WIRELESS FETAL HEART RATE MONITORING USING GSM

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***Abstract*- The measure of fetal heart rate will decrease the fetal mortality in high risk maternal population. Nowadays, the fetal mortality rates are increased even in developed countries. Our goal is to prevent fetal mortality in high risk maternal population. In a day to day life it is difficult to visit a hospital routinely for 2-3 times in a week for working women and diabetic patients. This technique will reduce the mortality rate, assist can be measured from home and alerts the patient. The system consists of wearable ultrasound sensors, built into a fabric belt. Transducer collects the ECG signal and the waveform were displayed using MATLAB, sends heart-rate via SMS to mobile phones. This will alert the patient and also can get suggestion from the expert by sending SMS in a tumultuous situation.**

***Keywords*- Cardiotocography, wireless monitoring, GSM, SMS.**

I. INTRODUCTION

Fetal heart-beat are acquired through the ultrasound sensor, the acquired signal are processed and sent as a SMS. GSM technology is used to send the fetal heart rate as SMS, at the transmitter side the signal also displayed. This will ensure that the signal displayed and the information sent through SMS was same and the technique is reliable.

II. LITERATURE SURVEY

Carditocography is the routine test done to measure the fetal heart rate and the condition of the fetus. The average fetal heart-rate ranges from 110 to 220 beats per minute (bpm) and vary up-to 25 beats per minute. It is a wired technique, it should be done under the supervision of technician and bulky, hence the women should visit the hospital weekly twice. This will be risky and expensive for the patient who has diabetic or other diseases [2].

It has two methods internal and external. In external sensors are attached externally to the mother abdomen and measured. Internal method is an invasive procedure. Electrodes are inserted directly. It is high risk and infectious. Misplacement of electrodes may affect the baby and proper output cannot be obtained.

To overcome this problem wireless technique was proposed. In this system Bluetooth technique was used to transmit the data. The two devices are paired at a time and the data are transmitted in a short package through spread spectrum techniques in 2.4GHz band. As it's a short range communication it can be used in a remote location to transfer data for distance location. If the parity of the devices fails, the transfer of data was terminated [2].

The Zigbee method was later introduced for the wide range communication. Zigbee connects to the other network and transfers the data to the modules. Zigbee works through Internet and cannot achieve end-to-end data transmission. It is not secure more than 802.11 wireless network, transfer of data speed is slower [1] [6].

As the transfer of data is in short range in the existed system, it will be difficult to transfer the information to a distance location for remote population. The fetal activity should be measured frequently for the ill patients. If any of the activity is missed the risk will be increased. Hence to avoid the maternal risk we provide the GSM technique. It has wide range communication compared to Bluetooth and zigbee. GSM is faster, reliable, low cost, and compact. It is the only technique which will sends SMS [7].

III. METHODOLOGY

In this paper we propose a wireless mobile fetal monitoring system which consists of body worn belt in which the monitoring devices with wireless networking technology for better care and anywhere/anytime monitoring.

1) Proposed system

Figure 1 and 2 shows the architecture of proposed system. The proposed system consists of an ultrasound transducer which measures the fetal heart activity then the signal is given to the microcontroller for processing. The whole system works on 5V DC supply. The analog data is converted into digital data by inbuilt ADC present in the microcontroller and then the heart rate is calculated [8]. Finally, the heart rate is transferred through the GSM modem to the required individual. The data is transferred with the format of

<<Heart rate = Number of beats per minute >>

The safe range of heart beat rate is 130<Heart beat<160. If it exceeds, alarm is triggered [9].

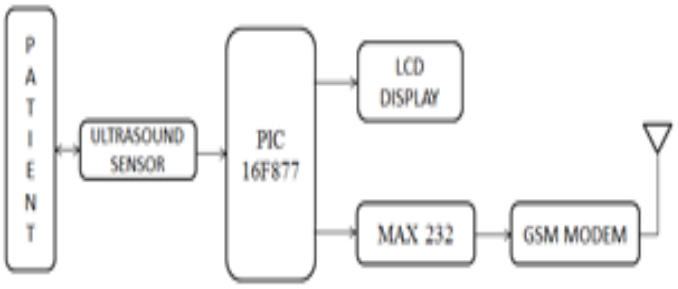

Fig 1: Block diagram of transmitter side

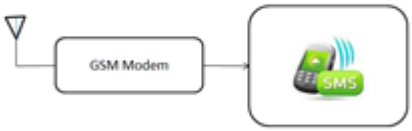

Fig 2: Block diagram of receiver side

2) GSM

GSM have Control over hardware, Ultra small size, lightweight, Low power consumption and High performance on low price. We are using 01.07 versions which is plug and play modem in which it has RTC (Real Time Clock). GSM can operate on three band frequency [10],

-900 MHz (External GSM)
-1800 MHz (Digital communication Service)
-1900 MHz (Personal Communication Service)

3) MAT LAB

MATLAB is the software used for simulation; it is one of the easiest ways to calculate the higher order functions. In this project we are using MAT LAB for simulation and display [5]. The graphical user interface (GUI) tool is used for the simulation. It is a graphical display used to enable a user to perform interactive tasks in which the windows contain control. The script or type commands at the command line are not to be given by the user to accomplish the task. Most GUIs wait for their user to manipulate a control. The GUI itself contains callback which has one or more user-written routines. A particular user action such as pressing a screen button, clicking a mouse button, selecting a menu item, typing a string or a numeric value, or passing the cursor over a component will trigger the execution of callback function. The GUI will respond to these events. The GUI created using MATLAB tools can communicate with other GUI and easily plot the signal required. Radiobutton is used to assign the maximum and minimum property value. All the functions are assigned to call from GUI. Once the functions are assigned the measured signal is loaded and the serial communication timer and baud rate was assigned [4]. The measured signal is segmented. Based on the frequency the fetal and maternal signal are separated and displayed. The expected output is shown in fig 3, fig 4.

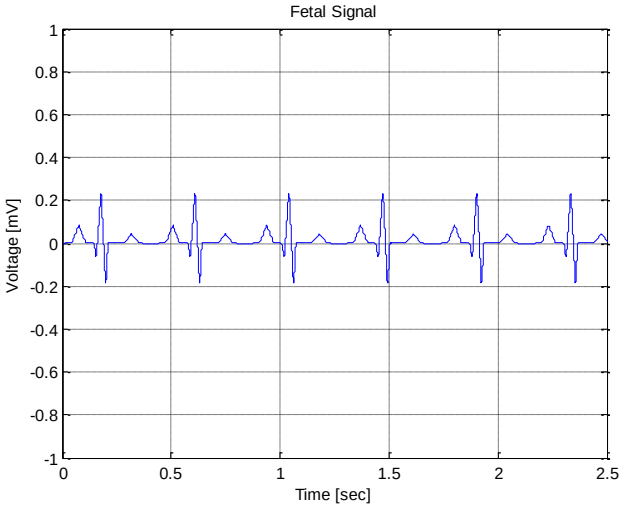

Fig 3: Waveform of fetal ECG

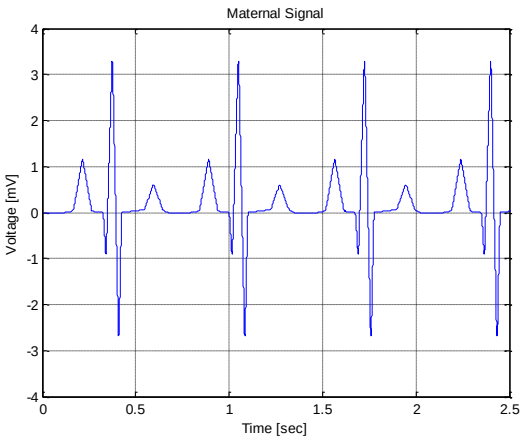

Fig 4: Waveform of maternal ECG

If the electrode disconnected or misplaced, it displayed as error. So that, the patient will aware about the placement of electrodes.

IV. ILLUSTRATION AND RESULT

The implementation of the sensing unit is shown in fig 5.The unit integrates the ultrasound transducers, processing and control circuitry, and the GSM module.

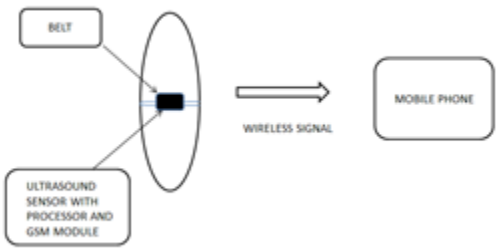

Fig 5: Illustration of system hardware

The user must plug in components in order to activate power and data collection [2].

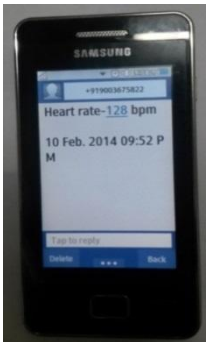

Fig 6: Result displayed on mobile screen

The FHR monitor automatically detects the presence or lack of a connection, to inform the user of the monitor status: such as a valid input connection, GSM modem connection and working. Now, after measurement of heart rate it is sent to the specified mobile as a text message as shown below in fig 6.

V.CONCLUSION

The present fetal monitoring technology is wired and which is applicable to specific clinical locations. In order to collect the measurements, provide diagnosis, and care, patient have to be physically co-located, in time and place.

The proposed system is both wireless and mobile, introducing a new paradigm of care. The measurement can be done as close to the mother's location as possible while the data is viewable from any mobile phones. In addition to enabling remote measurement, diagnosis, and care, current usage scenarios replication are allowed. This is especially beneficial to pre-natal care in developing countries where pregnant mothers may face significant challenges getting to the clinic or hospital multiple times for such a test. The proposed remote monitoring technology makes use of wearable sensors. The system can be improved by using of Wi-Fi and cellular data communication network with reduced size and low cost, without compromising the quality of measurement.

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