization and access of health care facilities are often interrelated with distance, socioeconomic condition and literacy levels of women. Studies show that fetal, neonatal and maternal mortality rate is higher in rural areas and it is found that most of the reasons that causes them can be avoided by proper detection and diagnosis during the pregnancy period. Awareness of and access to a health care center, equipped with modern maternity facilities has a significant positive impact on the health-seeking behavior and pregnancy outcome of rural women. Lack of knowledge thus is a cause of high maternal mortality rate among the women. They suffer from various health problems such as anemia, weakness and vomiting. Programs to improve neonatal survival in such

rural settings will need to invest both in strengthening primary health services provided during pregnancy period. To make these effective, parameters that helps in understanding the current health status of pregnant woman is recorded and is stored for further reference of doctor by a health care worker. Also, a mobile application to notify critical condition of the patient can act as an immediate measure. Enabling doctors to view the records and videos of scanning in a more efficient and user friendly manner completes the functionalities of the proposed system.

III. SYSTEM ANALYSIS AND HEALTH CARE SCENARIOS

Our proposed healthcare system mainly takes care of pregnant women of rural areas who are in desperate need of help and assistance to reduce maternal and neonatal mortality rates and other complications during pregnancy.

Since the system is aimed at a great cause, we made a visit to gynecology department of Amrita Institute of Medical Science (AIMS - one of the largest Multi-Specialty hospital in India) to discuss more about the scope of the system. We were able to get the appointment with the chief doctor of the department to see and study the working and related details of the ultrasound scanning system used in the hospital. The devices used in hospitals are non-portable, sophisticated and thus expensive. Portable probes are less expensive and thus a person proficient in conducting the scans can help us take scans accurately. Also, our system takes into account, some of the vital parameters of pregnant women like temperature, pressure, heart rate and ECG. To accurately predict complications of pregnant women, it must take into account more and detailed health details and past health records of the patient. Our mobile application is an assistive system aimed at helping the health care worker to know the critical condition of the patient. We were able to collect the normal and critical ranges of the parameters in our proposed system i.e. the test data and also some of the abnormalities that can be predicted from these collected data. Medical care of pregnant women involves a lot of attention, proper and timely diagnosis, medication patients should undergo and of course all this costs a lot of money. People in rural areas rarely do proper checkups during pregnancy. The proposed system attempts to give quality and timely medical care at very less expense.

IV. SYSTEM DESCRIPTION

Here is a brief description of how the system functions. Overall, our system has hardware and a software part. The hardware part comprises of electronic gadgets that are attached to the body of the pregnant woman. The function of the gadgets is to perform ultrasound scan and also to measure the heart rate, temperature, pressure and ECG. Each patient is provided a unique memory card where their details are stored. Readings from the gadgets are also stored into this memory card. We need the service of an experienced health care worker to monitor all these activities.

The software part comprises of two applications: an android mobile application and a windows desktop application. With the help of Arduino Bluetooth shield, values from the gadgets are sent to the mobile application via Bluetooth. Mobile application is designed in such a way that it raises notifications if the input readings lie in critical ranges. This helps the caretaker to take further measures. Options are also provided so as to send an SMS to the/she doctor.

The windows desktop application is designed for him to store all the videos and values into the central database. Another windows desktop application helps doctor to view all the values measured corresponding to each patient's details. It also helps him to view the scan videos by providing a media player for concurrently viewing the readings. This helps the doctor to identify complexities associated with the fetus and thus helps the doctor in providing a more accurate diagnosis. He can provide his feedbacks and report for each patient which will be stored back into the memory card. All these procedures follow ASTM E1384 EHR standard. In case of any emergency, the patient details can be used to take necessary steps. The following figure gives an overall idea of the system.

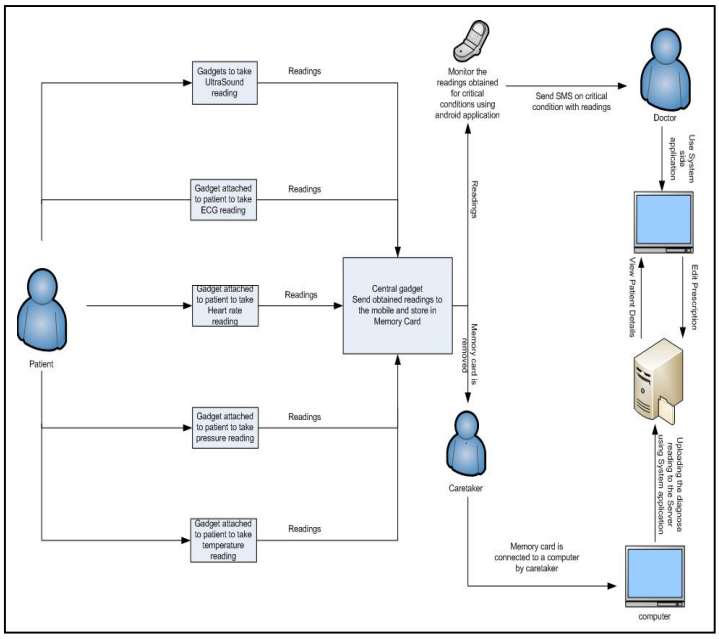

Figure 1 : Architecture diagram

V. HARDWARE DESIGN

The hardware design comprises of electronic gadgets that are attached to the body of the pregnant woman. The function of the gadgets is to perform ultrasound scan and also to measure the heart rate, body temperature, blood oxygen saturation level, blood pressure and ECG. Each patient is provided a unique memory card where their details are stored.

A) Ultrasound scanning method: This method is mainly used to check the growth of the baby in the mother's womb. With the help of an ultra sound scanner we can identify many issues such as fetus development anomalies, chances for miscarriage, confirming a pregnancy, multiple pregnancies etc. The ultra sound transducer consists of an array of piezoelectric sensors. The sound waves produced from the probe are transmitted through the body. When the sound waves hit an object between acoustically different tissues some of the waves are reflected back. Other waves travel further until they reach another object. The reflected

echoes are received by the transducer which converts it into electrical signal. These signals are processed to calculate the exact location and intensity of these reflections. Eventually after making a series of image processing and compressions with these results, a set of videos/images can be obtained. There are different modes of scanning in an ultra sound scanner. A-mode scans are usually used to measure the dimensions. It can give one-dimensional information so it cannot be used for imaging purposes. B-mode scans can give two-dimensional information about the cross-section of the body and hence it is used for imaging. Phase-mode scans consist of a number of transducers in the same probe. This type of scanning can produce high resolution images. The phase mode scan output can be displayed on the monitor who can help the health care professionals to know the health condition of the patient.

B) Heart rate and oxygen saturation level Measurement: Heart rate is the number of times the human heart beats in a single minute i.e. Beats per Minute (BPM).In this design, we use photoplethismography technique (PPG) to obtain the heart rate. PPG is a simple and low cost optical technique that can be used to detect the blood volume changes in the micro vascular bed of tissues. Pulse oximeter comprises of two light emitting diodes (red and infrared) and a Photodiode kept at opposite sides at the tip of the index finger. The oxygenated haemoglobin in blood absorbs Infrared whereas the deoxygenated one absorbs red. Each light gives a distinct waveform at the phototransistor. The waveform corresponding to the IR light shows the concentration of oxygen carrying haemoglobin in blood whereas the other waveform shows the concentration of oxygen less haemoglobin in blood. The ratio of amplitudes of each waveform gives the oxygen saturation of blood. Only the sensor will be present at the fingertip. All other remaining signal conditioning is situated in the central circuitry. Dual Operation amplifiers play a vital role in the signal conditioning of these signals. The heart rate and oxygen content is related to blood flow and is taken into microcontroller where further manipulations take place to obtain values.

C) BP using Electrocardiogram and PPG: Blood pressure (BP) is a major concern for any human being. For a pregnant woman the blood pressure will keep varying slightly throughout the 10 months. This is what makes them feel dizzy during the pregnancy period. Monitoring Blood Pressure is very important as the variation in blood Pressure can affect the baby's supply of oxygen and nutrients. In this design, the blood pressure can be measured using Pulse Transit Time (PTT) method. PTT is the amount of time a particular volume of blood inside the artery takes to shift from one arterial site to another. Photoplethysmography (PPG) and Electrocardiogram (ECG) are the two main technologies used for measuring Pulse Transit time. In this method, PTT is calculated by an ECG-PPG combination. The PQRS waveform obtained by the ECG is compared with the Photoplethysmography waveform which is obtained by the apparatus fixed at the fore-fingertip. The time interval between the R-peak of the ECG waveform and the peak of photoplethysmography waveform gives the pulse transit time. Pulse wave velocity (PWV) is calculated by measuring distance from heart to location of PPG module, and then divides the distance by the PTT. At the end, Blood pressure is estimated through linear regression analysis. An increase in Blood Pressure makes an increase in PWV as a result of which blood takes very less time to move from one arterial location to another. A low blood pressure gives a high PTT value.

D) Temperature Measurement: DS1620-Temperature sensor from Dallas Semiconductor is used to measure the body temperature of the subject.

Mass Storage Device Model (MSDM)

The use of mass storage device in our system has several advantages as it is small in size, reusable and is easily portable. This ensures plenty of space for ultrasound scans video data. The ECG data is also stored in this card. After storing the ultrasound scan video data and ECG data in the card, the health care worker delivers it to the doctor at the health care center to store all these details into database for analysis and future reference. Scan will be conducted at least three times during the pregnancy period. The interval can be increased upon the medical expert's advice. As mass storage devices' price has got reduced drastically, thanks to the technological innovation, for each of the pregnant women, one SD Card will be used. Once the women deliver the babies, the same SD card can be reused.

VI. SYSTEM MODULES AND SOFTWARE DESIGNS

The whole system has been divided into 2 modules:

i. Mobile application module
ii. Desktop application for other doctor/other staff

A. MOBILE APPLICATION MODULE

An android mobile application is developed here. The system requires the service of an experienced health care worker. He should be trained well to do ultrasound scan. Operating mobile phone doesn't require much proficiency. Even though he is experienced, he may not be able to predict critical condition of the patients. Also, after the routine checkup, it should reach the health center and thus it may take a few days for the doctor to diagnose the health parameters of the patient. So, the mobile application serves as the assistive technology for the health care worker to help him in critical condition of the patients. The application basically collects the data sent from the Bluetooth shield via Bluetooth, and processes it. It also triggers the alert mechanisms in case of emergencies. The application software developed will be customizable and will have provision for the medic to specify the critical limits and values beyond which the alert mechanism has to be triggered.

An algorithm to predict all kinds of abnormal condition is not possible since the proposed system takes into account only some vital parameters of the pregnant woman. Still, taking these parameters into account, an algorithm is implemented to

notify critical condition. Initially, the health care worker can attach the electronic gadgets to the body of the pregnant woman. The mobile application is designed in such a way that, it searches for the Bluetooth shield from which all the data are read into the application via Bluetooth. Out of the measured parameters, temperature, pressure and heart rate are passed on to the mobile application. OP number of the patient uniquely identifies each patient according to the hospital records. OP number, age and month of the pregnant woman is fed into the application. The algorithm notifies the critical condition and thus prompts for sending an SMS with all the patient details like OP number and readings to the concerned doctor for immediate action to be taken.

Algorithm that is designed for the mobile application is given below. We have included a decision making system for the mobile application by considering the age and month of gestation of the pregnant woman.

ALGORITHM

1. Start
2. Turn on Bluetooth of the mobile device and search for active connection of Bluetooth shield.
3. Start receiving data (readings of temperature, pressure, heart rate) via Bluetooth.
4. Enter OP number, age, month of gestation into the application.
5. If age falls between 16and 35,then
   If heart rate does not fall in range 66-78,
   Condition is critical.
   Else if age falls between 36 and 50, then
   If heart rate does not fall in range 67-75,
   Condition is critical.
   If heart rate<60, then
   Patient shows symptom of Bradycardia.
   Else if heart rate>100, then
   Patient shows symptom of Tachycardia.
   Else
   Heart rate is found to be normal.
6. If temperature>37,then
   Patient may have fever.
   Else if temperature<35
   Patient shows symptom of Hypothermia.
   Else
   Temperature is found to be normal.
7. If month<5,then
   If pressure does not fall between 120|70 and 130|80, then
   Patients' condition is critical.
   Else if month>=5, then
   If pressure does not fall between 130|80 and 140|90, then
   Patients' condition is critical.
   Else
   Blood pressure is found to be normal.
8. Notifies all critical condition and prompts to send SMS to doctor.
9. If he/she press 'yes', then
   Choose number from contacts and send SMS.
10. Shows all the readings collected
11. A report on patients' health condition is displayed.
12. Stop.

B. WINDOWS DESKTOP APPLICATION FOR DOCTOR/OTHER STAFF

This application is designed for both the usage of doctor as well as the caretaker. Login credentials help to determine the type of user interacting with the application.

For caretaker or other staff responsible for entering details into the central database, after the routine checkup, the memory card of the patients is brought to the nearby health care center. In order to sort the values to the database, we have 2 applications: server and client applications. The Server application receives the various ultrasound scan videos and ECG signals and other vital health parameters that are uploaded from the client application. The server application is designed to handle multiple clients at the same time so that many staffs can upload the patient details to the server simultaneously. Admin can create new patients details and upload diagnosed reading to database.

When the doctor logins to the application, it enables the doctor to view the patient details and diagnosis reports and generate new prescription so that it can be saved in the database for future use. The doctor can view the Ultrasound videos so that he/she can get a better view about the patient's health status. He/she can view all patients by providing patient's op no and can generate report(problem list, extended encounters, care plan, procedures , legal documents , schedules , Fetus growth) depending on diagnosed readings and issue prescription. He/she can view all diagnosed readings stored in central db.

The central database needs to be well organized to retrieve all patient related details properly. In our database, 3 tables are keeps track of the entire patient and health related information and another table stores all the staff details who are users of this application. Access to the application is restricted using login credentials.

TABLE 1. PATIENT DETAILS

No	Patient details	
	Field name	***Description***
1	OP number	Number that helps to uniquely identify a patient in hospital records
2	Name	Name of the patient
3	Husband name	Name of husband of the patient
4	Address	Address of the patient
5	PIN	PIN no of address to identify locality of the patient's residence
6	Phone number	Phone number to reach for the patient
7	Age	Age of the patient
8	DOB	Date of birth of the patient
9	DOR	Date of registration of the patient into the hospital records

Table 1 describes all the fields associated with storing all the patient details.

TABLE 2. PATIENT RECORDS

No	Patient Records	
	Field name	***Description***
1	OP number	Number that helps to uniquely identify a patient in hospital records
2	DOC	Date of check up
3	Ultrasound scan	Ultrasound scan video of the patient
4	ECG	ECG readings of the patient
5	Pressure	Blood pressure readings of the patient
6	Body Temperature	Body temperature of the patient
7	Heart rate	Readings of heart rate of the patient
8	Prescription	Prescription to be provided by the doctor based on readings
9	Problem list	Relevant health related problem lists of the patient
10	Extended encounters	Extended encounters the patient may suffer.
11	Fetus growth	Fetus growth is diagnosed and recorded

Table 2 shows stores patient health details. All the readings of the monthly checkup are furnished into the database using this table.

In our system, we have followed the **ASTM E1384-07** standard wherethe record carries health related information about the pregnant woman. Those are, diagnosed readings of ultrasound scan, pressure, heart rate, body temperature, ECG, Prescription, problem list, extended encounters, care plan, procedures , legal documents , schedules , fetus growth. All these fields help the doctor to diagnose and prepare report on patient's condition based on a standard electronic health record format. Tables 2 and 3 are designed in accordance of this EHR standard.

TABLE 3.PATIENT DOCUMENT

No	Patient Document	
	Field name	***Description***
1	OP number	Number that helps to uniquely identify a patient in hospital records
2	Care plan	Care plan associated with the patient
3	Procedures	Procedure followed in case of that particular patient
4	Legal documents	Legal documents if any that are relevant for proceedings
5	Schedules	Schedules that are assigned to that particular patient

Table 3 keeps record of patient's legal documents and care plan

TABLE 4. STAFF DETAILS

No	Staff details	
	Field name	***Description***
1	ID	Number that helps to uniquely identify a staff in hospital records
2	Password	Password to be used as login credential of the staff
3	Name	Name of staff
4	Designation	Designation of the staff
5	Department	Department to which the staff belongs

Table 4 keeps record of staff details.

VII. SYSTEM IMPLEMENTATION

In our system, mobile application is used as an assistance to health care worker. It efficiently implements algorithm and notifies critical condition. We have created an Android mobile application that works on Android 2.3 and higher versions. Following screen shots of working application in Android emulator are provided to help you understand the mobile application interface.

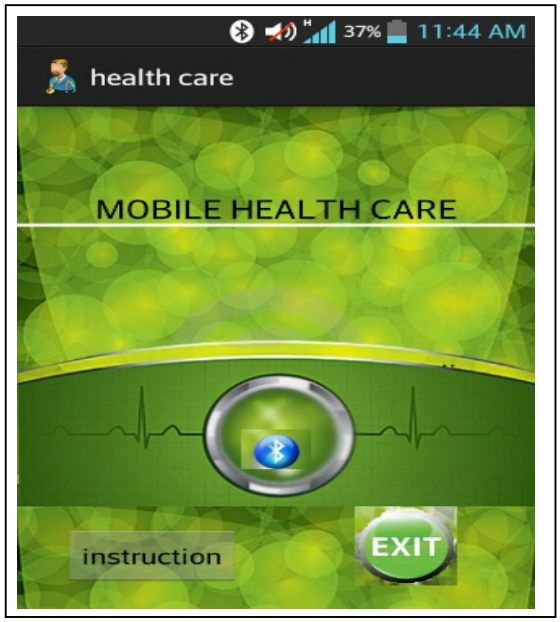

Figure 2

Figure 2 is the home screen of our application. Bluetooth button enables to switch on Bluetooth of the mobile and it starts searching for Bluetooth shield to connect. 'Instructions' button redirects user to a screen where user gets all the instructions to operate the mobile application. 'Exit' button helps you to exit from the application.

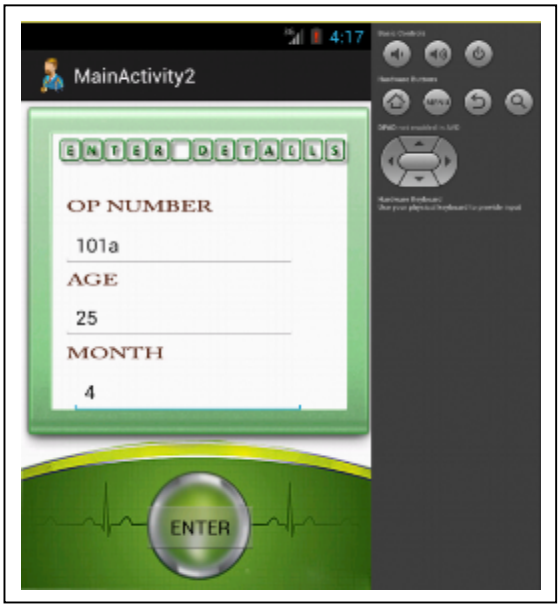

Figure 3

Figure 3 is the screen where user is prompted to enter all the patient related details like her OP number, age, month of gestation. Our algorithm which is already discussed under section IV.A notifies critical condition by considering both the age and month since normal range of vital parameters differ according to it. When the user presses "ENETR' button, all the read values are compared with the algorithm.

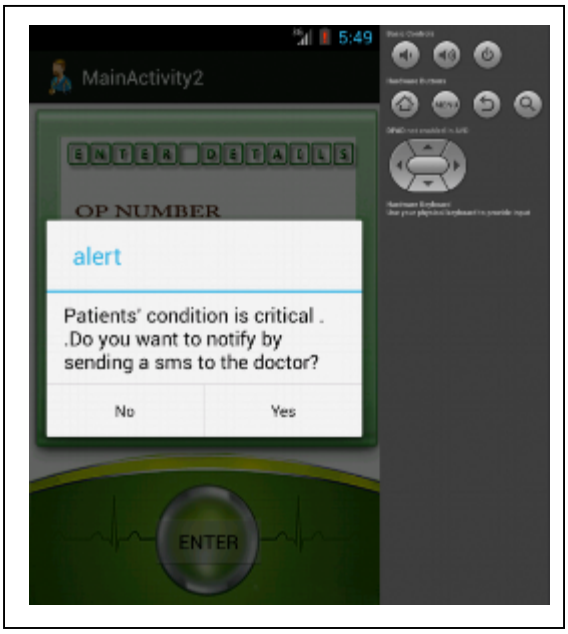

Figure 4

Figure 4 shows scenario where the patients' health condition is found to be critical according to the algorithm. An alert is generated so as to ask user whether to send an SMS to notify the critical condition. CHOOSING 'Yes' directs him to a screen where he can choose number from contacts and send SMS. If the user chooses 'No', all the measured values and report will be displayed to the user.

Figure 5

Figure 5 is the screen where user presses 'select number' to select the numberof doctor from contacts list and send SMS enables to send him along with the OP number of the patient and measured readings.

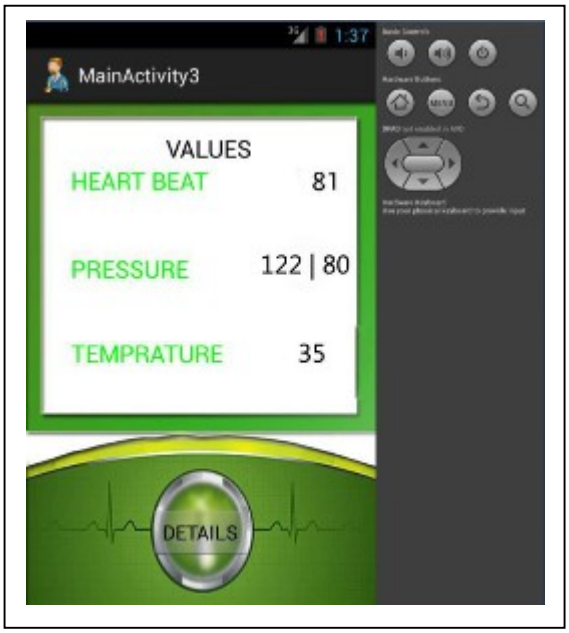

Figure 6

Figure 6 displays all the measured values, the heart rate, temperature and blood pressure. The algorithm has helped to implement a decision supporting system. When the user presses details, he/she gets detailed report on the patient's health condition.

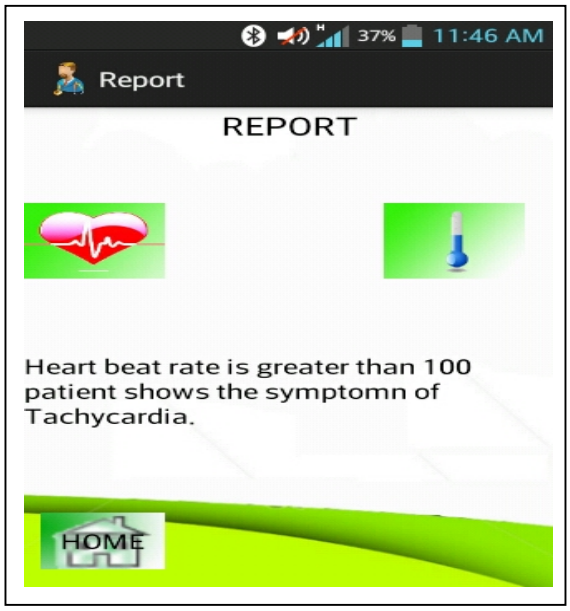

Figure 7

Figure 7 displays detailed report on patient's health condition upon pressing 'Details' of figure 5.

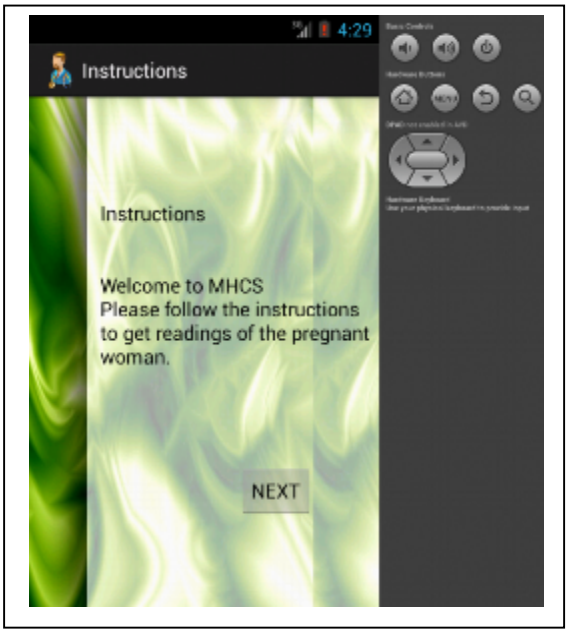

Figure 8

Figure 8 shows the first page of 'Instructions', the guide to use this application. It helps user to understand working of the application.

Server application is a simple application to handle client when, client uploads Patient diagnosed readings of ECG and Ultrasound Scan. For the first time in Server we need one time configuration to create database. Once configured, defaultAdmin user will be created in database for client application.Once configuration is done, start the server. Now we have configured server machine and server application.Thus all the users making use of client application can be satisfied.Once we start the client application, for the first time same as server application we need to configure the client application also. The following screen shots of client application helps to know more.

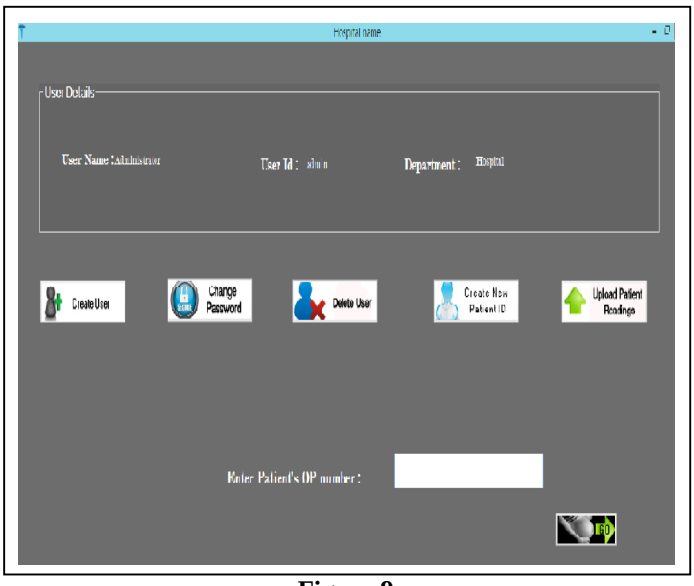

Figure 9

Figure 9 shows the admin login form. Admin can

- Create user
- Change password for existing user(only he can).
- Delete user.
- Create new patient id (new patients with details).
- Upload diagnose readings for existing patients.
- View patients diagnosed readings and reports using patient's op number.

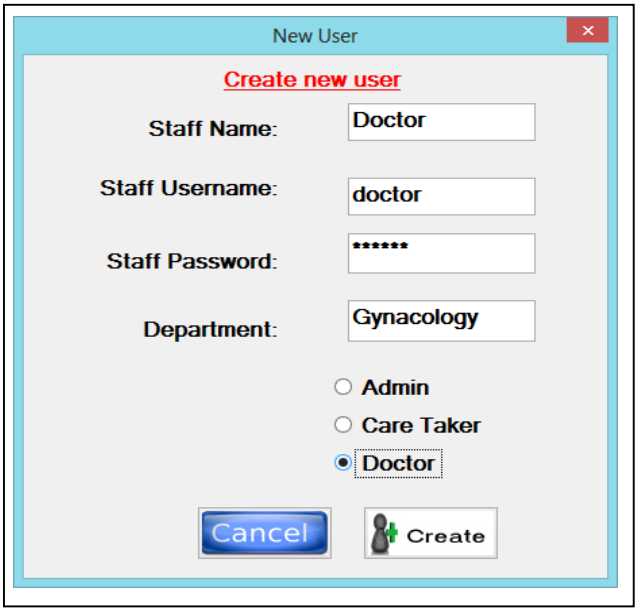

Figure 10

Figure 10 shows the admin creating the user 'doctor'.

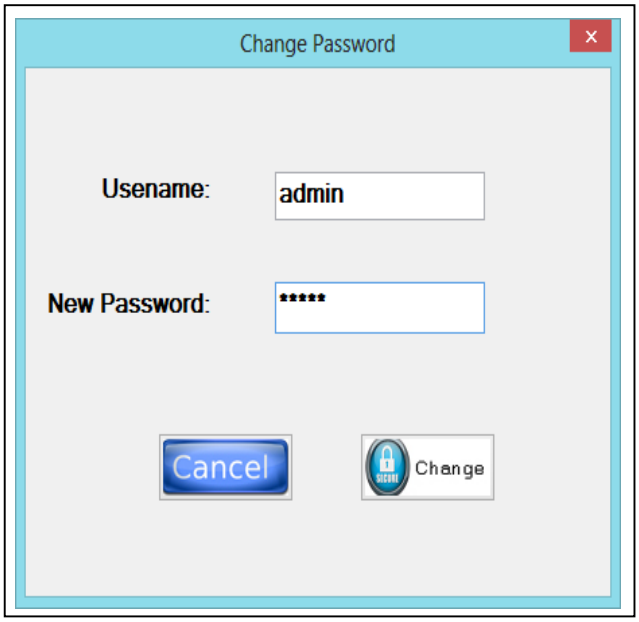

Figure 11

Figure 11 show that admin can change all users' password.

Figure 12

Figure 12 show that all the three users (Admin, Doctor, care taker) can create new patient's id.

When the caretaker logins into the application, he is provided with all the readings in appropriate formats.ie, both ECG readings and ultrasound scan readings will be converted into video format so that he can login and upload these details to the database.Caretaker need to enter the patient's op number to check whether patient exists and the latest readings are uploaded or not.

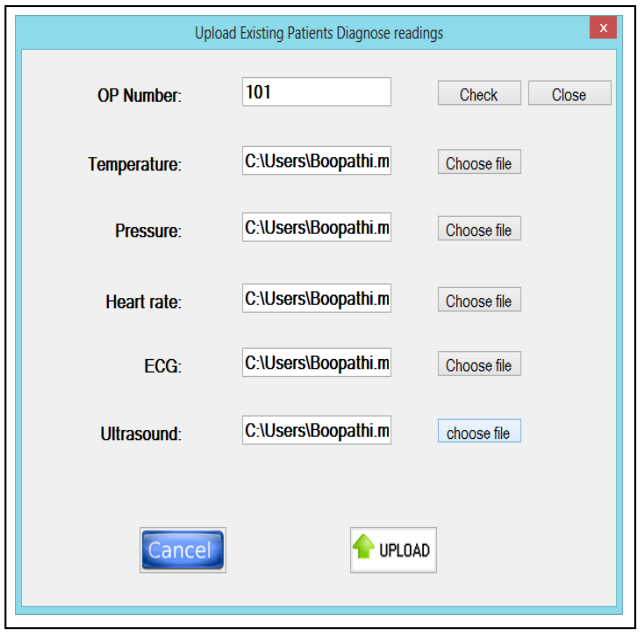

Figure 13

Figure 13 If patient exists the user can upload diagnosed readings. For each patient per day,one diagnosed reading can be uploaded. New reading of same patients can be uploaded next day only .

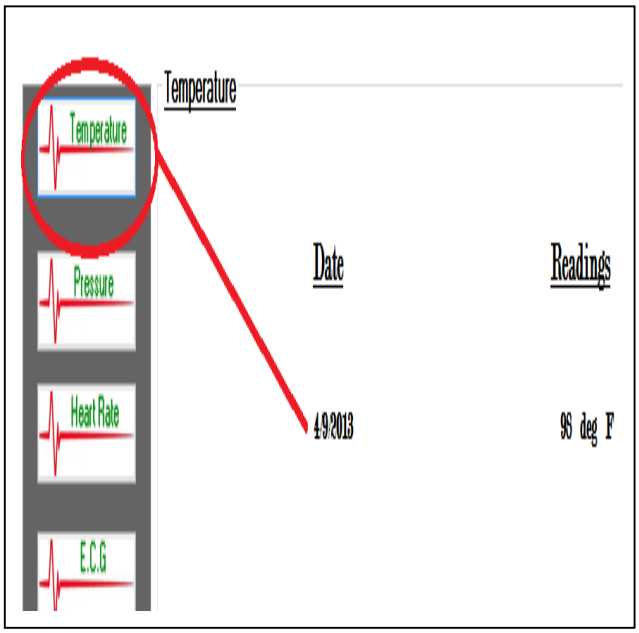

Figure 14

Figure 14 By clicking temperature option user can view patient's body temperature readings with diagnosed date. All the uploaded readings will be displayed. Here we upload only one reading. Normally, health care workers take the patients reading once a month by visiting their place .Temperature below 95F and above 101F displayed in red color. Similarly appropriate readings are shown for all the other options as displayed in the window, namely, the heart rate, pressure and ultrasound scan video. Screen shots of ECG readings and ultrasound scan is provided here for more understandability.

Figure 15

Figure 15 By clicking ultrasound option user can view the ultrasound scan video of the patient according to the date of recording of the readings. Care taker uploads the scan video which is converted into the video format from the readings of the scanner. A doctor can understand the growth, position and length of the fetus by observing the above video and can prescribe further medications based on it. Abnormalities can be soon found out and thus helps in better diagnosing.

Figure 16

Figure 16 By clicking ECG option user can view patient's ECG readings according to the date. By observing the spikes, the doctor can diagnose the ECG status and prescribe accordingly. Here also, the caretaker uploads this reading which is already converted into the video format.

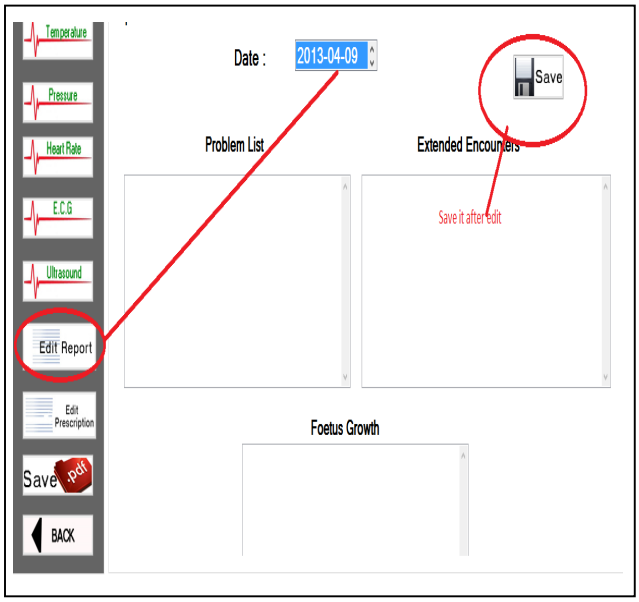

Figure 17

Figure 17 shows that, by clicking Report option user can view patient's Report and edit it by choosing the date and save it after edited it. Report generation format is also based on the ASTM EHR standard.

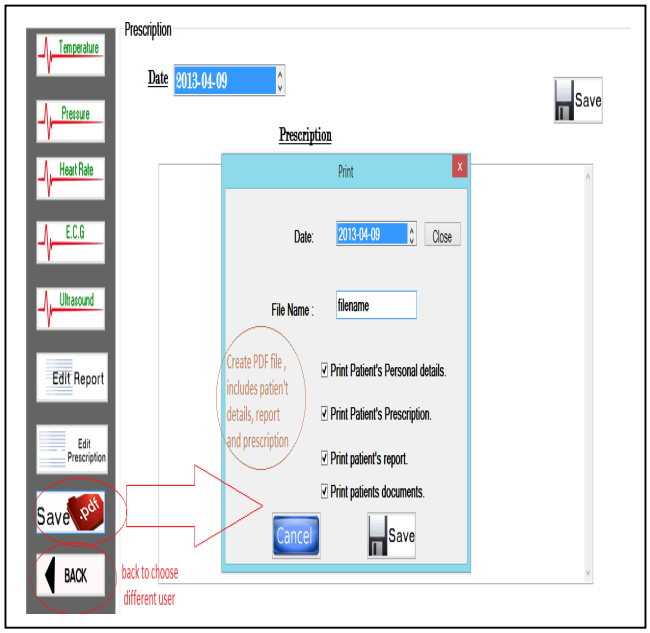

Figure 18

Figure 18 By clicking Prescription option user can view patient's prescription and edit it by choosing the date and save it after edited it .User can only edit the latest prescription, but can view all prescription. 'Save' option is to save report, prescription and patient's other details in pdf file according to the date. Back option is to choose another (different patient) patient.

VII. ASTM E1384-07—STANDARD GUIDE FOR CONTENT AND STRUCTURE OF THE ELECTRONIC HEALTH RECORD

Electronic health record is a repository of electronically maintained information about an individual's lifetime health status and health care, stored such that it can serve the multiple legitimate users of the record. It contains patient-centric, information about an individual health status and health care that focuses on tasks and events directly related to patient care which is optimized for use by clinicians. Also, it provides support for all activities and processes involved in the delivery of clinical care.

This practice covers all types of healthcare services, including those given in ambulatory care, hospitals, nursing homes, skilled nursing facilities, home healthcare, and specialty care environments. They apply both to short term contacts and long term contacts. The vocabulary aims to encompass the continuum of care through all delivery models. This practice defines the persistent data needed to support Electronic Health Record system functionality.

ASTM E1384 identifies the content and logical data structure and organization of an Electronic Health Record (EHR) consistent with currently acknowledged patient record

content. The record carries all health related information about a person over time. It may include history and physical, laboratory tests, diagnostic reports, orders and treatments documentation, patient identifying information, legal permissions, and so on.

In our system, we have followed the **ASTM E1384** standard wherethe record carries health related information about the pregnant woman like ultrasound scan report, ECG, temperature, pressure, heartbeat rate. The records include prescription, problem lists, extended encounters, care plan, patient history, procedures, legal documents and schedules. This record can be generated by the doctor according to the readings of the patients that are already measured by the health care taker.

CONCLUSION

Most studies of maternal mortality are hospital based. However, in developing and under developed countries, where many such deaths take place in the home, hospital statistics do not reflect the true extent of maternal mortality. Furthermore, the socioeconomic and demographic factors and health behavior affecting maternal mortality are rarely known. The complications of pregnancies and the births are found to be the leading causes of deaths and disability among women of reproductive age. Poor infrastructure and ineffective public health services are also responsible for low inadequate obstetric care.

Our system tries to provide quality and timely health assistance for pregnant women of both under developed and developing nations. Ultrasound scan for detailed study of patients and alert mechanism are highlights of our system. It helps to get details about health condition of pregnant women in rural areas thus providing portable mobile health care system that helps in proper diagnosis at early stages of pregnancy thereby it helps in reducing fetal and maternity mortality rate.

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