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## ADVANCED FETAL ESSENTIAL PARAMETERS OBSERVATION USING WSN

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### Abstract

Pregnancy can be challenging because of unexpected early uterine retrenchments and there are fetal enlargement constraints. To get timely recognition of obstetric troubles, arrangements have been built up for taking electrophysiological readings of fetal heart-rate and electrocardiogram. A distant observation system has been developed for the required parameters gauging at residence. For this to occur instantaneous, the chain of messages about required information must be in such a way that all the home measured signals must reach remote observing place(hospital or a doctor clinic) then and there. Furthermore the gynecologist should be able to receive the data from any place. With internet and a web function, gynecologist can be capable of accessing the information. A web server is created which keeps the patient documentations, changes the signals from graph form into ECG, PPG signals. It also upholds the statement of data with apt protection policy. This advancement of WSN in telemonitoring facilitates immediate attention and treatment of pregnant women whenever required.

**Keywords:** Tele-monitoring, fetalcare, ECGsensor, EMGsensor, Photoplethysmogramsensor.

### Introduction

Pregnancy problems now-a-days have become very common. So, pregnancy monitoring systems have become a prerequisite. Ten to twenty percent of pregnancies are complex due to preterm delivery, fetal hypoxia, fetal growth restriction or hypertension. Unluckily, the percentage of infant mortality is relatively high even in developed countries such as the Netherlands. High-risk pregnancies are generally supervised in the hospital where the patient has to stay for days and even weeks if needed which is costly and besides that the pregnant woman is secluded from her own surroundings. If the delivery is at home the midwife has only a Doppler probe to hear the fetal heart rate. In case of any complications the woman would be suggested to approach the doctor. Later on the gynecologist loses additional time by a baseline measurement of the fetal and maternal condition. Continuous monitoring would be

required at home comfortably, but the monitoring devices that are used at home now a day are not suitable to be used for a long period and always require professional help for initiating and for often adjusting the measurements. Besides, these measurements will be available only in offline and the measurements can be seen by the obstetrician only at a later moment in the hospital. Other limitation of the available devices like CTG (cardiotocograph) is that their sensitivity and accuracy are so low for precise analysis.

### **Related Works:**

In order to overcome all these problems, an enhanced and comfortable measuring system is looked-for. The use of non-invasive electrophysiological measurements is the best idea to aid comfortable home measurements and to attain enough sensitivity for consistent diagnosis of pregnancy problems. There is no availability of, obstetric electrophysiological measurement system with telemonitoring currently [1]. The FECG developed has the potential to progress fetal monitoring in a home delivery setting, because of the electrodes used and the measuring device are of less cost, more patient- friendly, and does not need any adjustment during the measurement when compared to normal CTG devices.

So, for the measurement and data acquirement this system has been chosen. A method has been developed in our study for transmitting the signals to any location wirelessly and for the analysis by gynecologists. Besides, the amplified fetal ECG signals are analyzed and applied on the recovered signals, which offers new prospects for better diagnostics given. For the diagnosis of heart and lung diseases since the early 19<sup>th</sup> century auscultation method has been used.

Few disadvantages exist in this kind of traditional methods. So, for the detection of lung sounds, a novel sound sensor with small size and high sensitivity is used. This sensor has a cantilever which is asymmetrically-gapped, and it consists of a movable mass along with three connection beams in which two are parallel beams which assimilate a piezoelectric element at the top and a mechanical beam at the bottom of sensor [2].

Because of the small size, high sensitivity and less cost, this sensor can be used in the lung sound detection and in particular its emphasis is on the deep breath induced sound. Among the intensifying health problems, heart failure is one, with few effective methods for home monitoring. For detecting changes in cardiac output and contractility, previously ballistocardiogram (BCG) measured on a weighing scale has been shown to be capable. In the later studies, it has been investigated if the measured BCG and electrocardiogram (ECG) signals on a wireless modified scale could track the clinical status of HF patients precisely during their hospital stay [7]. It has been found that by

using logistic regression the root-mean-square (RMS) power of the BCG proved to be a good fit for clinical status.

Diabetes is one of the leading causes of death.

Healthcare professionals monitor health-related measurements in remote health monitoring systems. But, in this remote health monitoring system data-driven methods for dynamically prioritizing and generating tasks are not well investigated.

In the later studies WANDA(Weight and Activity with Blood Pressure and Other Vital Signs) which is a task optimization health project done wirelessly [6]. It uses sensor technology and wireless communication to monitor the health status of diabetic patients it uses sensor technology and wireless communication [8].

The developed algorithm lessens the number of daily task of the patients by using associated rules that satisfies a minimum support threshold.

### **Proposed System**

In this system the following are the three modules:

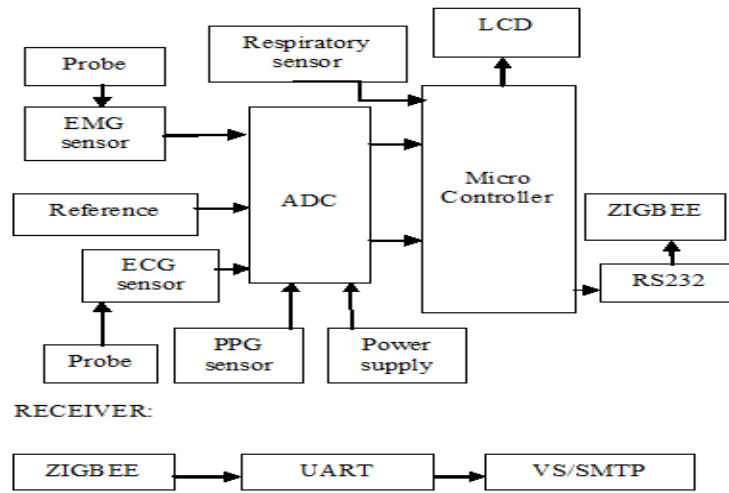
1. Interfacing the sensors with microcontroller.
2. Transmission of data from microcontroller to PC through ZIGBEE.
3. Display of the obtained data from PC in the visual studio.

In our proposed system the sensors present will give the analog output. The analog output is converted into a digital output by analog to digital converter. This output is given to the AT89s52 microcontroller [3]. UART present is used for the serial transmission of data. The resultant signals are transmitted wirelessly to the PC through Zigbee transmitter. At the receiver side Zigbee receiver receives the signals and display the resultant signals in the visual studio.

ZIGBEE: Zigbee is used to transmit the data wirelessly. In this we adopt collision avoidance method, because of which conflicts while transmitting the data are avoided. Besides, time delay is very short i.e in less than 60ms data will be transmitted. It also provides authentication to the data.

Analog to Digital Converter:

Sensors used will be analog in nature. This analog output from the sensors must be converted to digital form so that the corresponding signal will be processed by the microcontroller [4]. It can easily be interfaced with microcontroller. It offers high speed and accuracy. All these features make it suitable for applications

**Block diagram:**

**MICROCONTROLLER:** AT89s52 microcontroller is being used. This is an 8-bit low power microcontroller with 8kb of flash memory. Because of the on-chip flash memory it allows the program memory to be reprogrammed in-system for future use [9]. The UART (universal asynchronous transmitter/ receiver) in the microcontroller is used to change the parallel information from analog to digital converter to serial data which is used for the transmission of data. rs232 is used to get both +12 or -12 volts

**ECG SENSOR:** ECG (Electrocardiograph) sensor is used to measure the heart-rate, the dimensions and location of the heart chambers. It is also used to trace out the damages to the heart muscles in case if any.

**EMG SENSOR:** Electromyography (EMG) sensor is used to evaluate and record the electrical activity of the skeletal muscles.

**PPG SENSOR:** Photoplethysmogram (PPG) sensor is used to sense the rate of blood flow which is controlled by the heart's pumping action.

We perform tele-monitoring on a pregnant lady by putting various sensors on different body parts of the women. We put ECG sensor on the heart to know the heartbeat of women [5]. Next we put PPG sensor in between fingers to know the rate of blood flow and EMG to know the skeletal muscles movement. The received signals will be converted to digital signals by ADC converter.

This will be interfaced with microcontroller AT89s52. The UART in microcontroller change the parallel information to serial data and sent to ZIGBEE which is a wireless transmitter. The gynaecologist present in the hospital will receive the signals through ZIGBEE receiver and if any medication is required he will send it to the patient through SMS or mail.

**Result:**

```

1 #include <reg51.h>
2 #bit zpp=P1^0;
3 #bit ppp=P1^1;
4 #bit epp=P1^5;
5
6 #bit zpp=P1^6;
7 #bit zpp=P1^7;
8 #bit Al=P1^0;
9 #bit Al=P1^1;
10 #bit Cl=P1^0;
11 sfr adcc=AD0;
12 sfr ladc=LAD0;
13 void delay(unsigned int time)
14 {
15     int i=0;
16     for(i=0;i<time;i++)
17     {
18     }
19 }
20 void lcdcmd(unsigned char cb)
21 {
22     zpp=0;
23     zpp=0;
24     ladc=cb;
25     epp=1;
26     ...
27 }

```

```

*** WARNING L16: UNCALLED SEGMENT, IGNORED FOR OVERLAY PROCESS
SEGMENT: PPR?_LCDGAT?EEEE
Program Size: data=16.0 xdata=0 code=239
creating hex file from "aaaaaaa"...
"aaaaaaa" - 0 Error(s), 1 Warning(s)

```

**Conclusion**

In the previous works tele-monitoring system has been used for monitoring and the medication of diabetic, heart patients and gait analysis [10]. But in our paper this tele-monitoring system has been implemented on pregnant ladies also. Previously, fetal heart rate was found. In our proposed system we are using ECG sensor, EMG sensor, PPG sensor and respiratory sensors for detecting the heartbeat, muscle contractions and heart rate respectively .In our system we are using ZIGBEE wireless technology for wireless transmission of data received from sensors.

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