VISVESVARAYA TECHNOLOGICAL UNIVERSITY

JNANASANGAMA, BELAGAVI-590 018, KARNATAKA.

FINAL YEAR PROJECT REPORT – PHASE 2

ON

"SMART PRENATAL HEALTH CARE MONITORING SYSTEM FOR PREGNANCY WOMEN IN RURAL AREAS USING IoT"

Submitted in the partial fulfillment of requirement for the award of Degree

B.E.in Computer Science & Engineering

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Department of Computer Science and Engineering

Vision and Mission of the Department

VISION

To be a centre of excellence in imparting state-of-the-art technology in the field of Computer Science and Engineering education enabling the students to become professionally sound and ethically strong.

MISSION

M1	Adapting best teaching and learning techniques that cultivates Questioning and Reasoning culture among the students.
M2	Creating collaborative learning environment that ignites the critical thinking in students and leading to the innovation.
M3	Establishing Industry Institute relationship to bridge the skill gap and make them industry ready and relevant.
M4	Mentoring students to be socially responsible by inculcating ethical and moral values.

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The graduates will be able to

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PEO2	To continue their career in industry, academia and to pursue higher studies and research
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PEO4	To work in diversified environment by acquiring leadership qualities with strong Communication skills along with professional and ethical values

PROGRAM SPECIFIC OUTCOMES (PSOs)

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PSO2	To develop secure, Scalable, Resilient and distributed applications for industry and societal requirements.
PSO3	To learn and apply the concepts and construct of emerging technologies like Artificial Intelligence, Machine learning, Deep learning, Big Data Analytics, IOT, Cloud Computing, etc for any real time problems.

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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. and now a-days, Corona virus is a most dangerous virus in the World. We followed Covid-19 Protocol's, but the cases are Going to High Many death Case's we seeing. In this Pandemic Situation the Pregnancy Women are lived In rural areas can't go to city and take the treatment, 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 transferinto the ARDUINO UNO 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 way of IOTand 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.

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CHAPTER 1

INTRODUCTION

Due to unavailability of hospitals in rural areas and longer distance required to travel, People are not really conscious about their health, for small injuries and routine check-ups. Due to this pregnant lady 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. During Pregnancy, every trimester will be considered of 14 weeks and overall pregnancy length will be of 42 weeks. During this period, there is possibility of various complication due to maternal sepsis, bleeding and variation in blood pressure which may results in gestational diabetes and weight gain during pregnancy. 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 results in low birth weight and premature delivery. Due to high blood sugar levels, it is possible that the baby may gain extra weight.

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 it. 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.

1.1 INTERNET OF THINGS

Internet of Things (IoT) is gaining prevalent popularity among research community because of its impending to digitize real world physical objects around us. IoT has emerged as a result of current wireless telecommunication services and ever-present presence of Internet. Wireless sensor networks, RFID tags, actuators and various handheld intelligent devices such as mobile phones, PDAs, Tabs etc. are foremost to the surfacing of IoT. 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. 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.

1.2 IoT SERVICES

Internet of things is supposed to make devices to be smart by enhancing their efficiency. Various Industries and domains have leveraged this technology in order to make the task easier. Below are some of the important services provided by virtue of the Internet of things.

- **Medical treatment**

There are devices that have been developed using IoT that helps the patient while treatment. On the one hand, where being seated in the hospital to get the treatment done is way too expensive; on the other hand, using such IoT-enabled devices makes it affordable to patients to continue the treatment at a low cost. The most commonly used device in this domain is used to fight against diabetes.

- **Remote control**

IoT lets us control the devices that are located geographically far away. It is the feature of devices connected through IoT that they can take input from the other devices that are connected through the internet. Commonly the mobile phones are being used commonly to send instructions to the device remotely. In such cases, usually, the Internet is preferred, while if the devices are connected to the same network, they can communicate using WiFi.3) Enhancing Lightning Experience IoT can be used to bring several functionalities to make your experience and interaction with light-emitting devices the best. We can consider making the lights glow so that it does light up only when someone is walking, which could lead to saving lots to power consumption.

- **Detecting Machine failure**

The machines use these days are way too complex to understand. By making the use of IoT, a system could be developed that can detect the failure in the machines. Such machines are used to alert the user regarding the improper working of any part of the device that will be helpful to ensure the quality of the product. It can also lead to prevent the users of the machine from a fatal accident.

- **Developing an optimal indoor surrounding**

Using the IoT-enabled devices in the inside environment could be made very smart and optimal. Smart devices lower down the consumption of resources and enhance efficiency. This could lead to a better working setting as it is the place that needs to be well developed by using fewer resources, and IoT can be proven to be the best option to serve such environments.

- **Integration with AI application**

Artificial intelligence is the next big thing, as almost all smart devices use it to enhance efficiency. The concepts and features of IoT could be integrated with AI-based applications to make it work much better and increase computing power. There are already devices out in the market that leverage both the AI apps and the IoT, and those devices are already working efficiently.

- **To offer a personalized experience**

In the era of e-commerce, there are millions of customers dependent on the online website to buy the stuff they need. The e-commerce websites also understand that it is very important for them to treat their customers with a personalized experience so that they can feel comfortable using their platform, and here is the place where IoT could be used in the best manner. It makes the user use the online platform with ease so that they can focus on what they need to buy rather on focusing on how the platform works.

1.3 SENSORS

a sensor is a device, module, machine, or subsystem that detects events or changes in its environment and sends the information to other electronics, frequently a computer processor. Sensors are always used with other electronics. Sensors are used in everyday objects such as touch-sensitive elevator buttons tactile sensor and lamps which dim or brighten by touching the base, and in innumerable applications of which most people are never aware. With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure and flow measurement, for example into MARG sensors. Analog sensors such as potentiometers and force-sensing resistors are still widely used. Their applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, robotics and many other aspects of our day-to-day life. There is a wide range of other sensors that measure chemical and physical properties of materials, including optical sensors for refractive index measurement, vibrational sensors for fluid viscosity measurement, and electro-chemical sensors for monitoring pH of fluids.

A sensor's sensitivity indicates how much its output changes when the input quantity it measures changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, its sensitivity is 1 cm/°C it is basically the slope dy/dx assuming a linear characteristic. Some sensors can also affect what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors are usually designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly faster measurement time and higher sensitivity compared with macroscopic approaches. Due to the increasing demand for rapid, affordable and reliable information in today's world, disposable sensors—low-cost and easy-to-use devices for short-term monitoring or single-shot measurements—have recently gained growing importance. Using this class of sensors, critical analytical information can be obtained by anyone, anywhere and at any time, without the need for recalibration and worrying about contamination

1.4 LANGUAGES

1.4.1 EMBEDDED C

Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems. Embedded C programming typically requires nonstandard extensions to the C language in order to support enhanced microprocessor features such as fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations .It includes a number of features not available in normal C, such as fixed-point arithmetic, named address spaces and basic I/O hardware addressing. Embedded C is an extension of C language and it is used to develop micro-controller based applications. The extensions in the Embedded C language from normal C Programming Language is the I/O Hardware Addressing, fixed-point arithmetic operations, accessing address spaces, etc.

1.4.2 PYTHON

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed. Often, programmers fall in love with Python because of the increased productivity it provides. Since there is no compilation step, the edit-test-debug cycle is incredibly fast. Debugging Python programs is easy: a bug or bad input will never cause a segmentation fault. Instead, when the interpreter discovers an error, it raises an exception. When the program doesn't catch the exception, the interpreter prints a stack trace. A source level debugger allows inspection of local and global variables, evaluation of arbitrary expressions, setting breakpoints, stepping through the code a line at a time, and so on. The debugger is written in Python itself, testifying to Python's introspective power. On the other hand, often the quickest way to debug a program is to add a few print statements to the source: the fast edit-test-debug cycle makes this simple approach very effective.

1.5 CLOUD COMPUTING

Cloud computing is believed to have been invented by Joseph Carl Robnett Licklider in the 1960s with his work on ARPANET to connect people and data from anywhere at any time. In 1983, CompuServe offered its consumer users a small amount of disk space that could be used to store any files they chose to upload. Simply put, cloud computing is the delivery of computing services—including servers, storage, databases, networking, software, analytics, and intelligence—over the Internet "the cloud" to offer faster innovation, flexible resources, and economies of scale. In searching for other uses for the computer, Joseph discovered a way of connecting people, allowing the sharing of data and communicating on a global scale. After this, the global sharing and communication network ARPANET was created and enabled Cloud Computing to take form.

Benefits of cloud computing

- Reduced IT costs. Moving to cloud computing may reduce the cost of managing and maintaining your IT systems.
- Scalability.
- Business continuity.
- Collaboration efficiency.
- Flexibility of work practices.
- Access to automatic updates.
- Also consider.

1.6 BLYNK PLATFORM

Blynk is the most popular IoT platform for connecting devices to the cloud, designing apps to remotely control and monitor them, and managing thousands of deployed products. Blynk is an IoT platform for iOS or Android smartphones that is used to control Arduino, Raspberry Pi and NodeMCU via the Internet. This application is used to create a graphical interface or human machine interface (HMI) by compiling and providing the appropriate address on the available widgets. All data you send from Hardware to Blynk is saved by default. But you can access it only via application we don't have any other interface at the moment. If you need more than that - you have to install local Blynk server and you'll be able to get all your in csv files.

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE SUMMARY

- "IoT Based Health Care Monitoring System for Rural Pregnant Women" by S.ShinyAmalaandDr.S.Mythili: In this proposed system analyze about detail survey on pregnant women health monitoring. They give multiple information about IOT technology.[1]
- "Security and channel noise management in cognitive radio networks" by A. Haldorai and A. Ramu: In this papers related to monitoring the Pregnant women health from rural areas by using iot technology. The sensors that sensed like heartbeat, temperature and blood pressure with the help of microcontroller and output of the sensors are viewed on smart phone through iot interface. They proposed smart health care monitoring for pregnant women. [2]
- "Canonical Correlation Analysis Based Hyper Basis Feedforward Neural Network Classification for Urban Sustainability" by A. Haldorai and A. Ramu : In this proposed system they use IOT CGM based technology which helps to collect the information about the diabetes. It is commonly known as diabetes mellitus. The glucose levels can be measured with the help of CGM. Then it viewed on health application. [3]
- "Efficient Diagnosis of Liver Disease using Support Vector Machine Optimized with Crows Search Algorithm" by D. Devikanniga, A. Ramu, and A. Haldorai : They suggested a baby application text. Their policy involves sending a message to pregnant women in order to encourage health and disease prevention within the target audience. They discovered that the application has potential. Heartbeat and temperature sensors for remote monitoring are managed using Arduino and a processing unit in this paper. Bluetooth is used for contact and tracking of mobile apps. These assist us in keeping track of our vital signs such as body temperature, blood pressure, and heart rate. [4]
- "Pilot evaluation of the text4baby mobile health program" by E. W.D., W. J.L., and S. J

  : In this system is proposed to monitor the movement of the fetus inside the womb of mother. By this they use ultrasound scan technique. This technique is highly cost efficient and by ultra sound wave there is a possible of health defect to fetus may occur. [6]
- In this proposed to They performed their study by analyzing the actions of pregnant

women on the internet. They looked at 47 different smartphone apps that pregnant women use. [7, 8]

- "Supervised machine learning techniques in cognitive radio networks during cooperative spectrum handovers" by H. Anandakumar and K. Umamaheswari : They discovered that apps related to child care, birth, and pregnancy have become valuable sources of knowledge for expectant mothers [9].
- "A bio-inspired swarm intelligence technique for social aware cognitive radio handovers " by H. Anandakumar and K. Umamaheswari : In this paper suggested a wearable system for pregnant women to use. With the aid of a microcontroller, it gathers critical parameters such as the woman's heart rate, pulse, and temperature, and sends a warning signal to the doctor from a nearby health center. [10]
- "Early Detection of Lung Cancer Using Wavelet Feature Descriptor and Feed Forward Back Propagation Neural Networks Classifier" by R. Arulmurugan and H. Anandakumar In this paper, they looked at how IoT would help with long-term data tracking during high-risk pregnancies. They use a smart program to keep track of pregnant women's vital signs. [11]

2.2 EXISTING SYSTEM

In the existing method ultrasound scan of the pregnant women is performed and along with that some vital signs is measured. The main drawback of the existing system is that the ultrasound scanning is expensive. 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.

2.3 PROBLEM STATEMENT

In rural areas there is a lack of smart health monitoring system for pregnant women and due to this there are lot of deaths happening.

2.4 PROPOSED SOLUTION

In this system the Arduino is used to attach with three sensors namely memes sensor and heart beat sensor. This acts akin to a microcontroller which collects and reads values from the sensor through the physical connection of input and output pins of the board. WiFi module are attached in this system thus it helps to take reading and display on your mobile.

2.5 PROPOSED OBJECTIVE

- To Construct the hardware model for measuring various health problems in pregnancy women and the fetus.
- To deploy the various parameters from the sensors and Arduino board to the cloud.
- To develop the android-based UI for interaction with cloud.

CHAPTER 3

SYSTEM REQUIREMENTS

3.1 TOOLS AND TECHNOLOGIES USED

3.1.1 HARDWARE STACK

- ACCELEROMETER SENSOR
- HEART BEAT SENSOR
- ARDUINO UNO
- WIFIMODULE
- BLOOD PRESSURE SENSOR

3.1.2 SOFTWARE STACK

- ARDUINO IDE
- EMBEDDED C LANGUAGE
- IOT PAGE

3.1.3 TOOLS IDENTIFIED

- SENSORS

  HEART RATE SENSOR

  ACCELROMETER SENSOR

  TEMPERATURE SENSOR

  ARDUINO
- ELASTIC BELT

3.1.4 CLOUD SERVICES

- BLYNK PLATFORM

CHAPTER 4

SYSTEM DESIGN

4.1 SYSTEM ARCHITECTURE

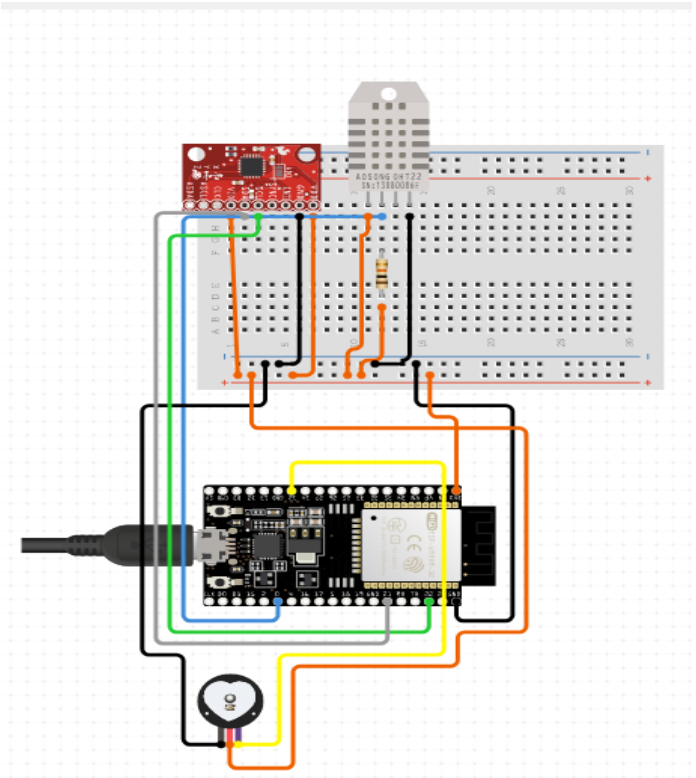

Fig 4.1: Pin Connections of Arduino board with Bread Board

The device simple and a wearable device which runs on a battery and also weightless and portable in very small size also runs on battery which so much safe . The system is used mainly to monitor the mother health in initial and required stages, but this can be used as a full-time health monitoring system. The system consists of an accl sensor which will record the baby kick and the temperature sensor which will record the mother body temperature even high temperature and low temperature of the body of the mother is not good for the baby for that reason we are monitoring body temperature. Doctor says the kick of the baby at least should be 10 kick per day. If it reaches more than 12 kick per day, it will notify to visit the doctor. There is a Heart rate sensor to measure the heart rate. Overall, this device can be used to monitor the health and also pregnant cannot travel long distance to meet doctor for small purpose they can have an online meeting while conduction of online meeting they can where this and consult doctor if there is any changes the doctor may prefer to come to hospital. And, patient side can also view real time health status and even doctors will have the interface with some more data.

4.2 METHODOLOGY DIAGRAM

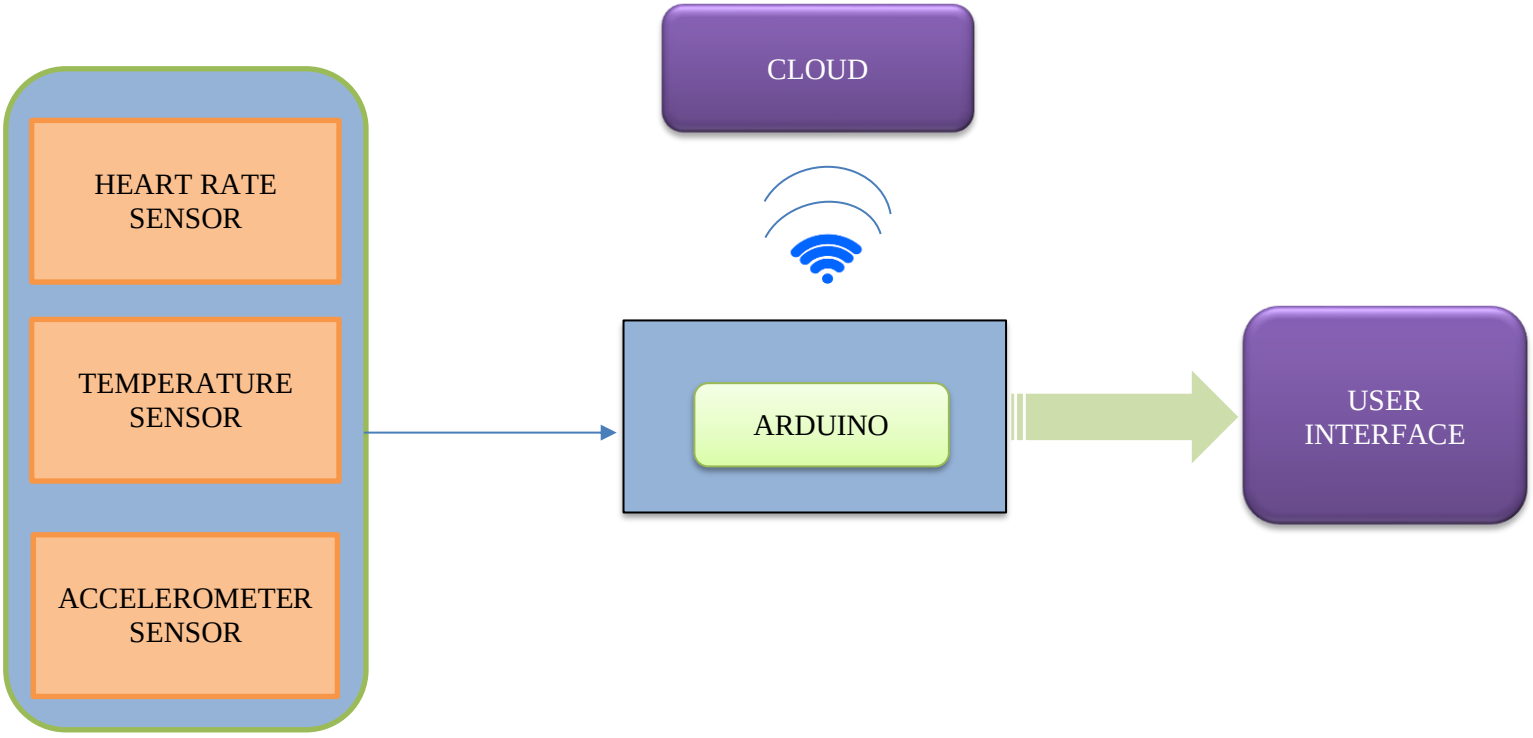

Fig 4.2: Methodology diagram

DETAILED DESCRIPTION OF THE METHODOLOGY

In this system the Arduino (ATmega328) is used to attach with three sensors namely memes sensor and heart beat sensor Blood pressure sensor. This acts akin to a microcontroller which collects and reads values from the sensor through the physical connection of input and output pins of the board. WiFi module (ESP8266-12E) are attached in this system thus it helps to take reading and display on your mobile. The Internet of things progressively allow to incorporate device capable of connecting to the internet and endow with information on the condition of health of pregnant women and provide information in real time to doctors who assist it. This data can be retrieved or viewed in the form a mobile at the instant of time with secured authentication. This data will be kept and stored as a backup for any kind of future reference. The main source of pregnant women health care system at present stage is that when pregnant women is at the rest position.

Heart beat sensor

Heartbeat Sensor is an electronic device that is used to measure the heart rate i.e. speed of the heartbeat. Monitoring body heart rate is the basic things that we do in order to keep us healthy. Monitoring heart rate is very important for pregnancy women as it determines the condition of the heart (just heart rate). There are more easy way to monitor the heart rate is to use a Heartbeat Sensor. It comes in different shapes and sizes and allows an instant way to measure the heartbeat. Heartbeat Sensors are available in Wrist Watches (Smart Watches), Smart Phones, chest straps, etc. The heartbeat is measured in beats per minute or bpm, which indicates the number of times the heart is contracting or expanding in a minute.

Heart beat sensor is designed to give digital output of heat beat when a thumb finger is placed between the LDR & LED on it. The LED will flash simultaneously at each heart beat, while the heart beat detector is working. This analog output is directly connected to microcontroller to measure the Beats Per Minute (BPM) rate of the body and it works based on the modulation of light by the gore flows through finger at each heart beat. Its mechanism is based on the theory of light modulation.

Fig 4.2.1: Heart Beat Sensor

Two Ways to Measure a Heartbeat

- **Manual Way**: Heartbeat can be checked manually by checking one's pulses at two locations- wrist (the **radial pulse**) and the neck (**carotid pulse**). The procedure is to place the two fingers (index and middle finger) on the wrist (or neck below the windpipe) and count the number of pulses for 30 seconds and then multiplying that number by 2 to get the heartbeat rate. However, pressure should be applied minimum and also fingers should be moved up and down till the pulse is felt.
- **Using a sensor**: Heart Beat can be measured based on optical power variation as light is scattered or absorbed during its path through the blood as the heartbeat changes.

Principle of Heartbeat Sensor

The heartbeat sensor is based on the principle of photoplethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (avascular region). In the case of applications where the heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by the blood, the signal pulses are equivalent to the heartbeat pulses.

Working of a Heartbeat Sensor

The basic heartbeat sensor consists of a light-emitting diode and a detector like a light detecting resistor or a photodiode. The heartbeat pulses cause a variation in the flow of blood to different regions of the body. When tissue is illuminated with the light source, i.e. light emitted by the led, it either reflects (a finger tissue) or transmits the light (earlobe). Some of the light is absorbed by the blood and the transmitted or the reflected light is received by the light detector. The amount of light absorbed depends on the blood volume in that tissue. The detector output is in the form of the electrical signal and is proportional to the heartbeat rate.

Temperature Sensor

They are devices to measure temperature readings through electrical signals. The sensor is made up of two metals, which generate electrical voltage or resistance once it notices a change in temperature. The DHT11 is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds.

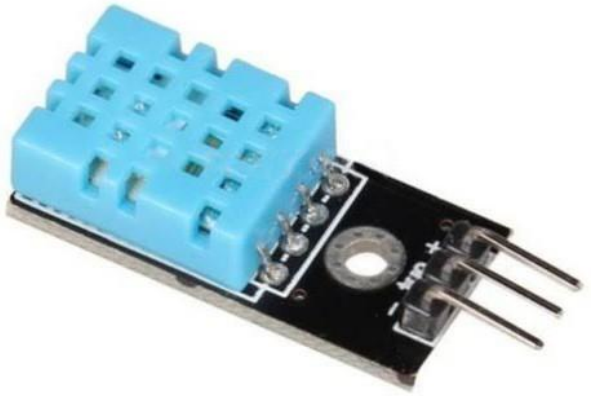

Fig 4.2.2: DTH11 Temperature Sensor

The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.

DHT11 Specifications

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data
- Temperature Range: 0°C to 50°C
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

Memes sensor / Accelerometer sensor

MEMS sensor is also known as accelerometer sensor and it is mainly used to measure the movements of the body. 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 MEMS sensor, the kicking measure of the fetus is measured.

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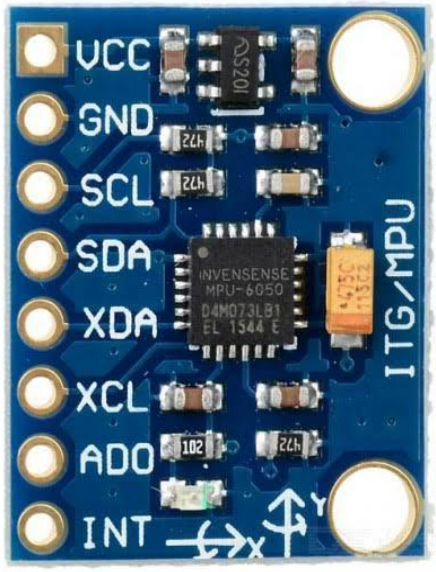

Fig 4.2.3: MPU 6050 Accelerometer sensor

MPU 6050

- MPU6050 is a Micro Electro-mechanical system (MEMS), it consists of three-axis accelerometer and three-axis gyroscope. It helps us to measure velocity, orientation, acceleration, displacement and other motion like features.
- MPU6050 consists of Digital Motion Processor (DMP), which has property to solve complex calculations.
- MPU6050 consists of a 16-bit analog to digital converter hardware. Due to this feature, it captures three-dimension motion at the same time.
- This module has some famous features which are easily accessible, due to its easy availability it can be used with a famous microcontroller like Arduino. Friend if you are looking for a sensor to control a motion of your Drone, Self Balancing Robot, RC Cars and something like this, then MPU6050 will be a good choice for you.
- This module uses the I2C module for interfacing with Arduino.
- MPU6050 is less expensive, Its main feature is that it can easily combine with accelerometer and gyro.

Arduino

The main purpose of Arduino is to sense the framework by collecting the input from the connected sensors. Then it sends this data to the cloud by sending this data to a particular URL/IP address. The collected data will send to IP repeatedly over a particular period of time.

Fig 4.2.4: Arduino

The ESP8266 Wi-Fi module is a Security Operation Center which is self contained that is integrated with TCP/IP protocol which will give direct micro controller entry to WIFI network. It is specifically designed for mobile devices and other IoT applications with reasonable prices. The physical device can be attached to a wireless WIFI network, internet intranet, extranet communication and other networking capabilities

4.3 BLOCK DIAGRAM

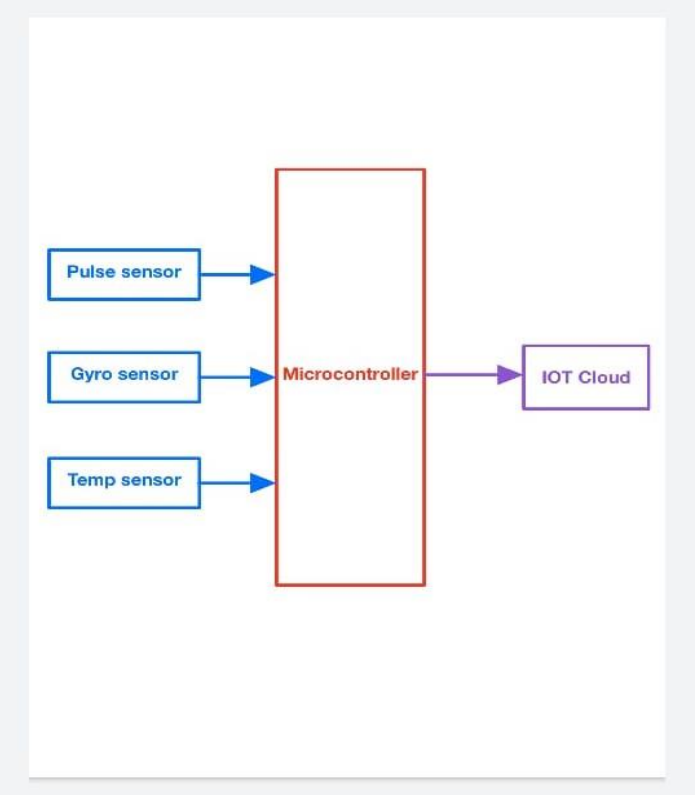

Fig 4.3: Block diagram

The sensors can have their own ADCs that are optimized to the resolution of the sensor data and assist with minimizing the power consumption of the node. These can then be interfaced to the microcontroller via a serial UART or general-purpose I/O pins, or through an I²C two-wire interface. This then delivers the data direct into the registers in the controller where it can be accessed by the protocol stack.

CHAPTER 5

IMPLEMENTATION

5.1 Working Steps

- Once the app starts working the device will starts debugging the code, then the device is going to search for a open WiFi with the pre mentioned credentials.
- After connecting with the WiFi it will start to read the data from the sensor and it will collect the data from sensor and send it to the cloud .
- Once the data is sent to the cloud operations are done on the data received and also the data pre-processing take place.
- After the data is processed in the cloud along with all the calculations the process data is sent to the app.
- Then the app will display the processed data.

5.2 Pseudo code

Pseudo code for staring the device

```
void setup(void) {
  Serial.begin(115200);
  Blynk.begin(auth, ssid, pass);
  while (!Serial)
  Blynk.notify("Device Online");
   delay(10); // will pause Zero, Leonardo, etc until serial console
opens

  Serial.println("Adafruit MPU6050 test!");

  // Try to initialize!
  if (!mpu.begin()) {
   Serial.println("Failed to find MPU6050 chip");
   while (1) {
    delay(10);
   }
  }
  Serial.println("MPU6050 Found!");
```

Working conditions of the sensors

```
if (!mpu.begin()) {
    Serial.println("Failed to find MPU6050 chip");
    while (1) {
      delay(10);
    }
  }
  Serial.println("MPU6050 Found!");

  mpu.setAccelerometerRange(MPU6050_RANGE_8_G);
  Serial.print("Accelerometer range set to: ");
  switch (mpu.getAccelerometerRange()) {
  case MPU6050_RANGE_2_G:
    Serial.println("+-2G");
    break;
  case MPU6050_RANGE_4_G:
    Serial.println("+-4G");
    break;
  case MPU6050_RANGE_8_G:
    Serial.println("+-8G");
    break;
  case MPU6050_RANGE_16_G:
    Serial.println("+-16G");
    break;
  }
```

Conditions of the Gyroscopic sensor

```
mpu.setGyroRange(MPU6050_RANGE_500_DEG);
  Serial.print("Gyro range set to: ");
  switch (mpu.getGyroRange()) {
  case MPU6050_RANGE_250_DEG:
    Serial.println("+- 250 deg/s");
    break;
  case MPU6050_RANGE_500_DEG:
    Serial.println("+- 500 deg/s");
    break;
  case MPU6050_RANGE_1000_DEG:
    Serial.println("+- 1000 deg/s");
```

```
    break;
  case MPU6050_RANGE_2000_DEG:
    Serial.println("+- 2000 deg/s");
    break;
  }
```

Condition for Accelerometer sensor

```
   Serial.print("Acceleration X: ");
  Serial.print(a.acceleration.x);
  Serial.print(", Y: ");
  Serial.print(a.acceleration.y);
  Serial.print(", Z: ");
  Serial.print(a.acceleration.z);
  Serial.println(" m/s^2");
```

Condition for Temperature sensor

```
 Serial.print("Temperature: ");
 Serial.print(temp.temperature);
 Serial.println(" degC");

  Serial.println(kick);
  lcd.print(0, 1, "no of kick ");
  lcd.print(12,1,kick);
  Blynk.virtualWrite(V3,g.gyro.x);
  Blynk.virtualWrite(V4,temp.temperature);

    Blynk.notify("Plz contact doctor");

     reading = analogRead(36);
     if(reading > UpperThreshold && IgnoreReading == false)
{
     if(FirstPulseDetected == false){
     FirstPulseTime = millis();
     FirstPulseDetected = true;
     }
        else{
      SecondPulseTime = millis();
      PulseInterval = SecondPulseTime - FirstPulseTime;
       FirstPulseTime = SecondPulseTime;
        }
```

```
  IgnoreReading = true;
    }
    if(reading < LowerThreshold){
      IgnoreReading = false;
    }

    BPM = (1.0/PulseInterval) * 600 * 1000;
     // uncomment these lines in case you want to view the various
values in the console.....
    /*Serial.print(reading);
    Serial.print("\t");
    Serial.print(PulseInterval);
    Serial.print("\t");*/
    Serial.print(BPM);
    Serial.println(" BPM");
    Serial.flush();
    int H = BPM;
    Blynk.virtualWrite(V7, H);

  delay(1000);

   Blynk.run();
```

CHAPTER 6

SYSTEM TESTING

Accelerometer sensor:

- MPU 6050 [3 axis accelerometer]
- Working voltage → 3.3-5 volts
- Communication Protocol I2C with controller
- Reading through X and Y axis movement

Temperature sensor:

- DHT-11
- Working voltage → 3.3-5 volts
- Analog and digital reading
- Temperature reading
- Accuracy (+/-) $2\text{-}3^0$c

Pulse sensor:

- Working voltage → 3.3-5 volts
- Analog and digital protocol
- Measure pulse rate and heart rate
- BMP

Programming platforms:

- Visual studio code
- Micro python
- Java script

CHAPTER 7

RESULTS AND DISCUSSION

Fig 7.1 Prototype model containing sensors

The above developed prototype model is going to detect the fetus moments and kicks With the help of accelerometer sensor and gyroscopic, and also detect the heart beat and temperature of the mother using heart beat sensor and temperature sensor. The results from the above sensors are transferred to the cloud, through these readings we can obtain the number of fetal kicks and it's graph, also the temperature of the mother along with the heart beat. From these results we can avoid the fetal and mother death's in rural areas and improve the health monitoring system in the rural areas.

Fig 7.2 : Pregnant women wearing the belt containing sensors

Fig 7.3 : Tested result 1

Fig 7.4 :Tested result 2

The above figures represents the various body parameters of the pregnant woman and depicts the result in the sentence formatting and also in the graph presentation and also intimate for the care taker of the pregnant women in case of any serious conditions.

CONCLUSION

In this project, the results obtained from the different sensors devices will be compared and analysed in detail the values are recorded using the sensors and processed using the microcontroller for emergency and send the precaution message to the doctor as well as the caretaker of the pregnant women so that immediate actions can be taken and save the life of the pregnant women as well as the fetus.

FUTURE SCOPE

The system is low cost ,self- monitoring device and used in remote areas efficiently. A new architecture of IOT health monitoring which provides security at the communication link as well as by providing user authentication.

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