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The Role of IoT in Enhancing Prenatal Care for Expecting Mothers

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ABSTRACT

In rural areas people do not have hospital facilities. So the people in rural areas are not conscious about general check-ups and health. Due to this the pregnant women in rural areas avoids regular check-ups during their initial stage of pregnancy. The main advantage of regular checkup is that it reduces abnormal child birth and fetal mortality rate.

During the time of pregnancy, some women may face the problem of high blood pressure which can impact on mother's kidneys and other organs. It can also result in low birth weight and premature delivery. Due to high blood sugar levels, there may be a chance that the baby may gain extra weight. All these problems may arrive if regular checkups does not happen.

The proposed system, i.e., "IOT based Pregnancy Monitoring System", with the help of IOT's keeps the necessary details and reports of a patient in the system, Due to this, The pregnant women need not go to hospitals for regular checkups. This system consists of a GSM module which sends a message to the doctor if any abnormal condition occur.

This system is designed to measure the count of kicks by unborn child and it is transfer into the ARDUINO MEGA controller. Motion of the foetal and some important parameters such as Blood pressure, 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 using IoT and it is displayed in the mobile phone. This system is highly sensitive and light weight, so it is preferred as a home monitoring device.

Index Terms *- ESP8266 Wifi Module, MAX30100 Pulse oximeter Heart rate sensor, DS18B20 Temperature sensor, OLED, GSM Module, ADXL345 Accelerometer Sensor, Arduino ATMega 2560 controller, Power Supply*

1. INTRODUCTION

In developing countries people living in rural areas do not have hospital facilities. So people in rural areas are not conscious about their health. During pregnancy some women may face Gestational diabetes, Preeclampsia which impact by high blood pressure and damage to the organs, Preterm Labor begins before 37 weeks of pregnancy, Infections, Fetal growth restriction etc. We cannot detect these problems if pregnant women neglect their regular check-ups. By using an IoT-based pregnant women health care monitoring system, healthcare providers can provide more personalized care and improve the outcomes of the pregnancy. It can also help to reduce the number of prenatal visits required, making it easier for women who live in remote areas to access quality care.

2. BLOCK DIAGRAM AND EXPLANATION

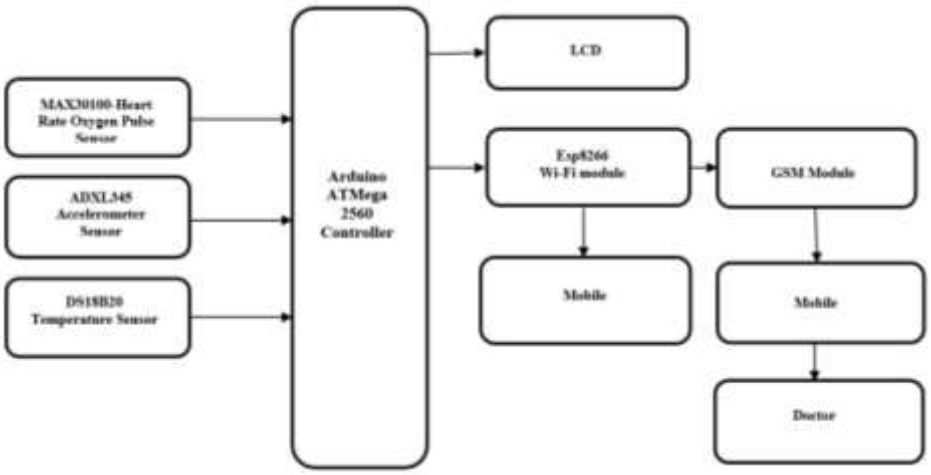


Fig. 1 Block Diagram

2.1 EXPLANATION

2.1.1 MAX30100 Heart Rate Oxygen Pulse Sensor:

MAX30100 Hearth Rate Oxygen Pulse Sensor can be used for multiple applications. It can detect both heart rate sensor as well as oxygen. The Operating Voltage is 3.3V

Applications:

- Medical Monitoring Devices
- Wearable Devices

2.1.2 DS18B20 Temperature Sensor:

The DS18B20 temperature sensor is a one-wire digital temperature sensor. This means that it just requires one data line (and GND) to communicate with the Arduino.

It can be powered by an external power supply or it can derive power from the data line (called “parasite mode”), which eliminates the need for an external power supply.

Each DS18B20 temperature sensor has a unique 64-bit serial code. This allows you to wire multiple sensors to the same data wire. So, you can get temperature from multiple sensors using just one Arduino digital pin.

2.1.3 ADXL345 Accelerometer Module:

The **ADXL345** Accelerometer sensor can provide angle of the baby. The sensor can do it in 3 axes, i.e., X, Y and Z axes. The sensor can also measure dynamic and static acceleration forces. This **ADXL345 Accelerometer module** consists of an ADXL345 Accelerometer IC, Voltage Regulator IC, Level Shifter IC, resistors, and capacitors in an integrated circuit. Different manufacturers use a different voltage regulator IC.

Arduino ATMega 2560 Microcontroller:

The ATMega2560 from Atmel is an 8-bit low-power microcontroller that is found in the popular Arduino Mega development board. It is based on the 8-bit AVR RISC architecture and has 256KB flash memory, 8KB SRAM, and 4KB EEPROM. It consists of 54 digital input output pins, 16 analog inputs, 4 UARTs, 16MHz crystal oscillator, a USB connection, an ICSP header, a reset button and a power jack.

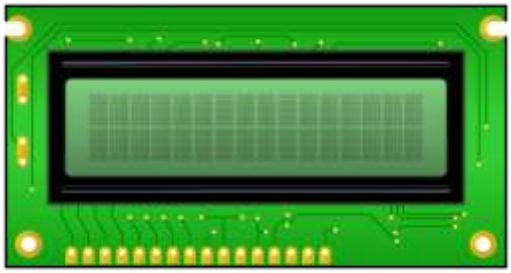
All analog pins of the board can be used as a digital I/O pins. When we compare these boards with other type of Arduino boards, tehse are physically superior

Features and Specifications

1. 86 programmable IO lines
2. Two 8-bit timer/counters, four 16-bit timer/counters
3. 16-channel 10-bit ADC
4. Four USART
5. SPI serial interface
6. On-chip analog comparator

2.1.4 LCD:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or Reflector. This is a display device used to display data like temperature, heart rate, oxygen levels and accelerometer values



2.1.5 GSM Module:

A GSM module is used to establish communication between a mobile device and a GSM system. In this project we are using a GSM module. The GSM module transmits the data through SMS. If any abnormal conditions occur, the message will be sent to the doctor

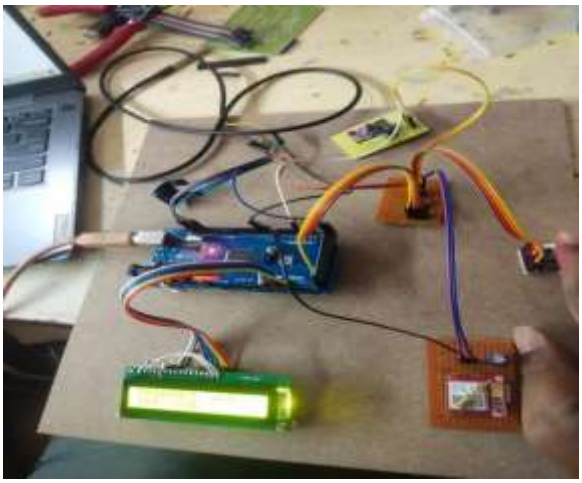
2.1.6 ESP8266 Wi-Fi Module:

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much WiFi-ability as a WiFi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost-effective board with a huge, and ever growing, community.

The Wifi module gives access to connect through internet. It will connect to mobile network. Then it send the data to smart application,i.e., ThingSpeak. In ThingSpeak we can see the graphical representation of data

3. WORKING PRINCIPLE

The hardware components that we are going to use in this project are Arduino ATMega 2560 controller, GSM module, Wifi module, Accelerometer, Temperature Sensor, Heart-rate pulse oximeter. The connections are made as shown in below figure. Accelerometer, Temperature Sensor, Heart-rate pulse oximeter are connected to Arduino ATMega. The parameters like heart rate, oxygen levels, temperature and accelerometer values are displayed on the LCD screen. The Arduino sends the data to GSM module. The GSM module transmits the data through SMS. Here Wifi module is used to provide access to internet. If any abnormal conditions occur, the message will be sent to doctor and hence necessary medications can be implemented by the doctor immediately



4. HARDWARE AND SOFTWARE REQUIREMENTS

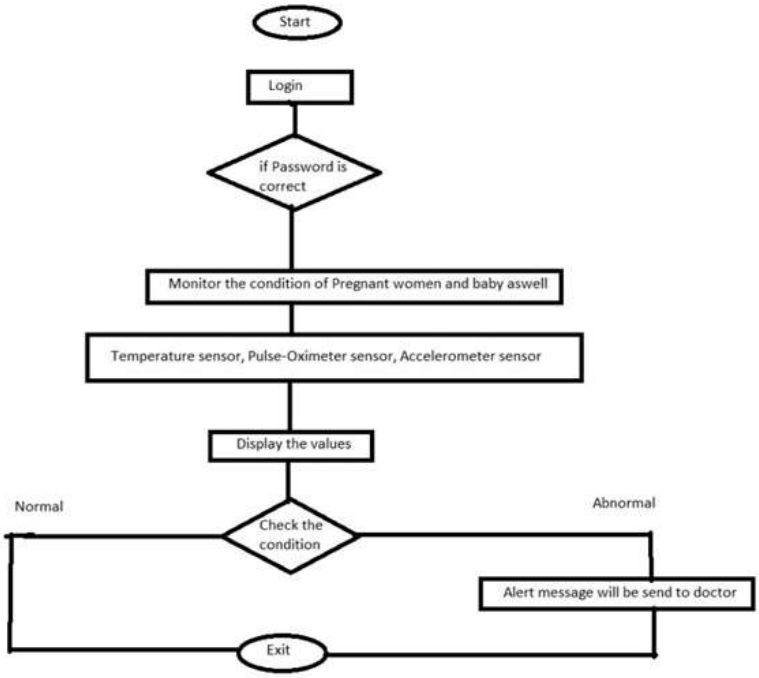
4.1 Hardware Requirements

1. Power supply
2. DS18B20 Temperature Sensor
3. ESP8266 Wifi Module
4. MAX30100 Heart rate oxygen pulse sensor
5. ADXL345 Accelerometer Module
6. OLED

4.2 Software Requirements

1.
2. Arduino IDE
3. Embedded C language

5. Design Flow



6. FIGURES

Fig: Graphical Representation Observed in Thinkpad

7. END SECTIONS

7.1 Appendix A

The Arduino IDE source code is included in Appendix A, which is written in the C programming language and uses the Microsoft environment to construct the software. The code must be entered into that software, then uploaded, and the results verified.

7.2 Appendix B

Appendix B includes references, as well as research papers from which we derived the foundational research for this project.

7.3 Acknowledgments

I'd like to take this time to thank the individuals listed below for their invaluable contributions and support with this project. Initially, I would like to thank my project supervisor, **Mr. CH. Lakshmana, M. Tech, Assistant Professor** for his guidance and support, especially for his valuable ideas and knowledge pro- vided throughout the Project. His expertise and experience in **Communication and signal processing** makes valuable comments and suggestions have been very useful in solving problems encountered during the Project.

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