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IOT BASED PREGNANT WOMEN HEALTH MONITORING SYSTEM FOR PARENTAL CARE

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Abstract: - 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 UNO to cloud server in real-time. Internet connectivity is the important factor for this application to run successfully**.** In the developing countries most of the peoples are lived in the rural areas and medical systems are not amalgamated for sharing information. mostly, the pregnant women are unable to do their normal checkups at the starting time of pregnancy time and this cause higher death count in case of newborn and parental in the rural areas as well as in urban also. Due to this situation, the women are facing an immense medical issue. Accelerometer sensor is designed to measure the Abnormal Positions of the women and it is transfer into the Arduino UNO. Some important parameters such as Heartbeat rate, and temperature for the women are measured using various types of sensors. The measured parameters are transmitted by way of IOT and it is displayed in the mobile phone. This system is highly sensitive and light weight even for small motion, so it is preferred as a home monitoring device. Finally, we used GSM module to send SMS for abnormal rate.

Keywords: Arduino UNO, Health parameters, Temperature sensor, IOT, TILT sensor, ADC, IOT.

I. INTRODUCTION

Internet of Things (IoT) is gaining prevalent popularity among research community because of its impending to digitize real world physical objects around us. IoT has emerged as a result of current wireless telecommunication services and ever-present presence of Internet. Wireless

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sensor networks, RFID tags, actuators and various handheld intelligent devices such as mobile phones, PDAs, Tabs etc. are foremost to the surfacing of IoT.

The swiftly mounting progress in data transmission technologies of contemporary smart objects gave an eye opening to a new era of application development for Internet of Things oriented network. In exacting, due to the effectiveness of the data retrieval with mobile objects, such as wearable equipment, several sophisticated types of healthcare monitoring system with body sensor networks have been proposed. In this paper work, we have introduced a secure Internet of Things -based pregnant women healthcare monitoring system, which operates with the Wi-Fi module interface. To accomplish system competence and robustness of communication, we utilize user entry authentication in a web page to retrieve or view the data. Moreover, the implementation of the proposed healthcare monitoring system with Arduino platform to augment the achievability and practicability of the proposed mechanisms.

An embedded system is one kind of a computer system mainly designed to perform several tasks like to access, process, and store and also control the data in various electronics-based systems. Embedded systems are a combination of hardware and software where software is usually known as firmware that is embedded into the hardware. One of its most important characteristics of these systems is, it gives the o/p within the time limits. Embedded systems support to make the work more perfect and convenient. So, we frequently use embedded systems in simple and complex devices too. The applications of embedded systems mainly involve in our real life for several devices like microwave, calculators, TV remote control, home security and neighborhood traffic control systems, etc.

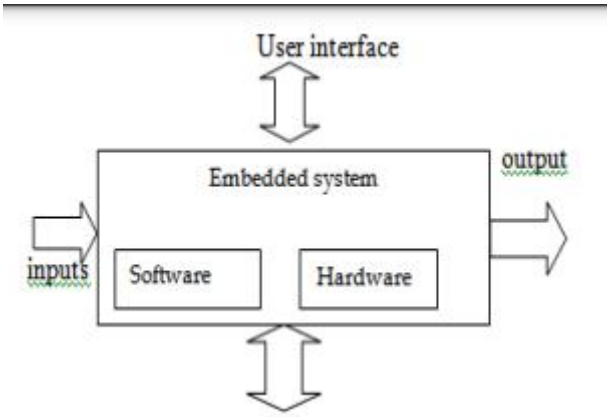

Fig 1 Overview of Embedded System

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Embedded System Software: The embedded system software is written to perform a specific function. It is typically written in a high level format and then compiled down to provide code that can be lodged within a non-volatile memory within the hardware. An embedded system software is designed to keep in view of the three limits:

- Availability of system memory
- Availability of processor's speed
- When the system runs continuously, there is a need to limit power dissipation for events like stop, run and wake up.

Bringing software and hardware together for embedded system:

To make software to work with embedded systems we need to bring software and hardware together for this purpose we need to burn our source code into microprocessor or microcontroller which is a hardware component and which takes care of all operations to be done by embedded system according to our code. Generally, we write source codes for embedded systems in assembly language, but the processors run only executable files. The process of converting the source code representation of your embedded software into an executable binary image involves three distinct steps:

1. Each of the source files must be compiled or assembled into an object file.

2. All of the object files that result from the first step must be linked together to produce a single object file, called the re-locatable program.

3. Physical memory addresses must be assigned to the relative offsets within the re-locatable program in a process called relocation.

The result of the final step is a file containing an executable binary image that is ready to run on the embedded system.

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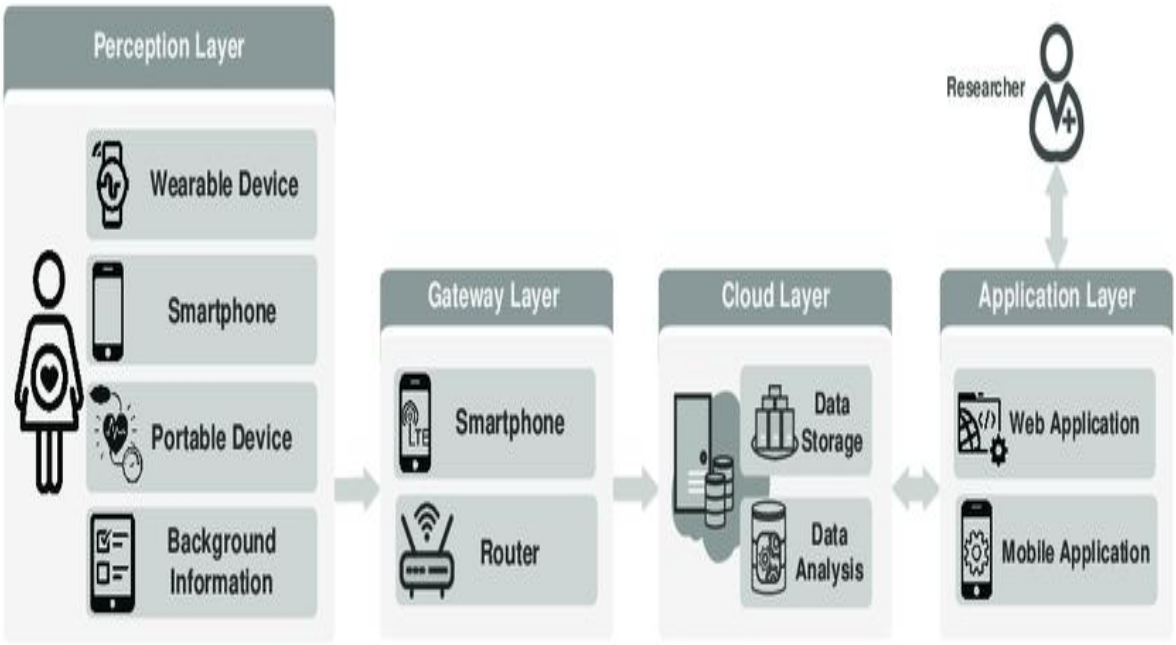

Fig 2 Overall Structure

II. RELATED WORK

Z. Zhao et al. (2020) studied the fetal heart rate classification using supervised learning models. ANN, SVM, random forest, and ELM labelled models are designed to monitor and categorize the embryo heart rate signals based on the features of maternal parameters observed regularly. Various features are observed from "Sis Porto" open-access database used for training and testing [13]. The author concluded that ANN outperformed well for classifying the fetal heart rates when validated with synthetic dataset recordings.

A mechanized discovery of pre-birth hypoxia by breaking down the Fetal Heart Rate (FHR) during labor has been proposed by F. Sarhaddi et al. (2021) in Ref. [14]. The proposed model comprises three stages where fetal signals are segmented as time series frames, and normalized compression distance metrics are also used for classification. Fetal heartbeat is continuously monitored during labor, compared with normal heart beat rate for identifying fetal hypoxia. Two distinct machine learning cataloguing algorithms, KNN and SVM, were developed as fetal movement detectors and achieved 88% accuracy for 1k subjects' data. The drawback of this proposed model is that it is insufficient for an extensive database, and more delay in estimation is observed.

M. Ahmed et al. (2020) in Ref. [15] introduced an unsupervised learning algorithm for Electronic Fetal Monitoring (EFM), and fetal heart rate (FHR) signals to prevent fetal hypoxia. The 2-dimensional image of a 1D

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preprocessed FHR signal was transformed using recurrence plot, which is thought to capture the nonlinear properties well. Several parameters of the RP were changed to enrich the final picture dataset, which was then fed into the convolutional neural network (CNN). The drawback of this model is high computational complexity and consumes more training time compared to other state-of-art classifiers.

A. Baccouche et al. (2020) proposed an Internet-of-things (IoT) framework for maternal wellbeing checking during and after pregnancy [16]. The system includes several data collectors that monitor the mother's health, including stress, rest, and physical activity. The creator's discoveries show that the introduced framework is suitable for framework use for nine months. The digital watch has been designed as a good energy economy for long-term monitoring and can gather reliable photoplethysmography data.

A. Matonia et al. (2020) developed another smart technique for predicting maternal health monitoring and fetal heart rate diagnosis for pregnant women [17]. All supervised learning models are prepared and tested with a real-time dataset. This paper aims to create the novel real-time database of maternal status during her labor period to save infants from hypoxia. The dataset includes distinct features regarding subject age, normal heart rate, fetal heartbeat, and sample time. The same record has been forwarded to the cloud using an IoT network. The limitation of proposed database can be validated with other unsupervised learning models.

Z. Hoodbhoy (2019) et al. proposed an ensemble of unsupervised learning models called BiLSTM and BiGRU for detecting heart diseases [18]. The proposed neural network is modelled as a binary classifier to detect normal or abnormal chances for heart attack.

X. P. Burgos-Artizzu et al. developed feature extraction algorithms to extract the significant characteristics from a dataset; Principal Component Analysis (PCA) and Independent Component Analysis (ICA) used huge heart rate database of mothers during pregnancy. The principal purpose is to identify the fetal positions and severity in labor with fetal electrocardiography signals [19].

R. Beri et al. (2020) proposed that this review concentrated on the accuracy of AI calculation methods on CTG information in distinguishing high-hazard embryos. CTG information of 2126 pregnant ladies was acquired from the University of California Irvine Machine Learning Repository. Ten diverse AI grouping models were prepared to utilize CTG information. Affectability, accuracy, and F1score for each class and general precision of each model were acquired to anticipate ordinary, suspected, and neurotic fetal states [20].

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B. Priyanka et al. (2020) proposed current deep learning classification techniques' maturity for usage in a real-world maternal-fetal clinical setting. Several operators and ultrasound machines obtained a big data collection of regularly gained maternal-fetal screening ultrasound pictures (which will be made openly accessible) from two particular clinics. A skilled maternal-fetal doctor manually labelled all of the photos. Four of the most regularly used fetal physical planes (Abdomen, Brain, Femur, and Thorax), the mother's cervix (broadly utilized for pre-development screening), and an overall classification to include some other more uncommon pictures were parted into six gatherings [21].

The primary objective of Ali Akbar Manasseh et al. (2021) is to improve the perceptron neural network's accuracy by training the neural network using meta-heuristic methods. The neural network input coefficients in this framework were determined via an integrated method. This framework's key benefit is that it has a lower prediction error, although training takes longer [22].

A brand-new blockchain and artificial intelligence-enabled secure medical data transfer for IoT networks was introduced by Omar A. Alzubi et al. (2021). In this concept, the sign-crypton method is used to transmit IoT data in a safe and trustworthy manner. By using the IoT networks' dependable data transfer, security and privacy were accomplished. However, this framework's higher computational complexity has been noted as its only downside [23].

Using Lamport Merkle Digital Signature, Jafar. A. Alzubi et al. (2021) developed a blockchain-assisted highly secure solution for medical IoT devices. The computational overhead was effectively decreased by this architecture but fails to guarantee a minimal delay [24]. New privacy-preserving encryption with DL based medical data transfer and classification model was introduced by Jafar.

A. Alzubi et al. (2021). With sailfish optimization, the given model develops the multiple key-based homomorphic encryption (MHE) method (SFO). This framework's key benefit is its improved accuracy and efficiency. However, this framework's increased computational complexity is a drawback [25].

III. EXISTING SYSTEM

In the existing method ultrasound scan of the pregnant women is performed and along with that some vital signs is measured. The main drawback of the existing system is that the ultrasound scanning is expensive. In order to overcome this an accelerometer sensor is used to measure the kick count of the fetus and the vital parameters such as temperature and

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heart beat is measured and the aim is to develop 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.

IV. PROPOSED METHOD

In this system the Arduino is used to attach with three sensors namely memes sensor and heart beat sensor. This act akin to a microcontroller which collects and reads values from the sensor through the physical connection of input and output pins of the board. WiFi module is attached in this system thus it helps to take reading and display on your mobile.

1.To Construct the hardware model for measuring various health problems in pregnancy women and the foetus.

2.To deploy the various parameters to the cloud.

3.To develop the android-based UI for interaction with cloud.

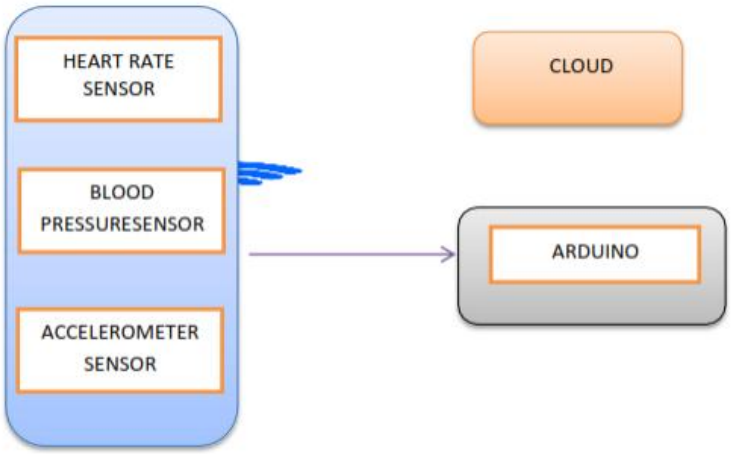

Fig 3 Methodology Diagram

In this system the Arduino is used to attach with three sensors namely memes sensor and heart beat sensor, Blood pressure sensor. This act akin to a microcontroller which collects and reads values from the sensor through the physical connection of input and output pins of the board. WiFi module (ESP8266-12E) is attached in this system thus it helps to take reading and display on your mobile. The Internet of things progressively allow to incorporate device capable of connecting to the internet and endow with information on the condition of health of pregnant women and provide information in real time to doctors who assist it. This data can be retrieved or viewed in the form a mobile at the instant of time with secured authentication.

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This data will be kept and stored as a backup for any kind of future reference. The main source of pregnant women health care system at present stage is that when pregnant women is at the rest position.

V. RESULTS

Fig 4 Hardware results

The above developed prototype model is going to detect the fetus moments and kicks with the help of accelerometer sensor and gyroscopic, and also detect the heart beat and temperature of the mother using heart beat sensor and temperature sensor. The results from the above sensors are transferred to the cloud, through these readings we can obtain the number of fatal kicks and it's graph, also the temperature of the mother along with the heartbeat. From these results we can avoid the fatal and mother deaths in rural areas and improve the health monitoring system in the rural areas.

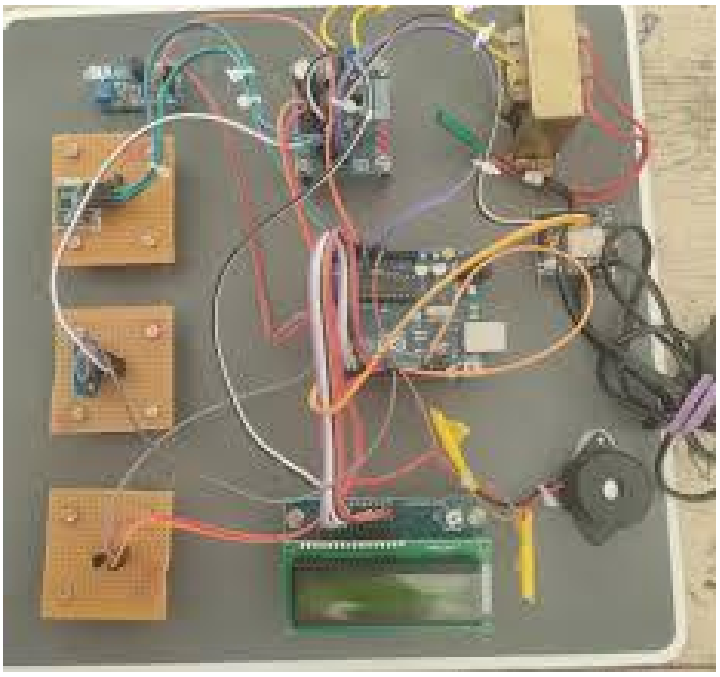

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Fig 5 Complete Hardware kit

Fig 6 Webserver Result

VI. CONCLUSION

In this project, the results obtained from the different sensors devices will be compared and analysed in detail the values are recorded using the sensors and processed using the microcontroller for emergency send the message to the doctor. The system is low cost ,self- monitoring device and used in remote areas efficiently. A new architecture of IOT health monitoring which provides security at the communication link as well as by providing user authentication

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