

# IoT Based Health Care Monitoring System For Rural Pregnant Women

S.Shiny Amala, S.Mythili

**Abstract—** Human resources is the backbone of developing and under developed nations. In most of the developing countries and in the smart cities medical systems is not centralized for sharing of information. Mostly pregnant women is not able to do their regular checkups at the early stage of pregnancy and this leads to higher mortality rate in case of infant and maternal in the rural areas. Due to these issues , the society is facing an immense health problems. In the existing method ultrasound scan of the pregnant women is performed and along with that some vital signs is measured and it is processed by Bluetooth technology. The main drawback of the existing system is that the ultrasound scanning is expensive and the Bluetooth technology. 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 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.

**Abstract—** Temperature sensor, Heart rate sensor, Accelerometer sensor, Arduino board, Internet of things.

## I. INTRODUCTION

Every day, approximately 800 women die from preventable causes related to pregnancy and childbirth. 99% of all maternal deaths occur in the developing countries. Maternal mortality is higher in women living in the rural areas and among poor communities.

About 75.3% of birth in rural areas occur at home. A quarter of world's neonatal deaths each year take place in India. But complications during the pregnancy and childbirth are a leading cause of death in the developing countries.

Therefore necessary efforts should start right from providing timely and quality health assistance to pregnant ladies which will lead to the birth of health

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 can 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. Also they suffer from various health problems 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 issues such as development anomalies, chances for miscarriage, confirming a pregnancy, multiple pregnancies etc. Since the Ultrasound scanning method is expensive and there are objections for its long-term usage. The side effects of long-term ultrasonic exposure on the fetal and young infants 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 fetal and maternal.

## II. PROPOSED WORK:

Proposed work mainly takes care of the pregnant women in the rural areas to help and reduce maternal mortality. The devices used in the hospitals are non portable, sophisticated and expensive. The aim of the proposed work is to develop a compact assist device for the rural pregnant in order to access the vital signs such as temperature, heart rate of the maternal and the kick

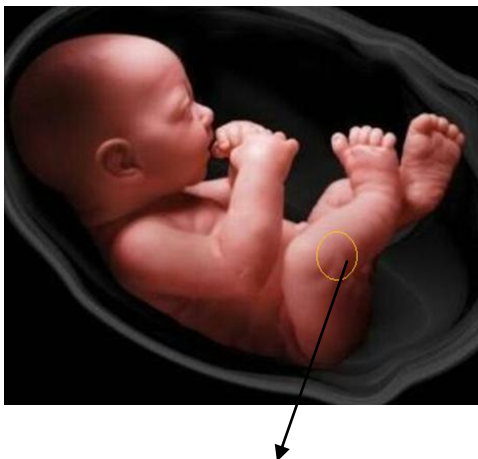
count of the fetus. Medical care of pregnant women involves a lot of attention, proper and timely diagnosis, medication patients should undergo and of course all this costs a lot of money. People in rural areas rarely do proper checkups during pregnancy. The proposed system attempts to give quality and timely medical care at very less expense.

### III. HARDWARE SETUP

In the hardware setup different types of sensors have been used to measure the parameters such as temperature, heart rate and the kick count of the fetus of the maternal. The following sensors are used they are

#### A. ACCELEROMETER SENSOR

The movements of the fetus or fetal movement, in the uterus is an expression of the fetal well-being and depends mainly on the vascular state of the placental insufficiency. These movements, known as “kicking” by the maternal perception occurs starting from the fourth month of pregnancy, as well as other activities such as sleeping, swallowing etc. In addition, the fetal movement will be most obvious in sitting or lying position. By measuring the fetal movement, the clinicians will be able to predict the condition and development of the fetal.



**Fig.1.Sensor placed on the mother abdominal wall**

Fetal movement is monitored by ultrasound scan but this is expensive .so accelerometer sensor is used. Single accelerometer sensor, exhibited low performance .The limitation of data for a single sensor might be caused by the large area of the maternal abdominal wall. Therefore, two accelerometer sensors are used for better accuracy. Accelerometer sensor that measures acceleration with a minimum full-scale range of  $\pm 3g$ . It has 3-axis sensing, Xout, Yout and Zout. ADXL335 Sensor have 3 axis. X and Y have the range from 0.5Hz to 1600Hz .Z have the range from 0.5Hz to 550 Hz. It also has a small and low profile package (4x4x1.45mm). Here, the accelerometer sensors are attached to the limb of the fetus in order to identify the movement of the fetus as shown in fig.1.

The table explains the fetal movement is normal or abnormal. From the fourth month onwards the baby will start kicking but it will not observed by the mother. From the fifth month onwards the mother will observe the movement. If the reduced fetal movement is less than ten times in 12 hours is an important manifestation of fetal hypoxia. So immediate measures should be taken.

**Table 1.Measurement of Fetal Movement**

Duration hours	No of fetal movement	No of fetal movement
	Normal	Abnormal
1 hours	3 or more	2 or fewer
2 hours	6 or more	Less than 6
12 hours	Greater than 10	Less than 10

#### B. TEMPERATURE SENSOR

Temperature sensor are mainly used to measure the body temperature of the maternal. If the temperature is greater than 37 the patient may have fever. If the temperature is less than 35 patient shows symptoms of hypothermia otherwise it is normal. LM35 sensor

operates from 4 to 30 volts. It covers the range from -55°C to +150°C.

### C. HEART RATE SENSOR

Heart rate sensor is used to measure the heart rate of the maternal. 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 output data level 5V TTL level, the heart beat detection is indicated by LED and Output High Pulse, Light source 660nm Super Red LED.

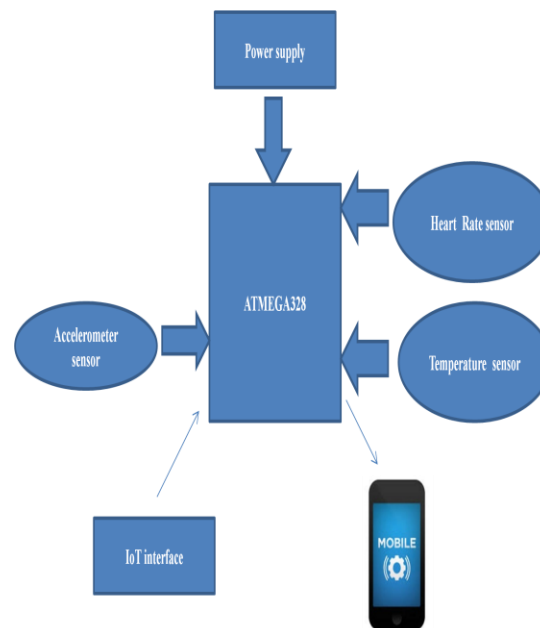
### IV. INTERNET OF THINGS

Internet of things is defined as Things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts. It can be considered the Future of Internet, where every object is connected to other objects. Every object is given a unique identity in the network. This allows remote access of devices through the network, anytime and at any location. IoT enabled objects communicate with each other, access information over the Internet, and interact with users creating smart, pervasive and always connected environments. IoT also enables machine to machine (M2M) communication which allows machines being controlled by the Internet and by other machines. This can revolutionize the way technology is used, as machine takes control of machines overcoming the constraints that people face while communicating with digital systems. Machines can monitor sensors all over the world to generate vast quantity of valuable information that would take a human years to achieve.

### V. SYSTEM DESCRIPTION

In this methodology both the temperature sensor, heart rate sensor and accelerometer sensor are controlled by using an Arduino controller. The data from the sensors are being analyzed by this controller and the results are being simulated. IoT refers to the inter networking of physical devices. The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the

ability to 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 distances.



**Fig.2 Block Diagram**



**Fig.3. Displayed output**

The Arduino UNO is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB, a power jack, an ICSP header, and a reset button. It contains everything

required to support the microcontroller. Coding was uploaded to the Arduino. Since the value sensed from the sensor is in analog form, it can be directly connected to the analog input pin. ADC in this Arduino microcontroller will convert to digital signal before any further process can be done. The Arduino will process the signal and the output will be in digital signal voltage form.

## VI. CONCLUSION

Most studies of maternal mortality are hospital based. However, in developing and under developed countries, where many such deaths take place in the home, hospital statistics do not reflect the true extent of maternal mortality. The use of ADXL335 accelerometer sensor on the maternal abdominal wall is an important advancement in automatic non-invasive detection of fetal movement. The device is lightweight and highly sensitive even for small movements, thus preferred a home monitoring device. Regular monitoring the vital parameters of fetus and women in the rural area, the infant mortality gets reduced. IOT provides quality and timely health assistance for both fetus and women.

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## AUTHORS

**S.Shiny Amala** , ME Scholar, Dept of ECE, PSNA CET., Dindigul, India.

**S.Mythili** , ME(PhD), Associate Professor , Dept of ECE, PSNA CET., Dindigul, India.