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PREGNANT WOMEN HEALTH CARE MONITORING SYSTEM FOR RURAL PEOPLES

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Abstract: **Human resources is the foundation of developing and under developed nations. Almost all maternal deaths (99%) occur in developing countries. Everyday 830 women die due to pregnancy. In the majority of the developing countries and in the smart cities medical systems is not centralized for sharing of information. Most part of the pregnant ladies may not be able to do their customary checkups at the beginning time of pregnancy and this prompts higher death rate in case of infant and maternal in the rural areas. Due to these issues, the society is facing an immense medical issues. In the existing strategy ultrasound sweep of the pregnant ladies is performed and along with that some fundamental signs are estimated and it is handled by Bluetooth innovation. The disadvantage of the existing framework is that the ultrasound scan is costly and the Bluetooth innovation. In order to overcome this, in the proposed work Accelerometer sensor is made wireless and it is mainly used to measure the movement of the fetus and some vital parameters such as the temperature, Humidity and heart rate and SPO2 for the women are measured by using different sensors. The measured parameters are transferred through IoT and it is viewed in the mobile phone. The proposed work concerns in developing a compact assist device for rural pregnant women in order to access the vital signs of maternal and fetus with low cost using recent sensors and internet of things for personalized care.**

Index Terms **– Temperature sensor, Heart rate sensor, Gyro sensor, Node MCU board, Internet of things etc.,**

1. INTRODUCTION

Every day approximately 830 women die from pregnancy and childbirth. It was estimated International Journal of Pure and Applied Mathematics Volume 119 No. 15 2018, 837-843 ISSN: 1314-3395 (on-line version) url: http://www.acadpubl.eu/hub/ Special Issue http://www.acadpubl.eu/hub/ 837 roughly that 303 000 women died during pregnancy and childbirth. Almost all of these deaths occurred in low-resource settings, and most could have been prevented. Almost all maternal deaths (99%) occur in developing countries. Women die as a result of complications throughout pregnancy and childbirth. Most of those complications develop throughout pregnancy and it is treatable. Different complications could exist before pregnancy but they are worsened throughout pregnancy, particularly if not managed as part of the woman's care. The major complications that account for nearly 75% of all maternal deaths are due to severe bleeding, infections, complications from delivery etc. Other factors that prevent women from receiving or seeking care during pregnancy and childbirth are Poverty, distance, lack of information, inadequate services, cultural practices. Therefore necessary efforts should start right from providing timely and quality health assistance to pregnant ladies which will lead to the birth of healthy children. For instances, pregnant women should perform ultrasound scan at least two times during pregnancy period to know about the fetal growth. Moreover, proper and timely checkups will ensure safe delivery. Women in the rural areas lack knowledge about importance of proper medication. Though India has made an appreciable progress in improving the overall health status of its population but it is far from satisfaction. Awareness 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 leads to high mortality among the women living in the rural areas. Also they suffer from various health issues such as anemia, weakness and vomiting. Ultrasound scanning method is mainly to check the growth of the baby in mother's womb. By using this ultrasound scanning method we can detect many problems such as development anomalies, chances for miscarriage, confirming a pregnancy, multiple pregnancies etc. Since the Ultrasound scanning method very expensive and there are objections for its long-term usage. The side effects of long-

term ultrasonic exposure on the fetal are not completely clear and it is the reason that this method is not recommended for long hours monitoring. Hence, we use latest sensors which will not harm both the fetus and the maternal.. Fig 1 shows the how sensor placed on the mother abdominal wall.

Fig.1.Sensor placed on the mother abdominal wall

The organizational framework of this study divides the research work in the different sections. The Literature review is presented in section 2. Further, in section 3 shown Concept of Internet of things, in section 4 shown the problem statement, in section 5 shown the Methodology and section 6 shown the implementation work. Simulation Results work is shown in 7. Conclusion and future work are presented by last sections 8.

2. LITERATURE REVIEW

Modern health care system introduces new technologies like wearable devices or cloud of things. It provides flexibility in terms of recording patients monitored data and send it remotely via IOT. For this connection, there is need of secure data transmission .To transmit the data with privacy is the Moto of this paper. The proposed system introduces security of health care and cloud of things .System works in two major parts viz. storage stage and data retrieving stage. In storage stage, data is stored, updated for future use. In data retrieving stage, retrieve data from cloud. The cloud server can share with authenticated user as per request. A patient with wearable devices continually updates his record every 5 or 10 min. In emergency mode, it updates for every 1min.The wearied device will send results to phone using Bluetooth connection or NFC technology. This can able to give to cloud server using GSM and 3G.

At cloud server, each patient is defines with unique address. So data at cloud can authenticate the right patient and provide the required request.[1]

Tele monitoring system via WBAN is evolving for the need for home based mobile health and personalized medicine. WBAN can able to collect the data acquired from sensor and record the output. This output results sent to controller wirelessly to health monitoring system. In this paper, Zigbee is used to in WBAN technology due to its guaranteed delay requirement for health tele monitoring system. Zigbee used in the communication.[2]

Afef Mdhaffar, Tarak Chaari, Kaouthar Larbi, Mohamed Jmaiel and Bernd Freisleben has explained low power WAN network to perform analysis of monitored data in health caring system. They have established WAN network for communication upto the range of 33m2 at around 12 m altitude. Also they have demonstrated that power consumed by LoRaWAN network is ten times less than the GPRS/3G/4G.The IOT architecture has been given for step wise working for understanding of IOT .The main purpose of LoRaWAN is the energy consumption. The power consumption in idle mode for LoRaWAN is 2.8mA while in GPRS is 20mA.Hardware cost in LoRaWAN is 10doller while in GPRS is 50 dollar. Maximum data rate in LoRaWAN is 50kbps (uplink), 50 kbps downlink while in GPRS is 86.5 kbps(uplink ,14kbps(downlink).These results gives the overall efficiency of LoRaWAN in the demonstration of IOT for health monitoring system. [5]

Mohammad M. Masud, Mohamed Adel Serhani, and Alramzana Nujum Navaz had given the measurement of ECG signals at various intervals and at different situations. They have considered energy aware, limited computing resources and lose network continuity challenges .For these challenges; mathematical model has been developed to execute each task sequentially. There are three approaches designed to work out the process .One is mobile based monitoring approach, data mining and third is machine learning approach [6]

Ayush Bansal , Sunil Kumar, Anurag Bajpai, Vijay N. Tiwari, Mithun Nayak, Shankar Venkatesan, Rangavittal Narayanan focuses on development of a system which is capable of detecting critical cardiac events. Using an advanced remote monitoring system to detect symptoms which lead to fatal cardiac events [7]

Hamid Al-Hamadi and Ing-Ray Chen gives trust based health IOT protocol that considers risk classification, reliability trust, and loss of health probability as design dimensions for decision making. Comparative analysis of trust based protocol and baseline protocols te check feasibility.[8]

Muthuraman Thangaraj Pichaiah Punitha Ponmalar Subramanian Anuradha ."Digital hospital" term is introduced for hospital management. It enables automatic electronic medical records in standard. Also discusses with the implemented real world scenario of smart autonomous hospital management with IOT.[9]

3. INTERNET OF THINGS TECHNOLOGY

The Internet of Things (IoT) is an ecosystem connected of physical devices that are accessible through the internet. The IoT allows objects to be sensed and 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. The concept Internet of Things (IoT), each device can be connected to the internet or intranet, or to other devices on the network. This enables the collection of a variety of information from the devices, including data on operations, configuration, energy consumption, and the power factor. The IoT enables devices to make smart decisions based upon analytical rules that serve the purpose of the devices

best. The devices can send, receive, store, and control information, sending the information individually to another device or broadcasting it to all devices..

4. PROBLEM DEFINATION

In today's social insurance framework for pregnant women who stays in home during post operational days checking is done either via overseer/ medical caretaker. Perpetual observing may not be proficient by this system, on the grounds that anything can change in well being parameter inside of part of seconds and in the midst of that time if guardian/attendant is not available in the premise causes more remarkable harm. So with this improvement created epoch where web administers the world gives a thought to add to another intense health awareness framework where time to time constant checking of the pregnant women is accomplished

5. METHODOLOGY

In this methodology the temperature sensor, heart rate sensor, accelerometer sensor are controlled by using an Node MCU controller. The data from the sensors are being analyzed by this controller and the results are being simulated. IoT refers to the internet 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.

6. IMPLEMENTATION

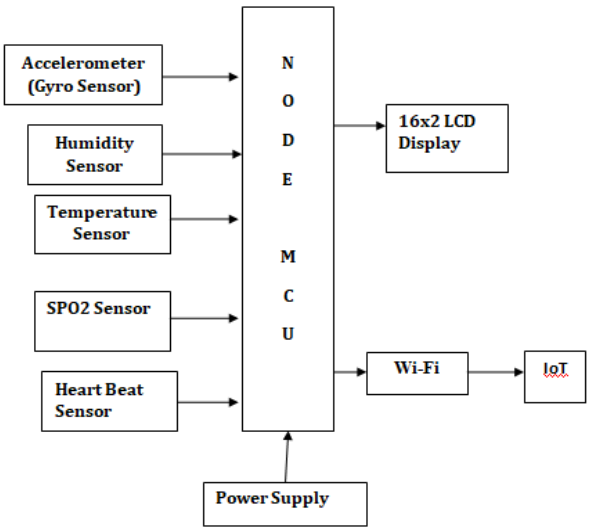

Fig.2 Proposed Block diagram

Fig 2 shows the proposed system .The health monitoring sensors are used to collect health related data i.e. for data acquisition. Communication can be done by controller for sending data on internet wirelessly. Data processing has been done at server. All data collected and aggregated at server point. To get health related information in understandable format it can be shown on web page i.e. data management.

1. HARDWARE REQUIREMENTS:

A. Node MCU

The NodeMCU (ESP8266) shown in Figure 6 is a microcontroller with an inbuilt Wi-Fi module. The total pins on this device are 30 out of which 17 are GPIO (General Purpose Input/ Output) pins which are connected to various sensors to receive data from the sensors and send output data to the connected devices. The NodeMCU has 128KB of RAM and 4MB flash memory storage to store programs and data. The code is dumped into the NodeMCU through USB and is stored in it. Whenever the NodeMCU receives input data from the sensors, it crosschecks the data received and stores the received data. Depending on the data received it sends a pulse to the Relay Module which in-turn acts as a switch to on or off the pump. The operating frequency of the NodeMCU ranges from 80 to 160 MHZ and the operating voltage of this device range from 3 to 3.6V. The Wi-Fi module presents in the NodeMCU range from 46 (indoors) to 92 (Outdoors) Meters. Node MCU controller shown in figure 3.

Fig.3 Node MCU

B. TEMPRATURE AND HUMIDITY SENSOR

DHT11 Temperature and Humidity Sensor shown in figure 4 it include a temperature and stickiness sensor complex with an adjusted computerized flag yield Temperature sensor are mainly used to measure the body temperature of the maternal. It can measure temperature more accurately than a using a thermistor. It is common for a woman's body temperature to change during pregnancy. During pregnancy the woman's body generates additional heat due to Increased metabolism, Elevated levels of hormones such as progesterone, Increased workload on the woman's body a result of extra weight as the pregnancy progresses as well as the processing and fetal nutrients and waste products. Simultaneously the woman has increased

peripheral circulation which leads to dissipation of heat from the body.It covers the range from -55ºC to +150ºC..

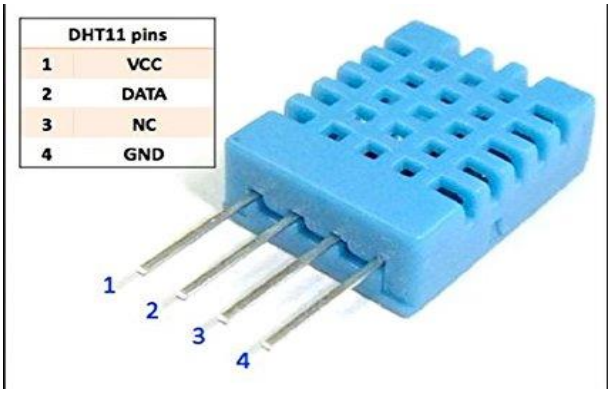

Fig.4 Temperature and Humidity Sensor

C. Pulse Oximeter

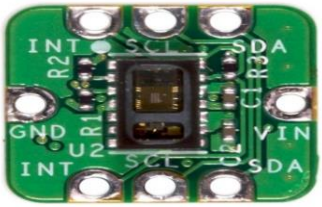

Fig.5 Pulse Oximeter

Figure 5 shows pulse oximeter . The heart rate measure kit can be used to monitor heart rate of maternal. The result can be displayed on a screen via the serial port. It is designed to give digital output of heart beat when a finger is placed on it. Operating voltage is +5V regulated and the operating current 100mA. The entire system is a high sensitivity, low power consumption and portable.

D. Accelerometer(Gyro) Sensor

One of the foremost common mechanical phenomenon detectors is that the measuring instrument sensor. Accelerometers are available that can measure acceleration in one, two or three orthogonal axis. The movements of the fetus is mainly due to the vascular state of the placental insufficiency in the uterus. These movements is known as “kicking”. From the fourth month onwards the baby will start kicking but it will not observed by the mother. By measuring the fetal movement, the clinicians will be able to predict the condition and development of the fetal. Fetal movement is monitored by ultrasound scan but this is expensive. so accelerometer sensor is used. The ADXL335 is a small, thin and low power sensor, it have 3-axis with signal conditioned voltage outputs. It will measure the acceleration with a minimum full-scale range of ±3 g. Accelerometer sensor have three voltage output pins namely XOUT, YOUT, and ZOUT. Bandwidths can be selected to suit the application, with a range of 0.5 Hz to 1600 Hz for the X and Y axes, and a range of 0.5 Hz to 550 Hz for the Z axis. The ADXL335 is available in a small, low profile, 16-lead, plastic lead frame chip scale package. The sensor shown in fig 6.

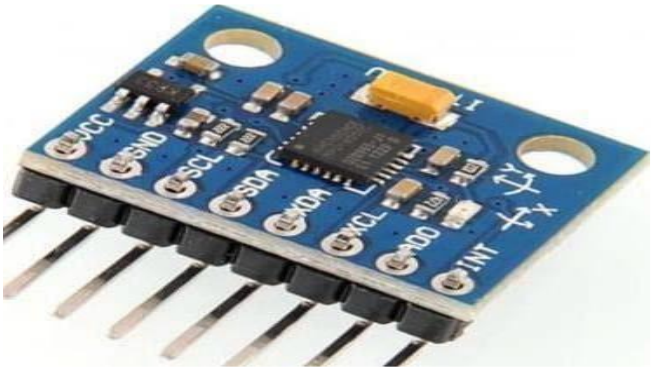

Fig.6: Gyro Sensor

E.LCD Display

LCD stands for liquid crystal display, which is used to show the status of an application, displaying values, debugging a program, etc.A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data. Shown in fig 7.

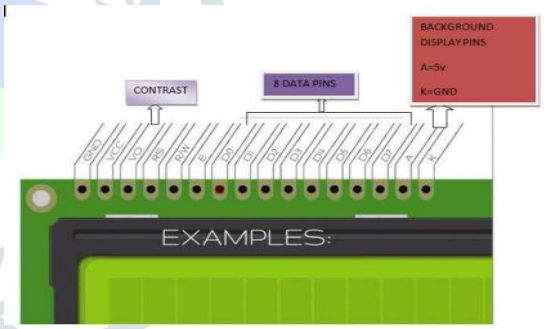

Fig.7 16x2 LCD Display

2. SOFTWARE REQUIREMENTS:

•ARDUINO IDE

Arduino IDE Arduino IDE is an open source software that makes to write the code in easy manner and helps to upload it into the Arduino board and the uploaded code contains the program that describes the working of the process. The main advantage is the software can be used in any Arduino board. The Arduino can control and interact with a wide variety of sensors like temperature, accelerometer and heart beat sensor.

- **UBI DOTS**

The basics components of any Internet of Things application powered by Ubidots are: Devices, Variables, Synthetic Variables Engine, Dashboards, and Events. Within this article we will address each of these concepts as they relate to Ubidots IoT Development and Deployment

Platform and how you can better organize your Ubidots Apps to best connect with the users.

7. EXPERIMENTAL RESULTS

The hardware setup is designed and the parameters such as the temperature, Humidity, Gyro and heartbeat are measured using different sensors. The accelerometer sensor is placed along with the three axis for the measurement of the kick count of the fetus. The parameters are measured and transferred to the mobile phone through IoT and the results obtained from the different sensors are discussed in this chapter.

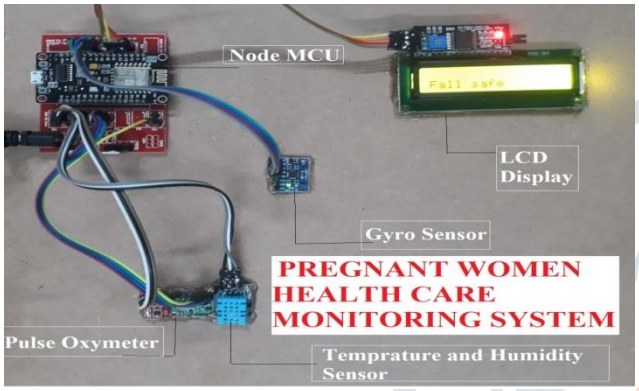

Fig .8 Experimental Hardware setup

The above Figure 8 shows the hardware setup of IoT based Health Care Monitoring System for Rural Pregnant Women. In that Accelerometer (Gyro) sensor, three axis X,Y,Z in the shows the tilt of the fetus when the sensor is placed in the mother abdominal wall. Accelerometer sensor is designed wireless and the fetal movement is measured. By using RF modules transmitter and receiver the output from the accelerometer sensor is transmitted to the Node MCU controller. LCD Display shows the displayed output of accelerometer sensor with the measured values of the three axis. The values in the accelerometer sensor vary according to the movement of the fetus.

It is designed to give digital output of heart beat of the maternal when a finger is placed on it. The temperature of the maternal can also be measured by placing a finger on it. The blood pressure of the maternal is measured by placing the cuff over the arm.

LCD Display shows the Displayed Output for the measured parameters obtained from different sensors. This hardware setup displays the output for the parameters measured such as the temperature, Humidity, SPO2 heart beat and along with the three axis in the accelerometer sensor using IoT based healthcare monitoring system.

8. CONCLUSION AND FUTURESCOPE

Most studies of maternal mortality are hospital based. However, in developing and under developed countries, most of the maternal deaths take place at home. In order to reduce these complications, a compact assistive device is designed and the vital parameters such as the temperature, pressure for women and heart rate of the fetus is measured by using different sensors. The device is lightweight and highly sensitive even for small movements, thus preferred as a home monitoring device. Regular monitoring of the vital parameters of fetus and women in the rural areas, reduces the infant mortality. The measured parameters is transferred through the IoT. It provides quality and timely health assistance for both fetus and women. The results are viewed in the mobile phone through the IoT.

Future Work

The Future work of the project is very essential in order to make the design system more advanced. In the intended system the enrichment would be involving more sensors to internet that measures a variety of other health parameters of pregnant women and would be advantageous for pregnant women monitoring i.e. linking all the objects to internet for rapid and effortless access. Establishing a Wi-Fi mesh type network would help to increase the communication range.

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