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Survey on development of convenient health monitoring system for pregnant women in rural area

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Abstract

The foundation of developing and under developed nations is Human resources. Almost all maternal complications occur in developing countries. Medical systems are not centralized for sharing of information in the majority of the developing countries and in the smart cities. Most part of the pregnant ladies might not be able to do their regular 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 issue. In order to minimize even more the death of both mothers and babies, various technique resources are being used in an integrated manner. At the early stage of pregnancy pregnant women from rural areas can't do their regular checkups. Birth of physically challenged infant in this system can be avoided by routine check-up. Some vital parameters of pregnant women like pressure, temperature, heartbeat rate are monitored and measured. This project presents a wearable device to continuously monitor the vital parameters which is to be monitored for a patient and do data logging continuously.

Keywords: health monitoring system, women security, rural area, pregnant women, fetus movement

Introduction

The global population is growing and aging in every year. In this demographic change chronic age-related diseases increase correspondingly, such as dementia, diabetes, cancer, heart failure, and chronic obstructive pulmonary diseases. Lots of people are affected by injured related and chronic condition type of disabilities. Some complications can be arise in pregnancy and childbirth because of this type of diseases. Almost all of these complications occurred in low-resource settings, and most could have been prevented. There are many complications which develops between the pregnancy but can be treated. This can be more worsened throughout pregnancy, particularly if not managed as part of the woman's care. The major complications that occur during pregnancy due to severe bleeding, infections, etc. Healthcare costs are increasing, poverty, distance, lack of information inadequate services, cultural practices are some of the other factors that prevent women from receiving or seeking care during pregnancy and childbirth. Quality of life and productivity are reclining, family members serve as primary are assistants, and in many cases.

Existing System

Previous system establishes a Fetus Heart Rate Monitoring System which is connected with mobile phone for gathering the Uterus Contraction signals for screening fetus parameter. FHRMS can gather the FHR values of fetus at certain intervals as well as the wrist band mother parameters. Any hand held Doppler product is sufficient to calculate biometry parameters. And another system is The hardware setup is designed and the parameters such as the temperature, pressure and heartbeat is measured using different sensors. In addition to this accelerometer sensor is placed along the three axis to measure the kick count of the fetus. The another one system presents a healthcare solution that combines web app and CC3200 techniques in a wireless sensor network to monitor the health condition of patient and present a unique range of effective, comprehensive, and convenient healthcare services. The specialist staying at a distance can monitor the pregnant ladies health condition so that he can save the life of the patient and also the infant. IOT technology is used so that we can monitor the patient condition easily from anywhere.

Related Works

Santhi *et al.* ^[1] has used an CC3200 microcontroller which also acts as an in build Wi-Fi board because of its fast interrupt handling capacity. It mainly focuses on the vital parameters of the women at the time of the pregnancy that are briefly monitored throughout the period of time. It also consists of the C4.5 Decision Tree classification algorithm. Yuvaraju *et al.* ^[2]

has discussed a major application of security purpose by using an acid detection sensor which senses the presence of acid and gives the required message to Arduino board. O.P. Singh *et al.* ^[3] projected the well being of the fetal movement as well as monitoring the fetal heart rate. This paper mainly focuses on the heart rate of the fetus. Amala *et al.* ^[4] developed an IoT based circuit using Arduino which monitors over the health parameters. Some of the sensors used in this paper are accelerometer sensor which senses the rotation of the baby inside the mother's womb after the fourth month. It also monitors the blood pressure. Anil Kumar *et al.* ^[5] proposed a Wireless Machine to Machine health care solution that uses IPV6 techniques to check the health condition of the patients. These M2M devices are designed and use for the purpose of biomedical signal measurement. Soumitra Das *et al.* ^[6] uses a Doppler device which is capable for regular screening and recognizing serious circumstances of fetus. A primary technique used here for screening fetal well being during labour is the Electronic Fetal Monitoring.

Piyush Kumar Verma *et al.* ^[7] has also used an Arduino sensor as the microcontroller which is having an extra emergency switch to be pressed at the time of danger. This will let her family members know about her current location so that the user gets home safely. This is more of a safety purpose device having some of the health measuring factors. Rajneesh Rai *et al.* ^[8] proposed a M2M device similar to paper ^[5] which also uses the IPV6 techniques for the measurement of the health parameters. SST microcontroller is used as the primary source of data handling. The parameters are then sent to the ARM 11 smartphone, so that the patient's health can be monitored and treated well by the doctor without needing the patient at the hospital.

This project is developed for continuously monitoring the health condition of pregnant ladies. Due to lack of hospital

facilities in villages and no proper check-ups of pregnant ladies in many areas will affect the pregnant women and her child. This will also increase the risk of pregnancy of both women and child or any one. Constant health monitoring of pregnant women with proper supervision will reduces the risk of disease and costly hospitalization. The health monitoring device recommends that it will continuously monitor the body temperature, heart rate and many other values of patient. If there is any variation in normal value, the information about her health condition is passed to the patient's personal doctor form her mobile. In this proposed system IoT also implemented which will helps the patient to get advices from doctor from any place at any time.

Problem Statement

In several rural parts of the country, there are many places which are still not developed. This affects the day-to-day life of the people living in the area. The major problem most often seen has occurred is the lack of medical facilities being provided to the people. Women are highly influenced by this problem as considered for the health facility at the time of their pregnancy. Also the cost of travelling and transportation is high similar to the cost of the hospital in big cities. In order to solve this problem, a home based health monitoring system for pregnant women is proposed. This system can monitor the health factors of the women at home and the doctor can also get informed totally at the hospital. This will surely reduce the cost of travelling to the hospital. Also the system sends a message to the doctor if there are any chances of emergency.

Hardware Setup

In the hardware setup different types of sensors have been used to measure the vital parameters like temperature, blood pressure, heart rate for the maternal and the movement of the fetus. Sensors are attached in the system so that it helps to take reading and it is displayed. IoT is growingly allowing to integrate devices which are capable of connecting to the Internet and provide information on the state of health of patients and provide information in real time to doctors who assists it.

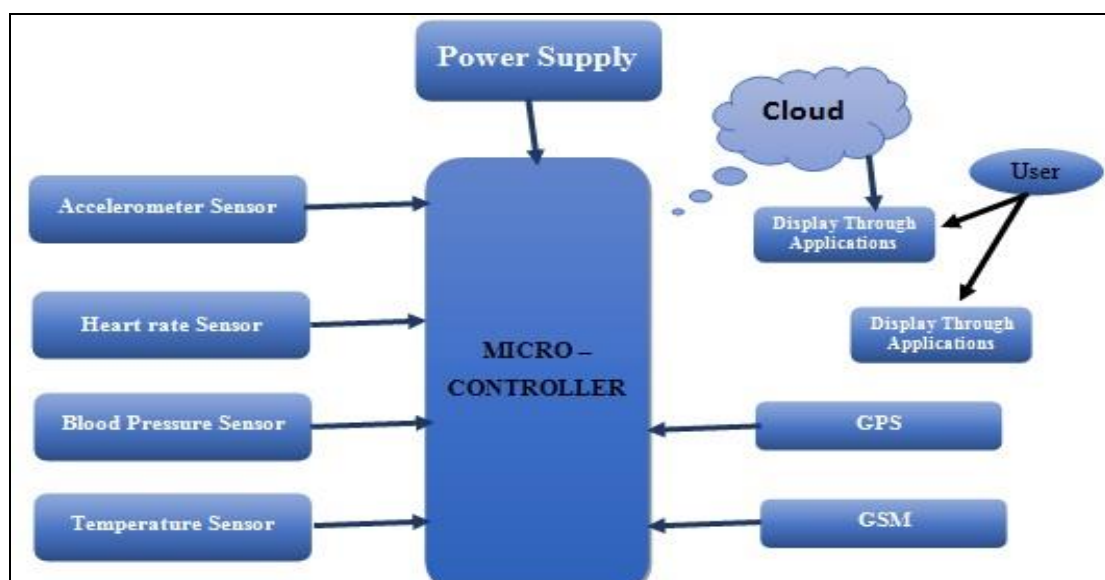


Fig 1: Block Diagram of the system

Raspberry Pi 0

The Raspberry Pi 0 is a fantastic, miniature version of the Raspberry Pi that shrinks the board down to about the size of a stick of gum, but one problem with it is the lack of wireless feature. The Raspberry Pi 0 W is a new version that packs in Bluetooth and Wi-Fi for double the price of original zero. It comes with most of the same specifications as the standard Pi Zero, but adds in the same 802.11n Wireless LAN and Bluetooth that the Raspberry Pi 3 has. The CPU and RAM are truly the same as the standard Raspberry Pi Zero, which are necessarily the same as the earliest Raspberry Pi 1 models.

Accelerometer Sensor

One of the major common mechanical phenomenon detectors is that the measuring instrument sensor. Accelerometers are sensors 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 of pregnancy onwards the baby will start kicking but it will not observed by the mother. By measuring the fetal movement, the doctors will be able to predict the condition and development of the fetal growth.

Temperature Sensor

Temperature sensors are mainly used to measure the body temperature of the maternal. It can measure temperature accurately than using a thermistor. It is generally common for a woman's body temperature to change during the

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 pregnancy progresses as well as the processing and fetal nutrients and waste products . LM35 sensor operates from 4 to 30 volts. It covers the range from -55 °C to +150 °C.

Heart Rate Sensor

The heart rate measuring kit can be used to monitor the heart rate of pregnant women. It gives results on a screen to be displayed via the serial port. It is designed in a way to give digital output of heart beat when a finger is placed on it. Operating voltage is +5V regulated and the operating current is 100mA.

Blood Pressure Sensor

Blood pressure is a major concern for any human being. For a pregnant woman the blood pressure level will keep changing slightly throughout the 10 months. This is the reason that makes them feel dizzy during the pregnancy period. High blood pressure during pregnancy period does not generally lead to serious problems. If the blood pressure is high even after 20 weeks of pregnancy, there can be complications. Preeclampsia can develop. This condition can cause serious damage to the brain and kidney. Preeclampsia is also known as toxemia or pregnancy-induced hypertension.

Design Flow

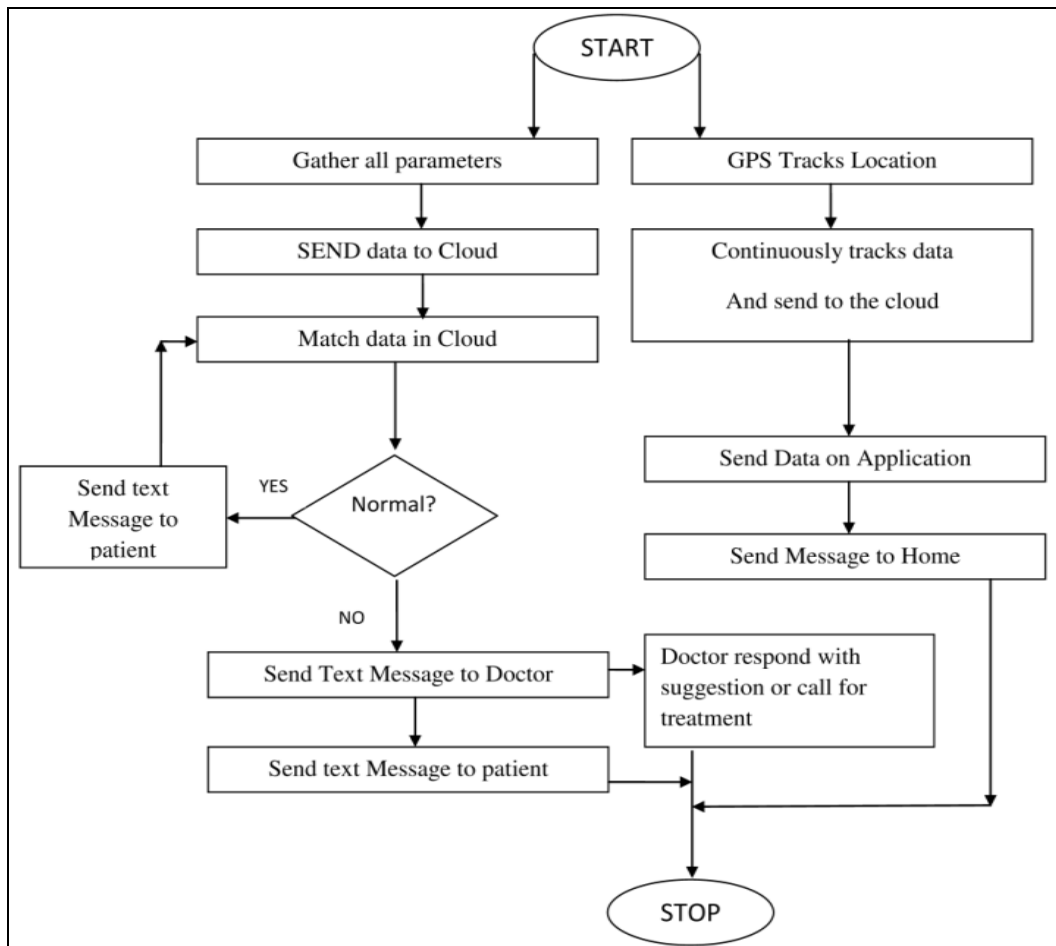


Fig 2: Design Flow for the operation

Applications

- Local monitoring applications
- Remote heart rate monitoring
- It can also be used as a vehicle tracking system

Advantages

- Wearable device
- Compact in size
- Ease of operation
- Durability

Conclusions

Systems which are currently available are not compact and wearable. Hence it occupies more space and measurement capacity is not that good. But the system that we have proposed will collect and transfer the information to the doctor at the earliest because of IoT and the product is compact in size and wearable. So, it is easy for the doctor to analyze the health condition of patient continuously. Since we use IoT, it is easy to retrieve the previous record which is used for analyzing during complications. Thus the results are accurate and precise. It helps pregnant ladies to avoid miscarriage and the doctors are able to suggest healthy diet to the women from their own place itself.

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