

PREGNANCY HEALTH CARE MONITORING SYSTEM

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Abstract —

The paucity of proper awareness on maternal health in rural area as well as in metro cities was fallouts in an alarming number of maternity and infant deaths. In developing nations like India where there are more rural areas as well as in metro cities, Most of the pregnant ladies were being alone in home and that is not safe for them since they get pregnancy pain at any time. Preventive measures by constant health care monitoring of the pregnant women and alert about the pregnancy pain to the nearby hospital which they preferred is the main objective of the project. The health monitoring device suggested in this project constantly measures the body pressure with the help of the pressure measurement kit and measures the Heart Beat of a Pregnant Women by using the Heart beat Sensor and whenever there are fluctuations from the normal value it sends the information to her gynecologist via the mobile. Also in this proposed system IoT (Internet of things) has been implemented, where IoT is a key and its related technology plays a dynamic role in pregnant women care taking inside hospital and outside. IoT ensure the effective and efficient care of pregnant women in any environment. The usage of these advanced technologies in pregnant women care environment, absolutely eradicates the pregnancy complications and harmful incidents.

Index Terms—Pregnant Women, Heart beat Sensor, Pressure Measurement, IoT.

I. INTRODUCTION

It is the responsibility of a nation to provide food, education and medical care to its citizens. 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 as well as in metro cities were not aware of the technological advancements to alleviate complications during pregnancy period. 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. Particularly, pregnant ladies who are alone in home facing major challenges during pregnancy. For instance, pregnant women should perform Ultra sound scans at least 2 times during pregnancy period to know more about fetal growth. 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. 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 and they need the proper

detection and monitoring system throughout pregnancy period.

Nowadays, technology plays a major role in healthcare not only for sensory devices but also in recording and display device and also in communication. In recent years, the growth of internet is tremendous and has been further extended to connecting things through internet. The Internet of Things (IoT) provides an intelligent network for analyzing, planning and decision making. It is generally considered as connecting objects to the Internet and using that connection for control and remote monitoring of those objects. The IoT helps in creating a brilliant invisible network which can be controlled and programmed through internet. Products developed based on IoT including embedded technology which allows them to exchange information among each other or the Internet and it is assumed that around 8 to 50 billion devices would be connected by the end of 2020. Since these devices come online, they provide better life style, create safer, more engaged communities and revolutionized healthcare. This entire concept of IoT stands on wireless network, sensors and gateway, which enables user to communicate and access the application/information consequently add to an IoT framework which gives secure health awareness checking. Data generated by the IoT devices are used for analysis and decision making process. The applications

of IoT can be grouped into domain like Transport and logistics, Health care, Smart Environment, Etc. The roles of IoT in all these domains are remarkably high.

In Transport and logistics vehicle identification, vehicle to vehicle communication, traffic communication etc. are the major advancements in the field of IoT. In the proposed system, some vital parameters like heartbeat rate, ECG value and the pressure were been measured using sensors and therefore each parameter is sensed by separate sensor devices which used to collect the blood pressure, ECG and heart rate of the pregnant women. In this system the Microcontroller collects the data from sensors and the recorded readings will be monitor by the doctor or care taker through IoT. So The Protected data sent which can be accessed anytime by the doctors by typing the corresponding unique URL address in any of the Internet Browser at the end user device.

The working principle of this system based on the sensors which used to record the readings of measurement and it checks the recorded reading of the pregnant women in normal and abnormal conditions. In any abnormal conditions, it will send the alert via message with the recorded readings to the preferred doctor, so the doctor will immediately monitor the pregnant women's abnormal condition with the measurement through IoT. Thus the critical stage of the pregnancy period will be overcome with the help of this proposed system and this highly reliable system will get under affordable prices so no care taker will be needed to be watch the pregnant women all the time and the patient detail such as heart beat rate, ECG value and the pressure measurement will be monitored continuously with the help of this system

II. LITERATURE SURVEY

Many various health monitoring system for pregnant women have been proposed, from patient's mobile doctor can access this information and monitoring using web application. If emergency condition is there then emergency team or ambulance can track and monitor current location of patient for emergency help, all system will acts as collaborative center for hosting all the data from given actors with the help of this database. The purpose of this system is that doctor can access information and monitoring using web application [1]. The drawback of this paper is that, only the particular doctor can use the particular application to monitor the patient status and this would not send the alert about the pain to

doctor since this system does not have some sensors which used to sense the pain of the pregnant women.

Many health care systems provide the health report of the pregnant woman is created and stored in the memory card [2]. The main objective of this paper is to examine relationships of normal blood pressure (BP), hypertension and degree of BP control with cardiovascular disease (CVD) risk factors and predicted 10-year risks for coronary heart disease (CHD) and stroke during pregnancy. The purpose of this system is that BP level was associated with other CVD risk factors among both normotensives and hypertensives. Women with inadequately controlled BP had the worst risk profile, followed by untreated hypertensives, those with adequately controlled BP and normotensives by use of this system during pregnancy. The drawback is that, this system requires the service of an experienced health care worker to store these values into a memory card for further reference by the doctor and there is no alert about the pregnancy pain will send it to the Doctor under any critical conditions.

The constant and reliable assistive technology is essential while taking care of home-bound patients. The case is even worse when they are bedridden. Several health problems along with their various disabilities will make the situation much more horrid. This is where they need extra care and attention from their care providers [3]. The purpose of this system is that, Under any emergency condition like a fall or abnormal heart rate will be informed to the caretaker by sending an alert to the caretaker's Smartphone as SMS, MMS or a voice call so that the caretaker can attend to the patient immediately and the drawback is that, Only the care taker can get the message and No data will be provided regarding the patient. Some approaches like a role-based intelligent mobile care system with alert mechanism in chronic care environment is proposed and implemented. The roles in our system include patients, physicians, nurses, and healthcare providers. Each of the roles represents a person that uses a mobile device such as a mobile phone to communicate with the server setup in the care centre such that he or she can go around without restrictions [4]. For commercial mobile phones with Bluetooth communication capability attached to chronic patients, we have developed physiological signal recognition algorithms that were implemented and built-in in the mobile phone without affecting its original communication functions. This paper also includes the alert management

mechanism has been included in back-end healthcare centre to initiate various strategies for automatic emergency alerts after receiving emergency messages or after automatically recognizing emergency messages. The main drawback of this system is that the Operating range would be minimum and less accuracy.

The relationship of blood pressure with birth weight has been proposed in [5] and the main objective of this paper is that to conduct a systematic review in order to summarize the relationship between birth weight and blood pressure, following numerous publications in the last 3 years, and assess whether other measures of size at birth are related to blood pressure, and study the role of postnatal catch-up growth in predicting blood pressure. The result of this paper was the skeletal growth is determined by the blood pressure and the drawback is that, Due to the variation in blood pressure the accurate growth cannot be determined.

Many of the GSM approaches provides the report of the patient and sent to her Gynaecologist as well to her guardians, if report shows any abnormality then immediately guardian will request for the ambulance by giving her exact location taken through GPS to the ambulance and request them to admit her in the nearest hospital [6]. Suppose if there will be minor change in report then doctor will send advice through IoT to the patient. So this device effectively helps the pregnant women to avoid miscarriage and take healthy diet as suggested by doctor so that she can give a birth to healthy baby. This is similar to the proposed system but the main drawback of this system is that, there is a possibility to miss the reports which has sent to doctor and guardian, since there is no alert mechanism has been used in this system.

Using IoT, the system collects information like temperature, blood pressure and pulse rate of the patient and updates the same to the doctor [7]. The doctor can monitor the progress of patients' health and then to advise them about their health and the data collected from the IoT devices to the system is huge and the information only for last three days can be viewed in mobile application. All parameters for the last three days can be viewed through the mobile application anywhere any time and the drawback is that no alert mechanism has been used in this system to alert the nearby hospital with the recorded readings of the patient. From [8], the availability of data at hitherto unimagined scales and temporal longitudes coupled with a new generation of

intelligent processing algorithms can facilitate an evolution in the practice of medicine, from the current post facto diagnose-and-treat reactive paradigm, to a proactive framework for prognosis of diseases at an

Incipient stage, coupled with prevention, cure, and overall management of health instead of disease and it helps to enable the personalization of treatment and management options targeted particularly to the specific circumstances and needs of the individual, also it helps to reduce the cost of health care while simultaneously improving outcomes. The drawback of this approach is that, it just highlighted the challenges for the IoT and there is no report kind of the health monitoring has discussed in this system. Similar to the proposed system, the data can be accessed anytime by the doctor. The controller is also connected with buzzer to alert the caretaker about variation in sensor output [9]. The security issue is been addressed by transmitting the data through the password protected Wi-Fi module which will be encrypted and the users/doctor can access the data by logging to the html webpage. At the time of extremity situation alert message is sent to the doctor through GSM module connected to the controller. Hence quick provisional medication can be easily done by this system. This system is efficient with low power consumption capability, easy setup, high performance and time to time response. In [10], the implementation of a monitoring system which monitors the heart pulse of a patient. This work presents a novel easy-to-use system intended for the fast and non invasive monitoring of the Lead I electrocardiogram (ECG) signal by using a wireless steering wheel. A novel heart rate detection algorithm based on the continuous wavelet transform has been implemented, which is specially designed to be robust against the most common sources of noise and interference present when acquiring the ECG in the hands. The voltages recorded will be sent to an instrumentation amplifier which amplifies the signal, and then to a filter which filters the noise. This paper only helps to monitor the heart beat rate and ECG value at any time and the drawback is that, there is no alert sensors has been used to alert the pain to the doctors \ through message.

III. PROPOSED WORK

A. BLOCK DIAGRAM:

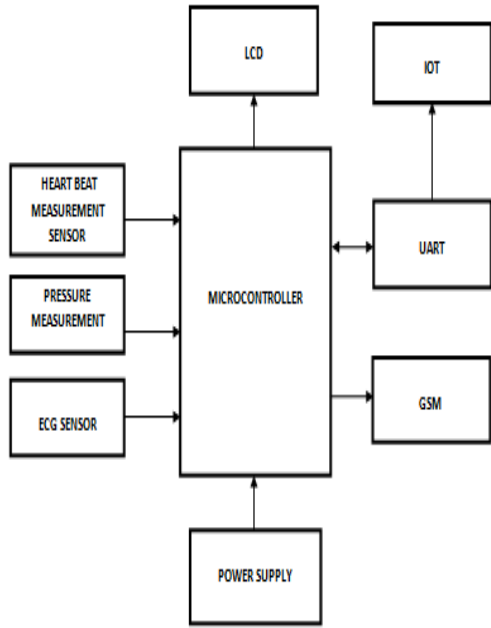


Fig 1: Block diagram of Health care monitoring system



Fig 2: IoT (Internet of Things) in Receiver unit.

In the proposed system, we are going to implement the detection and control system which can be implemented in the hospitals. If the pregnant ladies get pain means the pressure level will be high or low and immediately the IoT can get the message which is motoring continue by the doctor. In this project additionally the heart beat can be measured by using heart beat sensor and then if any change in the heart beat or pressure level, then it will immediately alert the nearby hospitals or close relation

IV. PROCEDURAL FLOW:

This module contains the series of workflow which determines the various conditions of the pregnant women. The proposed system of the health care monitoring system helps to record the readings of the ECG value, Heart beat and Pressure measurement of the pregnant women. It records the reading frequently, to check whether the measurements were normal.

If it is normal (Normal=Yes), it continues with the flow to check again. Under any abnormal conditions

(Normal=No), It will send an alert to the nearby hospital or care taker with the recorded readings via message over GSM.

Once the alert received to nearby hospitals which they preferred, the doctor will monitor the Heart beat, ECG and pressure measurement of the pregnant women and baby through IoT. Once the Doctor found out the recorded readings were abnormal, then immediately the hospital or care taker will reach out the pregnant Women to save both the baby and pregnant women under any critical conditions.

Below is a summarized flowchart figure 3.of the module.

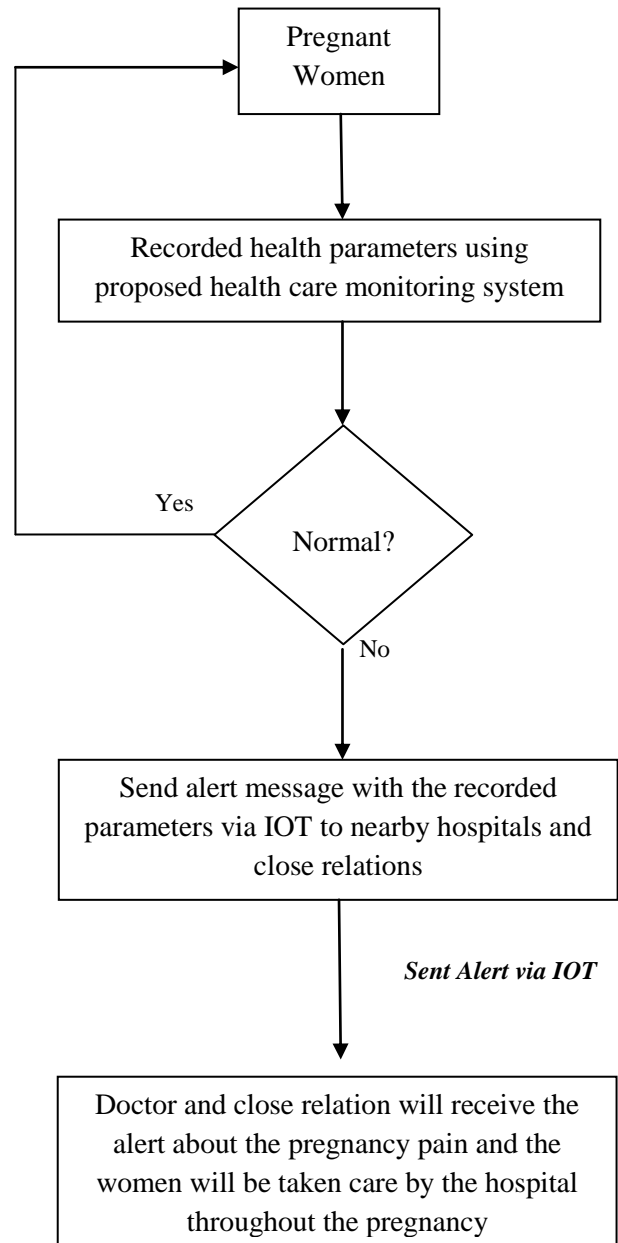


Fig.3. flow chart of the work module

A. HEART BEAT SENSOR:

Heartbeat sensor provides a simple way to study the function of the heart which can be measured based on the principle of psycho-physiological signal used as a stimulus for the virtual- reality system. The amount of the blood in the finger changes with respect to time.

The sensor shines a light lobe (a small very bright LED) through the ear and measures the light that gets transmitted to the Light Dependent Resistor. The amplified signal gets inverted and filtered, in the Circuit.

Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heart beat changes.

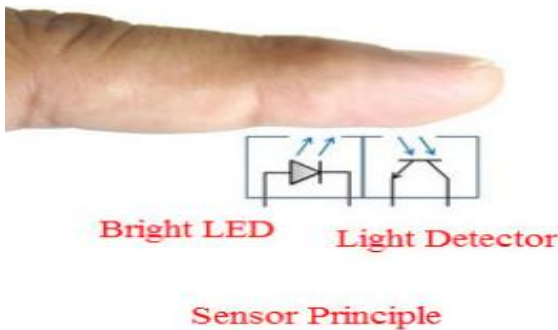


Fig 4:Sensor Principle

B WORKING OF A HEART BEAT SENSOR:

The heart beat sensor circuit diagram comprises a light detector and a bright red LED. The LED needs to be of super bright intensity because maximum light passes and spreads if a finger placed on the LED is detected by the detector.

This below figure 5 shows the working principle of the Heart beat sensor.

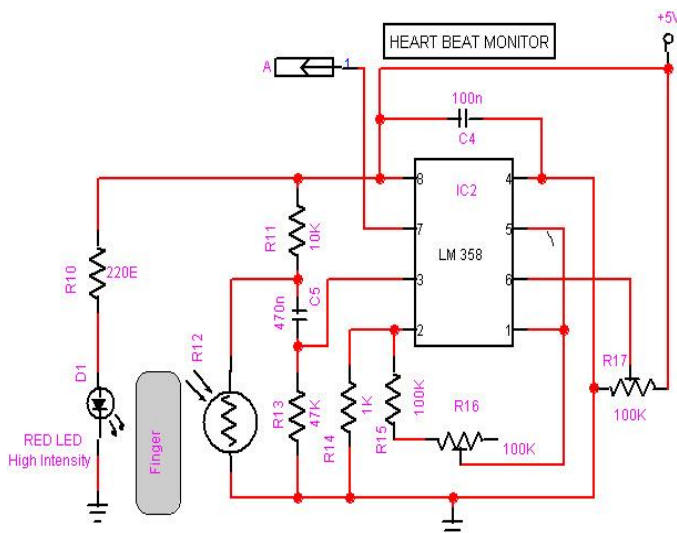


Fig 5:Working Principle of Hear Beat Sensor

Now, when the heart pumps blood through the blood vessels, the finger becomes slightly more opaque; due to this, less amount of light reaches from the LED to the detector. With every heart pulse generated, the detector signal gets varied. The varied detector signal is converted into an electrical pulse. This electrical signal gets amplified and triggered through an amplifier which gives an output of +5V logic level signal. The output signal is also directed by a LED display which blinks on each heartbeat rate.

The Features of the Heartbeat sensor are: Indicates heartbeat by a LED, Provides a direct output digital signal for connecting to a microcontroller, Possesses compact Size and works with a working Voltage of +5V DC and the primary applications are Works as a Digital Heart Rate monitor, a Patient Health Monitoring System and Used as a Bio-Feedback control of robotic applications

C. ELECTROCARDIOGRAM (ECG) SENSOR:

The AD8232 is an integrated signal conditioning block for ECG and other bio-potential measurement applications. It is designed to extract, amplify, and filter small bio-potential signals in the presence of noisy conditions, such as those created by motion or remote electrode placement.

The AD8232 Heart Rate Monitor breaks out nine connections from the IC that you can solder pins, wires, or other connectors to. SDN, LO+, LO-, OUTPUT, 3.3V, GND provide essential pins for operating this monitor with an Arduino or other development board. Also provided on this board are RA (Right Arm), LA (Left Arm), and RL (Right Leg) pins to attach and use your own custom sensors. Additionally, there is an LED indicator light that will pulsate to the rhythm of a heart beat. Biomedical Sensor Pads and Sensor Cable are required to use the heart monitor and can be found in the Recommended Products section below.



Fig.6. Heart Rate Monitor

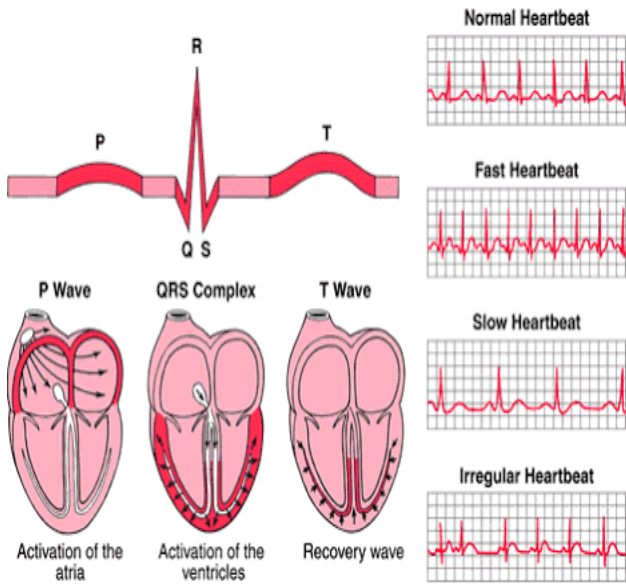


Fig.7.ECG output sample

D. Internet of Things (IoT):

The Internet of things is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

V. SYSTEM DESIGN AND IMPLEMENTATION:

The working principle of the smart health monitoring device for pregnant ladies is visually explained in the schematic block diagram and in the procedural flow. It consists of heart beat sensor, blood pressure measurement and ECG sensor. In this design, it senses the heart beat of the pregnant women through the finger print heart beat sensor as well as through the ECG sensor, also it checks for the blood pressure to ensure whether the pressure level is normal or high and under any critical conditions it will alert the pain to the nearby hospitals or close relations via message through GSM technology. So the doctor or care taker can monitor the condition of the pregnant women through IoT. Thus this proposed system helps to avoid the most critical stage of pregnancy period and it helps to save both the baby and the mother under any critical conditions.

VI. RESULT AND DISCUSSION:

Let's discuss about the workflow of the proposed health care monitoring system in Figure 8, Figure 9 and Figure 10 of this module.

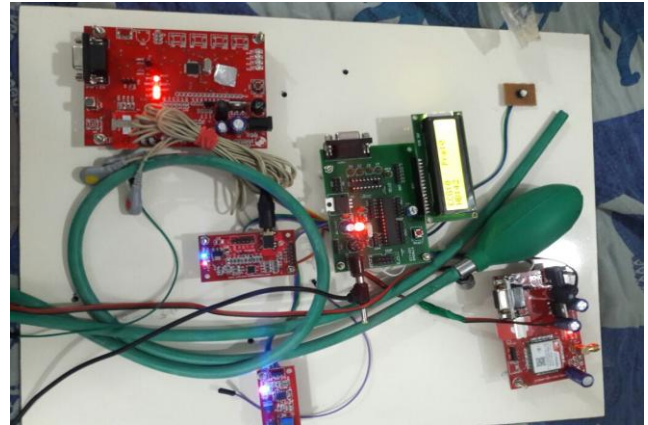


Fig.8. circuit design of system

The Figure 8 shows the circuit design of the proposed system.

- 1) Switch ON the 12 V, +5 Amps Power Supply.
- 2) Insert the data Sim and GSM Sim in place for data and message.
- 3) Then Reset the IoT modem using the Heart beat reset switch.
- 4) Once resetting the IoT modem reset the Controller.
- 5) After checking the OK condition of LCD, GSM and Controller, then reset the Heart beat sensor switch.

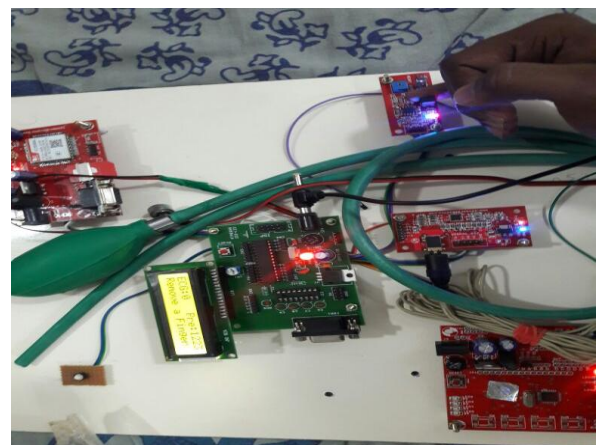


Fig.9. control flow module of system

The Figure 9 describes the control flow module of the proposed system with the below steps.

- 6) After pressing the reset switch in Heart beat sensor reset switch, the LCD will display "PLACE

THE FINGER”, which denotes it is ready to record the readings.

- 7) Now place the finger in the Heart beat sensor and paste the electrode of the ECG sensor in RA (Right Arm), LA (Left Arm) and RL (Right Leg).
- 8) Then tie the pressure band RA (Right Arm).

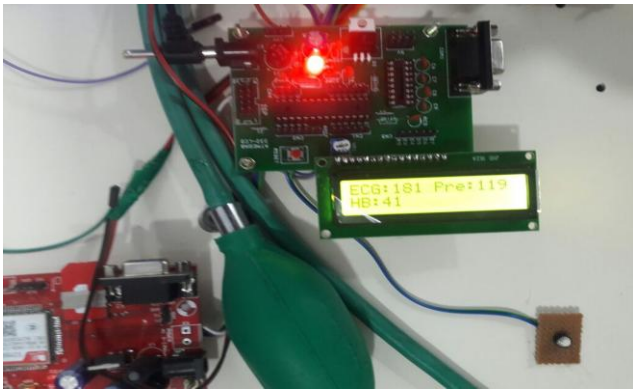


Fig.10.data flow module of system

The Figure 10 describes the data flow module of the proposed system with the below steps.

- 9) Once the Finger has been placed in Heart beat sensor, it will record all the readings and the LCD will display the heart rate in BPM, ECG value and pressure measurement in mm Hg.
- 10) The Controller will check the readings of the Heart beat of the pregnant women, ECG value and the pressure measurement to check whether the recorded readings were normal for every 5 seconds.
- 11) If any abnormal readings were recorded for Heart beat rate and ECG, The controller will send the alert over GSM to the nearby hospitals or to the concerned care taker (who has mentioned in the program) through message.
- 12) Then the Doctor or care taker will check the recorded reading of the abnormal condition of the pregnant women through IOT via using the link <http://www.myIoTproject.com/>

a) Login to IOT using username and password:



Fig.11.Login module of system

b) Below table refers to the recorded readings of the Heart beat measurement, ECG value and pressure measurement:

Table 1. Recorded readings of heart rate monitor

Date	Hb2	Pre3	Ecg
March 25, 2017, 5:22 pm	21	17	
March 25, 2017, 5:23 pm	21	5	
March 25, 2017, 5:24 pm	21		110
March 25, 2017, 5:24 pm	21		99
March 25, 2017, 5:28 pm		16	100

C) Below Graph refers to the Report of the Heart beat ECG value and pressure measurement.

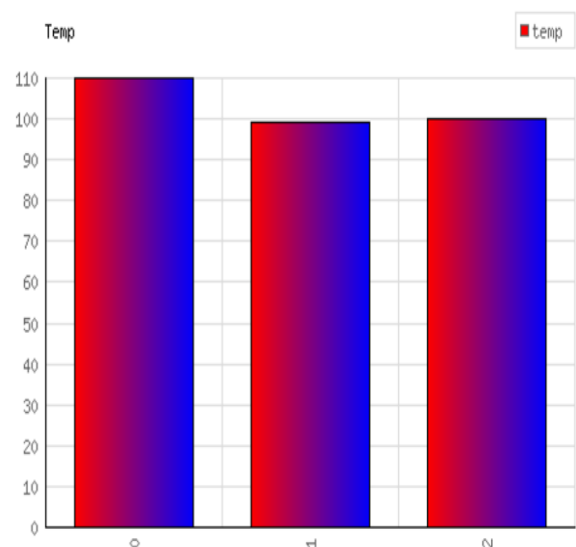


Fig.12.Report of heart beat based on ECG value

VII.CONCLUSION WITH FUTURE SCOPE

It can be concluded that the main objective of the design, analysis and implementation of a health care monitoring system to help pregnant ladies was achieved, in that the aim was to develop a cheap, affordable, reliable and efficient smart health monitoring system, which was successfully realized at the end of the design process. From the real time application, this system will helps to monitor the heart beat of the baby as well as the heart beat of mother and it will alert the pain of the pregnant ladies through IOT to the nearby hospitals as well as to close relations. So this device effectively helps the pregnant women to avoid the critical conditions during pregnancy. From the perspective of future scope, we planned to implement this design as a Smart belt, so the accuracy will be increased and the alert will be sent earlier through the sensors placed in the belt.

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