

Health Monitoring IoT + Android Application for Pregnant Women

Aayushi Vinai Tiwari¹, Garima Singh², Utkarsha Shrikant Talele³, Ranjita Chalke⁴

¹Information Technology, Pillai College of Engineering, New Panvel, Navi Mumbai, Maharashtra, India – 410 206

²Information Technology, Pillai College of Engineering, New Panvel, Navi Mumbai, Maharashtra, India – 410 206

³Information Technology, Pillai College of Engineering, New Panvel, Navi Mumbai, Maharashtra, India – 410 206

⁴Assistant Professor, Computer Engineering, Pillai College of Engineering Panvel, Navi Mumbai, Maharashtra, India – 410 20

Abstract: In many developing countries, the rate of fetal and maternal death is very high. There are several complications during pregnancy which requires many checkups and a restricted lifestyle. Repeated check ups also bring about high medical fees. To combat this, our project will monitor the pregnant woman and continuously log data of vital parameters such as body temperature, pulse. A mobile application will display these vitals. The app will also include a diet specific for pregnant women, their checkup schedule, medicinal information and nearby hospitals. There will be a specific section, especially for rural women, where they are given accurate information about their pregnancy and the things involved in it. For additional features, a section called child names is added for female, male, and unisex children. The parents can choose a name for their child if they are interested as the meaning of name is also provided. A chatbot is added too, which will be useful if the user wants to set up an appointment or just wants to chat.

Key words: Maternal Health, Pulse, Body temperature, Firebase, Android studio, Java.

INTRODUCTION

A. Fundamentals

Pregnancy is an important phase for a woman's health as well her child. All the precautions and steps taken in order to ensure better health and seamless delivery of the baby after 9 months is crucial. During such advancements in technology and increased use of devices for daily chores, we have introduced an android mobile application which could accompany the ladies during their pregnancy phase thoroughly. This application majorly would take primary vitals of the user, especially heart rate and body temperature. These values will be transferred via arduino to firebase and then shown in mobile application in real-time. Internet connectivity is the important factor for this application to run successfully.

B. Objective

The objective of this work is as follows:

Since multiple visits to the hospitals and maternity care homes is not accessible to many rural women, this will be able to reduce the amount of visits so that only compulsory check ups are given priority.

These in-home treatments are inexpensive and accessible. Since these are done at home and don't require frequent trips to the hospital, it reduces travel cost and time especially in rural areas where there are limited doctors and can also be miles away.

C. Scope

Project goals are to develop a maternal health monitoring system. Deliverables include sensors, a platform to connect these sensors and also include software requirements.

LITERATURE SURVEY

1. Baby Kicks for Prediction of Fetal health

Creator S.Shiny Amala, Dr.S.Mythili expressed the method for fetal status utilizing an accelerometer rather than ultrasound examination as this is costly. Accelerometers are mechanical marvel locators that can gauge speed increase in one, a few symmetrical tomahawks. The development of the hatchling is basically because of the vascular condition of the placental deficiency in the uterus. These developments are known as "kicking". From the fourth month onwards the infant will begin kicking however it won't be seen by the mother. By estimating the fetal development, the clinicians will actually want to foresee the condition and advancement of the fetal. The ADXL335 is a little, slim and low force sensor, it has 3-pivot with

signal adapted voltage yields.

2. Alarm buzzer for abnormal values

This paper presents a medical care arrangement that joins web application and CC3200 strategies in a remote sensor organization to screen the ailment of patients and give a wide scope of compelling, thorough, and helpful medical services administrations. In the transmitting part, the information is sent to the doctor via an IP address. If the values are abnormal i.e., varying over a small range than the preset value, this information will be received by the doctor along with an alarm sound. Hence the doctor will send back a prescription to the patient's IP address. If the values exceed a critical range then the doctor will call the ambulance and this information will be sent to the relative of the patient along with an alarm.

3. Smart Maternal Healthcare Monitoring System using Wireless Sensors Network Research

This paper presents a reproduction and continuous execution of heterogeneous organizations. It coordinates various sensors for checking the pregnant ladies from provincial regions during basic conditions. It dodges early newborn child demise or incapacitated baby conveyance due to ailing health by giving a sustenance outline in a standard time span. Remote cardiocography gadget is utilized for checking the hatchling heartbeat. The execution depends on the system of an ongoing telemedicine. The plan arrangement comprises 10 mobile nodes at patient's end and 4 wired hubs at specialist's end. Correlation of the presentation on recreated consequences of energy productive connection steadiness has been dissected with the steering convention (EELSRP (SIM)). In view of start to finish delay, throughput, bundle conveyance proportion and energy utilization, the exhibitions of EELSRP (SIM) and constant convention EELSRP (RT) were looked at.

4. C4.5 Decision Tree Classification for Prediction Based Health Monitoring

They referenced Prediction Based Health Monitoring in Pregnant Women Gestation or pregnancy a phase where ladies go through a few physiological changes, now and again inciting inconveniences turning extreme and starting occasions prompting passing of both mother and baby. Pregnant ladies should hence be shielded from inconveniences emerging during the development period. A few grouping calculations are effectively carried out in a few fields. Choice Tree Classification Method is one proficient technique best appropriate for clinical determination.

A popular algorithm C4.5 Decision Tree classification algorithm is appropriate for classifying the pregnancy data. The algorithm constructs a learning model from the training data and later risks in pregnancy are predicted for unseen pregnancy data. The main aim of this paper is to optimize performance of C4.5 classification algorithm by applying a standardized and appropriate format of data. The paper highlights the effective performance achieved by C4.5 classifier in accurately predicting risk levels during pregnancy from the collected, standardized and transformed data efficiently.

5. Android ECG Application Development: Behati Woubshet

This paper portrays the plan and execution part of ECG application. The essential explanation or objective of this paper was to use the power of android stage and produce a model of ECG application. It plays out its works with VS100, Bluetooth ECG observing gadget. This paper likewise depicts the design, advancement climate and devices that are utilized in android versatile application improvement. The apparatuses utilized in the improvement interaction or stage are Eclipse, Android SDK, ADT module for Eclipse. This gadget screens Heart Rate through Bluetooth correspondence. The consequence of this paper was speaking with fundamental sense gadget through Bluetooth correspondence. The fault of this framework is that it screens just ECG and not different boundaries like temperature.

Cell Phone Sensors in Health Applications: Evgeny Stankevich, ILYA Paramonov, Ivan Timofeev et al, [9] This paper reveals to us that versatile wellbeing utilizes implanted sensors and their applications 1. Mouthpiece Sensors-Use to get to patients feels for example myotonic disorder 2. Camera Sensors-Provides data about pictures and recordings. 3. Acidometer

Sensors-Purpose of this framework is to follow the individual's actual work. The motivation behind this paper is to utilize applications installed in cell phone sensors. The disadvantage of this framework is that different sensors are utilized which cost a ton.

SYSTEM METHODOLOGY

A. Methodology

In this methodology the temperature sensor, heart rate sensor are controlled by using an NodeMCU controller. The data from the sensors are being analyzed by this controller and the results are being simulated. IoT refers to the inter-networking of physical devices. IoT will transfer data over a network without requiring human-to-human or human-to-

computer interaction. IoT used in this technology will be able to transfer the data for long-distance..

B. System Architecture

The proposed system architecture is given in Figure.

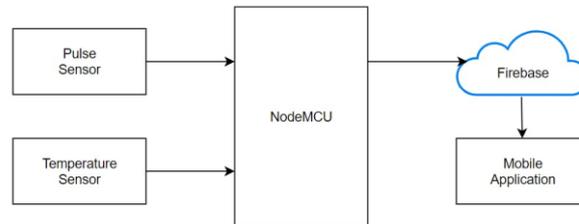


Fig. 1 System architecture for IoT based application for Pregnancy healthcare

Heart rate:

The pulse sensor/heart beat sensor (SEN-11574) cuts onto a fingertip or ear cartilage and plugs directly into Arduino with some jumper links. The pulse sensor comprises three wires which are as per the following: Red wire = +3V to +5V; Black wire = GND ;Purple wire = Signal. Here red wire is utilized as a supply for the sensor, black is given to the ground and therefore the purple wire is utilized to transmit signals from the sensor to the Arduino board. By using the heart rate sensors in our project, the information from the sensor is accumulated and put away within the information base for the various future registration for the patient. This sensor helps in observing the beat pace of pregnant ladies.

Maximum heartbeat of pregnant women	>100 bpm
Minimum heartbeat of pregnant women	<80 bpm

Fig. 2 Heartbeat range of pregnant women

Body Temperature :

The temperature sensor is chiefly used to measure the body temperature of the maternal. It can gauge temperature more precisely than utilizing a thermistor. It is normal for a woman's internal heat level to vary during pregnancy. During pregnancy the lady's body creates extra warmth because of Increased digestion, Elevated degrees of hormones, for example, progesterone, Increased remaining task at hand on the lady's body a consequence of additional load because the pregnancy advances as the preparing and fetal supplements and waste items. The LM35 estimates a temperature scope of -55 to 150 degrees Celsius. The temperature sensor is utilized to quantify the measure of heat energy in our body and it is changed over into a static form. A pregnant woman's core body temperature will often rise to about 37.8°C when it is normally 37°C.

Monitoring vital signs:

Vital parameters that are stated above will be calculated continuously or need-based, depending on the parameter. The data will be uploaded to cloud database (Firebase). Firebase is used for this because it can visualise the data for better understanding and send data to mobile applications to visualise it for users. The graphical data is represented through a mobile app, created through Android Studio, Java.

Mobile Application

Mobile application using Java Language with features such as Reminders for medicines (push notifications) , Live chat feature designed especially for pregnant women to be their personal assistant by helping them through their journey, Display vitals as visuals in the mobile application after being recorded by the input sensors, Emergency feature, on shaking the phone, an emergency contact will be called. Baby name suggester for male, female and unisex gender names, FAQ section, List of Vaccines that are ideal for both mother and baby.

REQUIREMENT ANALYSIS

The implementation details are given in this section.

A. Software

Programming	Arduino IDE
GUI creator	Android Studio
Database	Firebase

Fig. 4 Software Specification

B. Hardware

NodeMCU	converted upto 16 analog pins, inbuilt wifi module ESP8266
SEN11574	Heart Rate
LM35	Temperature

Fig. 5 Hardware Specification

C. Dataset and Parameters

The sample dataset used in the experiment are identified and given in Fig. 6

Test	Temperature	Pulse Rate
A	37.2°C	90
B	37.4°C	92
C	37.8°C	88

Fig. 6 Dataset Specification

VI. RESULTS

The study of different health parameters regarding pregnancy is presented. The different techniques such as how the vitals data will be sensed and collected. The way it will be displayed and handled. The relative investigation of different papers referenced above is introduced in this report. A cumulative approach of the ideas and techniques given in the papers has been used to form this hybrid approach. The performance measures like vital parameters, normal and abnormal states, are described in this report, pertaining especially towards pregnant women. The distinctive standard datasets or variable sources of info are characterized that might be utilized in this undertaking for this space framework. The uses of this area are distinguished and introduced. The data collected from the sensors showing parameters and records of pregnant lady's health are stored on a real time database.

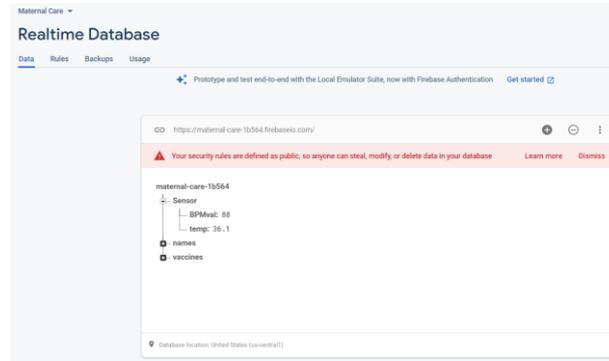


Fig. 7 Realtime database Data

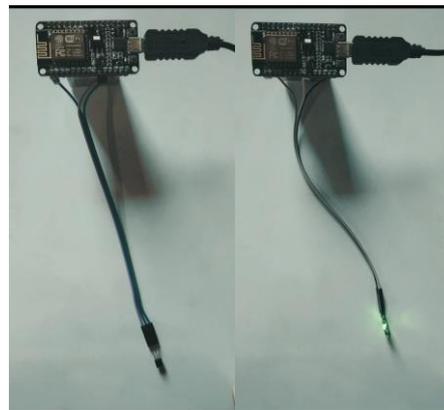


Fig. 8 LM35 and SEN11574 sensors with nodeMCU



Fig. 9 Readings on Android App

CONCLUSION

In this paper, studies of different health parameters for pregnancy are presented. A hardware prototype is integrated with an android application to make a free to use pregnancy equipment is created. The implementation is done as per maximum referred research papers. Pulse is sensed through a pulse sensor SEN11574 and transferred to real time database Firebase via NodeMCU. Body temperature is sensed through a sensor LM35. Data is stored in a NoSQL database so that data uploaded is semi-structured format. Data uploaded on Firebase in realtime will be shown in the application of user interface. The application was created via android studio using Java Programming language. The app will also include a diet specific for pregnant women, their checkup schedule, medicinal information and nearby hospitals. There is a specific section for weekly information for food intake and exercise, especially for rural women, so that they are given accurate information about their pregnancy and the things involved in it. For additional features, a section called child names is

added for female, male, and unisex children. The parents can choose a name for their child if they are interested as the meaning of name is also provided. An FAQ section is filled with numerous commonly asked questions regarding pregnancy. A live chat feature is added too, which will be useful if the user wants to set up an appointment, get any query asked from a professional or just wants to chat. Reminders section for medicine intake or time for exercise.

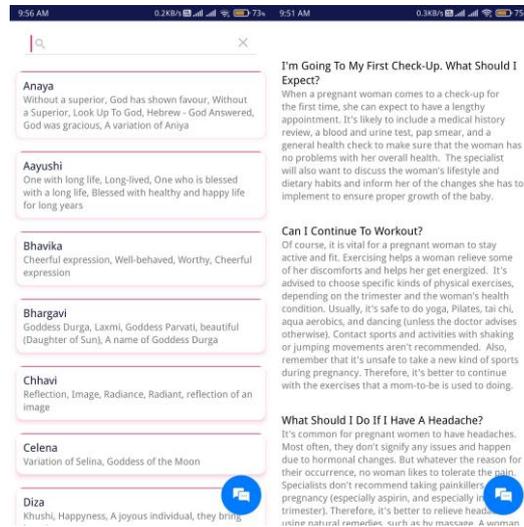


Fig. 10 Baby names Fig 11. FAQ

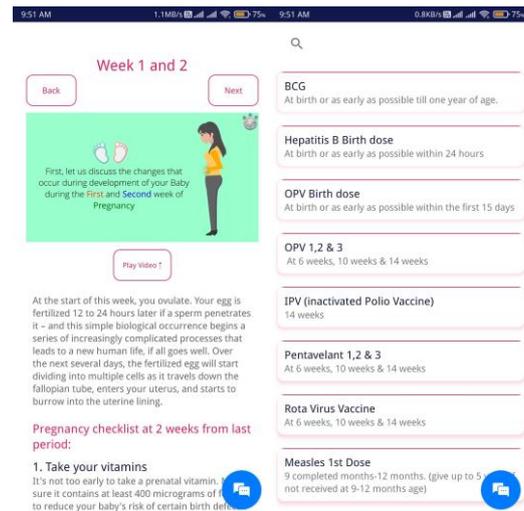


Fig 12. Weekly updates Fig 13. Medicines

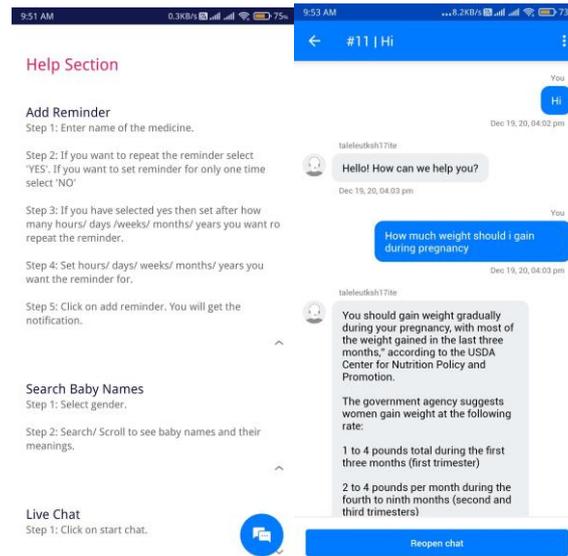


Fig. 14 Help section Fig. 15 Live chat feature

REFERENCES

[1] S.Shiny Amala, Dr.S.Mythili, "IoT Based HealthCare Monitoring System for Rural Pregnant Women", International Journal of Pure and Applied Mathematics, Volume 119, Issue 15, ISSN: 1314-3395, 2018

[2] V.Santhi, K.Ramya, APJ.Tarana, G.Vinitha, "IOT Based Wearable Health Monitoring System for Pregnant Ladies Using CC3200", International Journal of Advanced Research Methodology in Engineering & Technology, Volume 1, Issue 3, ISSN: 2456 6446, 2017

[3] A.C.Sumathi, P.Shayestha, M.Umira, S.Vinothini, "Health Monitoring System for Pregnant Women", International Journal of P2P Network Trends and Technology, Volume 7, Issue 4, ISSN: 2249-2615, 2017

[4] Santhi S, Gandhi AP, Geetha M, Nirmala K, et al. "Smart Maternal Healthcare Monitoring System using Wireless Sensors Network", BioTechnology: An Indian Journal, Volume 12, Issue 12, 2016

[5]<https://how2electronics.com/iot-based-patient-health-monitoring-esp32-web-server/>

[6]<https://forum.arduino.cc/index.php?topic=365940.0>

[7]<http://googlerobotic.com/androidfetching-data-thingspeak-arduino/>

[8]<https://www.electronicshub.org/arduino-rf-transmitter-receiver-module>

[9]<https://blogs.mathworks.com/iot/2017/12/20/learn-how-to-build-a-custom-android-app-for-a-thingspeak-iot-project/>