IOT BASED WOMEN PREGNANCY HEALTH CARE MONITORING SYSTEM USING PRENATAL CARE

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Abstract: *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 count of kicks/force by unborn child and it is transfer into the Arduino. Motion of the foetal and some important parameters such as Heartbeat rate, count of unborn child's kicks 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. Now-a-days, ultrasound scanning method is used. Because it is long-term usage and very expensive. Limitations of ultrasound scan method on foetal are not completely clear. so, ultrasound scan is not suggested continuous monitoring. Finally, we used GSM module to calculate the normal and abnormal rate*.

Keywords: Internet of Things, wearable device, maternal health, remote health monitoring

1. INTRODUCTION

Pregnancy is an important phase for a women's health as well as her child. All the precautions and steps taken in order to ensure better health and seamless delivery of the baby after 9 months are crucial. Pregnant ladies from rural areas avoids their regular check-ups at the initial stage of pregnancy. Regular check-ups will help to reduce abnormal children birth and fetal mortality rate. Due to unavailability of hospitals in rural areas and longer distance required to travel, pregnant women are not really conscious about their health, for small injuries and routine check- ups. During this period, there is possibility of various complications due to maternal sepsis, bleeding and variation in blood pressure which may results in gestational diabetes and weight gain. During pregnancy few women may face the problems of high blood pressure which is called as gestational hypertension which can impact on the mother's kidneys and other organs. It can also result in low birth weight, and premature delivery. Due to high blood sugar levels it is possible that the baby may gain extra weight. Due to underweight, pregnant women are more susceptible to decrease in the amount of amniotic liquid and there is a

greater risk of having a preterm birth.

A. M. Khairuddin et al 2018 [1]. "Design and Development of intelligent electrodes for future digital health monitoring". Electrodes are sensors used in electrocardiography (ECG) monitoring system to diagnose heart diseases. Over the years, diverse types of electrodes have been designed and developed to improve ECG monitoring system. However more recently, with the technological advances and capabilities from the Internet of Things (IoT), cloud computing and data analytics in personalized healthcare.

M. S. Mahmud et.al, 2017[2]. "Wireless health monitoring using mobile phone accessories". This paper presents the design and prototype of a wireless health monitoring system using mobile phone accessories. We focus on measuring real time Electrocardiogram (ECG).

Sheikh M et.al 2016[3]. "Maternal perception of decreased fetal movements from maternal and fetal perspectives,a cohort study". Maternal counting of fetal movement is a popular and valuable screening tool of fetal well being, however it is still not known what percentage of healthy pregnant women who gave birth to healthy term newborns had experienced decreased fetal movements during gestation and what maternal and fetal factors are associated with this maternal perception of decreased fetal movements. The aim of this study was to assess the associations between maternal perception of decreased fetal movements and maternal and fetal factors in normotensive singleton pregnancies with good pregnancy outcome.

Billie F Bradford Etall 2015[4], "A diurnal fetal movements pattern: Findings from a cross-sectional study of maternally perceived fetal movements in trimester of pregnancy". Information provided to pregnant women about fetal movements is inconsistent perhaps due to limited knowledge about normal fetal movement patterns in healthy pregnancies. We had consented to participate. Fetal movement data was gathered during pregnancy via a questionnaire administered face-to-face by research midwives. Participants remained eligible for the study if they subsequently gave birth to a live, appropriate-for-gestational-age baby at ≥37 weeks.

Joao Alexandre Lobo Marques Etall 2014[5], "IOT-Based smart health system for ambulatory maternal and fetal monitoring". The adoption of IOT for smart health applications is a relevant tool for distributed and intelligent automatic diagnostic systems. The fetal heart rate and a

group of maternal clinical indicators, such as the uterine tonus activity, blood pressure, heart rate, temperature, and oxygen saturation are monitored.

2 METHODOLOGY

2.1 Introduction

Maternity care aims to ensure the health and well-being of both the pregnant woman and her fetus. Maternal health has a great impact on the infant during the pregnancy but also in the future. In addition, health complications during pregnancy, for example, hypertensive disorders or gestational diabetes, may resonate with corresponding health problems in the pregnant woman's later life [1,2,3]. Hence, maternity care is essential to promote long-term health at the population level as well as preventing acute pregnancy complications in individuals. Regular check-up during pregnancy is essential to detect abnormalities and to prevent additional complications, injuries or even death [4].

The system consists of Hardware and Software .It is also called an Embedded System. From literature we concluded that very efficient pregnancy health monitoring system is required to avoid mortality rate of pregnancy women and to implement this system we need both hardware and software.

2.2 Hardware :

In the hardware the main controller is Arduino UNO, its detail specification has been studied. In the hardware setup different types of sensors have been used to measure the vital parameters such as temperature, heart rate, blood pressure for the maternal and the movement of the fetus. Sensors are attached in the system thus it helps to take reading and it is displayed. IoT is increasingly allowing to integrate devices 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.

2.2.1 Block diagram:

we are providing health monitoring of a pregnant women using Arduino interfacing them with health monitoring sensors like Heartbeat and temperature. By Using MEMS Sensor, we will check the count that how many times that baby kicks. So as this is for pregnant women it is required to monitor them all the time. If any abnormality happens message will be sent.
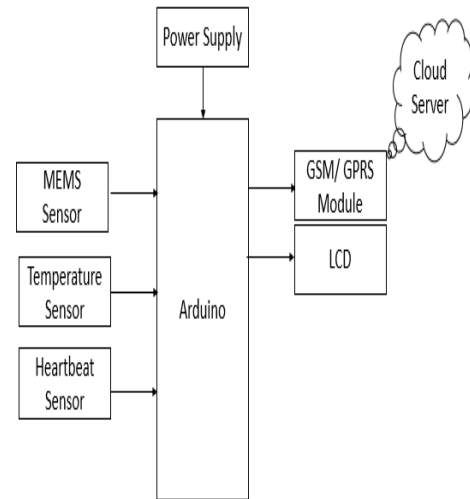

Figure 2.1 Block diagram of pregnancy health monitoring system

2.3 Software:

The application to be executed on above mentioned hardware. The Arduino UNO is the main programmable device .To execute program on Arduino UNO need an operating system, so here Arduino IDE has installed to operating systems like MAC, Windows .The application has been written by using Embedded C.

2.4 ALGORIHM:

Step1: Connect the hardware components as per the circuit diagram

Step2: Install the Arduino IDE software tool

Step3: Write the application in embedded C language

Step4: Compile and execute with system

Step5: Validate the Application by applying input

Step6: Place the sensor near the mother abdominal wall it will detect the movements of fetus. This sensor will detect the kicks/counts of fetus for normal/abnormal movements.

Step7: The temperature sensor will detect the temperature of mother as well as fetus, as well as another sensor like heartbeat sensor will sense the heartbeat.

Step8: The detected parameters data will be stored in Arduino, The data stored in the arduino will be transfer to physicians over mobile for consulting and remote medical examinations. If any medical emergencies had been detected by the doctor for pregnant lady the message will be sent back to the pregnant's mobile.

Step9: Then the pregnant lady must join in the hospital for urgent medication.

The system continuously detect the pregnant lady condition, if any abnormal or emergency condition occurs means the message will be sent through the mobile application.

2.5 ADVANTAGES OF THE PROPOSED WORK

- Monitoring the pregnancy ladies continuously.
- They can easily communicate with us.

The proposed system provided better monitoring for pregnant ladies, when any medical emergency occurs means message will sent immediately.

2.6 DISADVANTAGES OF THE PROPOSED WORK

- If there is no internet connectivity fastly available then it will be problem for proper medication.
- Privacy is the biggest challenge with IoT, as all the connected devices transfer data in real-time. Personal data can be hacked if this end to end connection is not secure. Criminals can use this personal data of others for their own benefits. Pregnancy related data values can be hacked.

2.7 APPLICATIONS OF THE PROJECT

- Used in the hospitals for pregnancy women.
- Patients at home.
- Remote heart rate monitoring applications.
- Local monitoring applications.

3. EXPERIMENTAL RESULTS

S. NO	Input (sensor data)			Output (response)
	MEMS sensor	Temperature sensor	Heart beat sensor	
1	Yes	No	No	MEMS sensor is used to detect the unborn child kicks and the fetus movement is less than ten times in 12 hrs it is considered as manifestation of fetal hypoxia and with this sensor immediate measures can be taken in avoid these type of issues.
2	No	Yes	No	Temperature sensor sense the body temperature per second for mother as well as fetus. If the temperature exceeds more than normal temperature(over **101ºF**) it will affect
				the fetus and leads to death of baby in womb. with the help of temperature sensor we can check the normal temperature as well as exceeded temperature. then the sensor will get alert and message will be sent.
3	No	No	Yes	Heartbeat sensor is used to monitor heart rate continuously. A normal fetal heart rate (FHR) usually ranges from **120 to 160 beats per minute** (bpm) in the in utero period

```
Serial.println("AT+CMGF=1");
delay(500);
Serial.println("AT+CMGS=\"+919491776070\"");
delay(500);
Serial.println("BABY DANGER");
delay(500);
```


Fig:3.1 When baby is in danger condition

4. CONCLUSION

It is designed to give digital output of heat 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 three axis X, Y, Z in the accelerometer sensor shows the tilt of the fetus when the sensor is placed in the mother abdominal wall. By using this approach the pregnant women and disable pregnant women in rural areas will able to do their regular checks ups on the daily basis.

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REFERENCES

[1] "A. M. Khairuddin, K. N. F. K. Azir, and P. E. Kan, "Design and development of intelligent electrodes for future digital health monitoring: A Review," IN PROC. Iop Conf. Ser., mater. sci. eng., vol. 318, NO. 1, mar. 2018, P. 12073"

[2] "M. S. Mahmud, H. WANG, A. M. Esfar-E-Alam, AND H. Fang, "A Wireless health monitoring system using mobile accessories," IEEE INTERNET THINGS J., VOL. 4, NO. 6, PP. 2009– 2018, Dec. 2017".

[3] Sheikh M, Hantoushzadeh S, and Shariat M, "Maternal perception of   decreased fetal movements from maternal and fetal perspectives, a cohort study," BMC Pregnancy Childbirth, ; vol.14 no.286, Aug 23, (2016).

[4] Billie Fradbord "A diurnal fetal movement pattern: Findings from a cross-sectional study of maternally perceived fetal movements in the third trimester of pregnancy" published on 2015.

[5] Joao Alexandre Lobo Marques, wanking wu "IOT-Based Smart Health System for Ambulatory Maternal and Fetal Monitoring" published on 2014.

[6] Ambrosio Toval , Mariam Bachiri "Experiment design of free pregnancy monitoring mobile personal health records quality evaluation" published on 2020.

[7] Kypros H. Nicolaides, Sally L. Collins "Fully Automated 3-D Ultrasound Segmentation of The Placenta, Amniotic Fluid, and Fetus for Early Pregnancy Assessment" published on 2021

[8] Marvin MOSER, Catherine M. BROWN, Carl H. ROSE, and Vesna D. GAROVIC, "Hypertension in Pregnancy: Is it time for a new approach to treatment?" J Hypertens; vol.30, no.6, pp.1092-1100, Jun, (2012).

[9] Mir Sajjad Hussain Talpur, Murtaza Hussain Shaikh, Riaz Ali Buriro, Hira Sajjad Talpur Fozia Talpur, Hina Shafi Munazza Ahsan Shaikh, "Internet of Things as Intimating for Pregnant Women's Healthcare: An Impending Privacy Issues," TELKOMNIKA Indonesian Journal of Electrical Engineering vol.12, no.6, pp.4337-4344, June, (2015).

[10] Amal Rammah, Kristina W Whitworth, Inkyu Han, Wenyaw Chan, Judy Wendt Hess, and Elaine Symanski, "Temperature, placental abruption and stillbirth," Environment International, vol.131, no.105067, October, (2019).

[11] "E. Nemati, M. J. Deen, And T. Mondal, "A Wireless Wearable ECG Sensor for Long-Term Applications," IEEE COMMUN. MAG., VOL. 50, NO. 1, PP. 36–43, JAN. 2012"