Development of Livestock Healthcare Management System using Heartbeat Sensor and Temperature Sensor

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Abstract:

The paper's main topic is the improvement of the domestic animal livestock healthcare system. Our system uses the power of the Arduino and the sensors to monitor the condition of the livestock. It helps the farmer to maintain the good health conditions of the livestock. What do we do if we feel that we have increased in temperature? We get a check-up done. How do we get to know that we have a fever? By thermometer. Similarly, animals also need to be checked by veterans on a regular interval of time for different diseases. Most of the chronic diseases are possibly avoided by discovering and treating them at an early stage. So, we came up with a system which will do this work for you.

Keywords: Domestic animals, Healthcare, Temperature Sensor, Arduino, Proteus

I. Introduction

As we know India is an Agriculture Principal country. And livestock is the main asset for every farmer in the whole India. One research says that there are almost 65,000 to 70,000 cases per year of various livestock diseases aroused in the last two decades and out of which 9000 cases came to be fatal every year. There are a total number of 1828 outbreaks of small and chronic diseases in livestock. Because of this outbreak India suffers a loss of around 43248 Crores INR annually. This data included diseases named peste des petits ruminants, foot and mouth disease, haemorrhagic septicaemia, classical swine fever and sheep & goat pox and anthrax.[1]

R. Parate, S. Sharma came up with a research paper. Three important bodily parameters—heart rate, temperature, and oxygen saturation level—were provided in the paper. They connected these sensors with Node MCU ESP32 and made a prototype of the system. Our system is also influenced by this system, but we are working on more advanced models and on Mobile applications.[2]

We are using the MAX30100 sensor for oxygen level monitoring. For this we referred to one paper presented by Gökhan Ertas from Turkey in which he performed a detailed assessment of this MAX30100 sensor. In this research, they used Infrared Light and Red light for comparison and to perform output of research.[3]

This one is more of the latest research done in this field. As the name suggests, originally this research paper or we can say project was originally performed for Covid crisis. But this is also related to our project as it uses the same sensors as ours. They have interfaced these sensors with Atmel ATmega328 MCU and programmed it in C/C++ IDE.[4]

Next research paper is based on the LM35 temperature sensor. They came up with a simple demonstration of LM35 to calculate room temperature. Instead, we are using it to calculate body temperature. They used a PIC16F877A microcontroller to perform this experiment.[5]

Next research paper presented by E. Jahan et al. and they used infrared and red LED light to measure Oxygen level in blood. They gave the overview on Pulse and oxygen level in Humans.[6]

Paper presented by R. Sunitha, K. Prathyusha. Main feature of this model is they interfaced this model with mobile SMS service. If temperature or heartbeats exceeds its limit, then automatic SMS are sent to the ambulance.[7]

This paper is presented by E. Dogo, Sado and S. Adah in computer journal. As its name suggests, their device is basically made only for heartbeat calculations. They used a PIC16F648A Microcontroller for the processing of input and output operations. This model was very early research, so it does not contain any latest technology like online/offline access or mobile connectivity. They only were able to show output on basic LCD displays. As the paper suggests, this device can only be used by athletes or Doctors which cannot afford high end machines and devices for Heartbeat monitoring.[8]

Next paper is written by A. M. Ghosh et al. Halder for the fifth international conference of IEV. This system can achieve near perfect goals for Remote Monitoring of persons health. They made a system as complete as possible. They interfaced live tracking of a particular person's health and not only live tracking but also storing that data on a database for future use. By this, it's very helpful for the guardian of a patient to access a person's health remotely. This method overcomes the distance barrier and simplifies various complex processes.[9]

Sharanbasappa Sali and Dr. Parvathi C. S. made this model which is completely based on IOT. They interface Arduino with three sensors namely: ECG, Blood Pressure and Pulse Oximeter. They received data from the sensor and transmitted it to the Zigbee Transmitter. Zigbee is basically Connection of various Mesh Networks which works on low power and provides low data transfer rate and relatively fast. It is named by its zigzagging just like bees from one flower to another.[10] So, this model uses ZigBee as its transmission channel and using ZigBee they send data to server and on server that data is analysed using various algorithms and after that data is sent to doctor for further process.[11]

We referred to the next paper for further study of the LM35 sensor which we used for our model. This paper is presented by C. Liu et al. They used LM35 sensor measures and analysed the temperature of soil at various depths and in various seasons. By doing so they were able to study soil behaviour and can come up with solutions that can help farmers in their crop selection.[12]

E. Semenkin et al. mentioned a very interesting idea to measure group heart rate monitoring using ESP8266 Module. They have the basic intention of connecting complete hospitals under one server and monitor all patients at once. They connected every patient with one ESP8266 and sent its data to a one Wi-Fi Router which connects the Code Hosting Server, Database and third and most important Smartphone devices, Tablets, and laptops & computers. Using this method, they were able to achieve three major things at once. Easy access to code, complete data of patients and finally live monitoring of all patients.[13]

II. Research Methodology

Micro-controller Arduino UNO. Arduino Uno is a microcontroller board primarily based totally at the ATmega328P (datasheet). The total number of input/output pins is 14 of which are PWM input/outputs, six are analog inputs/output, and a sixteen MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power supply, and an ICSP header and a reset button to reset the Arduino.[14]

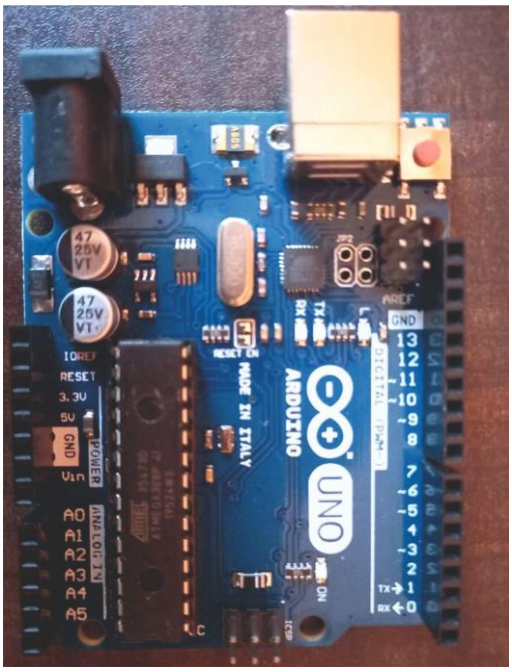

Fig1. Arduino UNO

Microcontroller NodeMCU ESP8266. This NodeMCU ESP8266 is a development board as well as a microcontroller that comes with the ESP-12E module containing the ESP8266 chip having Ten silica Extensa 32-bit LX106 RISC microprocessor. ESP8266 helps RTOS and operates within the frequency range of 80MHz to 160MHz. NodeMCU consists of 128 Kilobytes Random Access Memory and 4 Megabytes of Flash memory to store data as well as machine code. Its excessive processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating functions make it best for IoT projects.

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). UART, SPI, and I2C interfaces are supported by it.

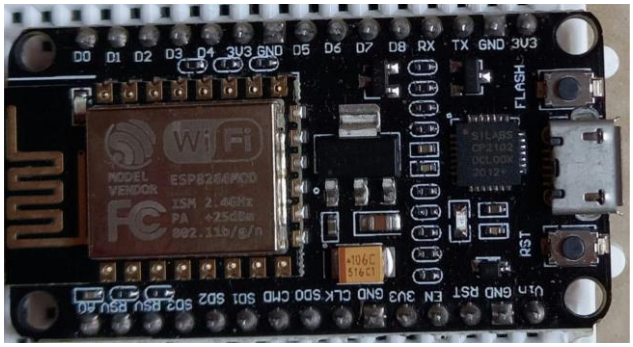

Fig2. NodeMCU ESP8266

Sensor LM35. Here we have used this sensor for measuring body temperature of livestock. LM35 is a temperature sensor that outputs a voltage that is proportional to the current temperature. The output voltage can effortlessly be interpreted to acquire a temperature reading in Celsius. The benefit of lm35 over thermistor is it no longer requires any external calibration. The coating of lm35 protects itself from self-heating.

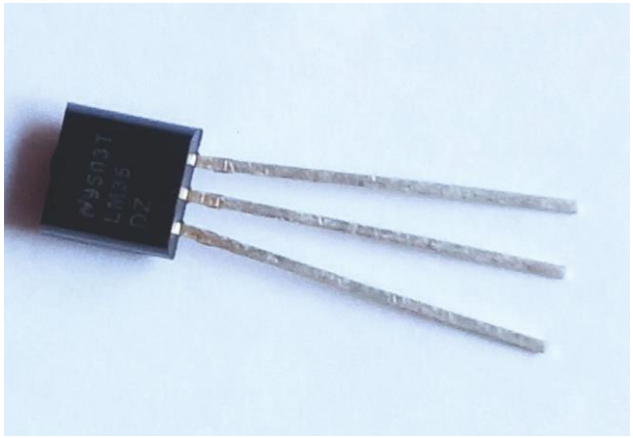

Fig3. LM35 Temperature Sensor

Heartbeat Sensor. Heartbeat sensor is used to detect a heartbeat of a subject and convert it into digital signal and pass it on to the Arduino and then from there to the Think Speak API. It has 3 pins Output, Ground and Voltage(5V).

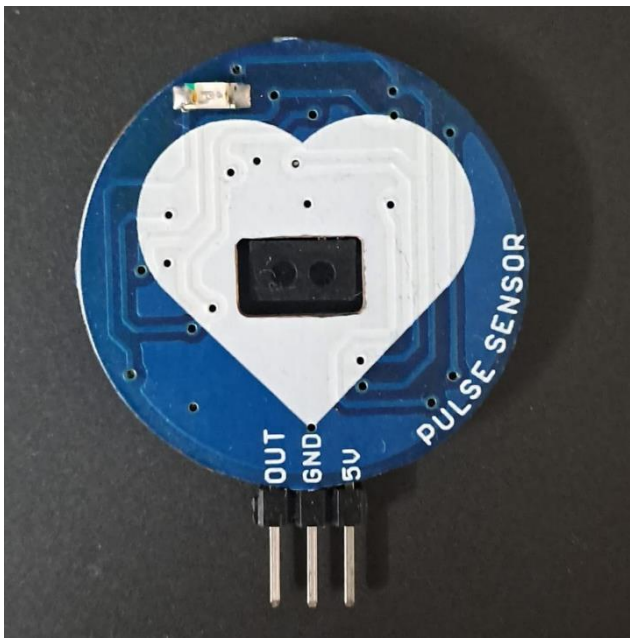

Fig4. Heartbeat Sensor

Arduino IDE Software. Arduino IDE is used to write, compile and for uploading code on the Arduino. It connects to Arduino via serial port available on Arduino to upload the code. The software writes the EEPROM of the Arduino thus giving the Arduino machine language code which will be executed by the Arduino itself.[14]

Proteus 8 Student Version. Proteus is a circuit simulation software used to build desired circuits using the inbuilt libraries which the software provides by itself. The Arduino is simulated by using the compiled code file location and then simulating the circuit thus giving us the desired output.

Algorithm

Step1: Start.
Step2: Specify pin Mode for Arduino Connect ESP8266 to Wi-Fi.
Step3: Initialize pulse oximeter sensor and temperature sensor interfaced with Arduino.
Step4: Take inputs from the sensor.
Step5: Define threshold values of sensor readings for healthy livestock.
Step6: Compare defined values with sensor readings.

Step7: If values are out of bound alert esp8266 board raise flag variable by 1 each time alert is given.
Step8: Send data continuously to cloud storage for analysis with ESP development board.
Step9: If the Arduino alerts too many times for abnormal readings, then it sends a message to the owner regarding livestock's bad health.
Step10: Set flag variable equal to 0 and start the process over again.

III. Results and Discussion

In Figure No. 5, we can see all the connections that are made with Arduino. In figure No. 6 we firstly did the modelling in Proteus software then we made the connections accordingly. We receive input from both the sensors to the Arduino and then the received data from the sensors is given to ESP8266 which then sends that data to Thing Speak API and Mobile application also thus plotting the graphs as shown in below (Fig.7 and 8).

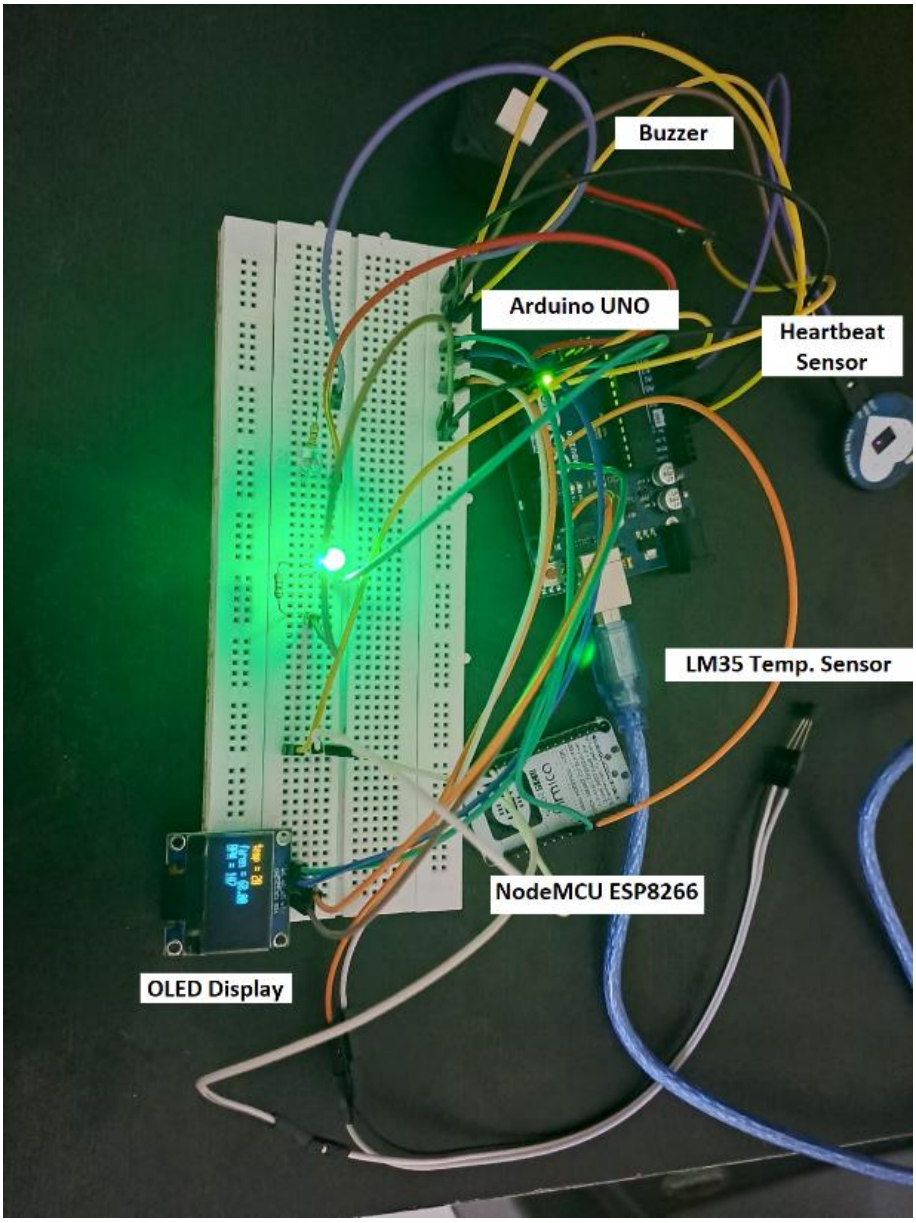

Fig5. Assembled Model of Project

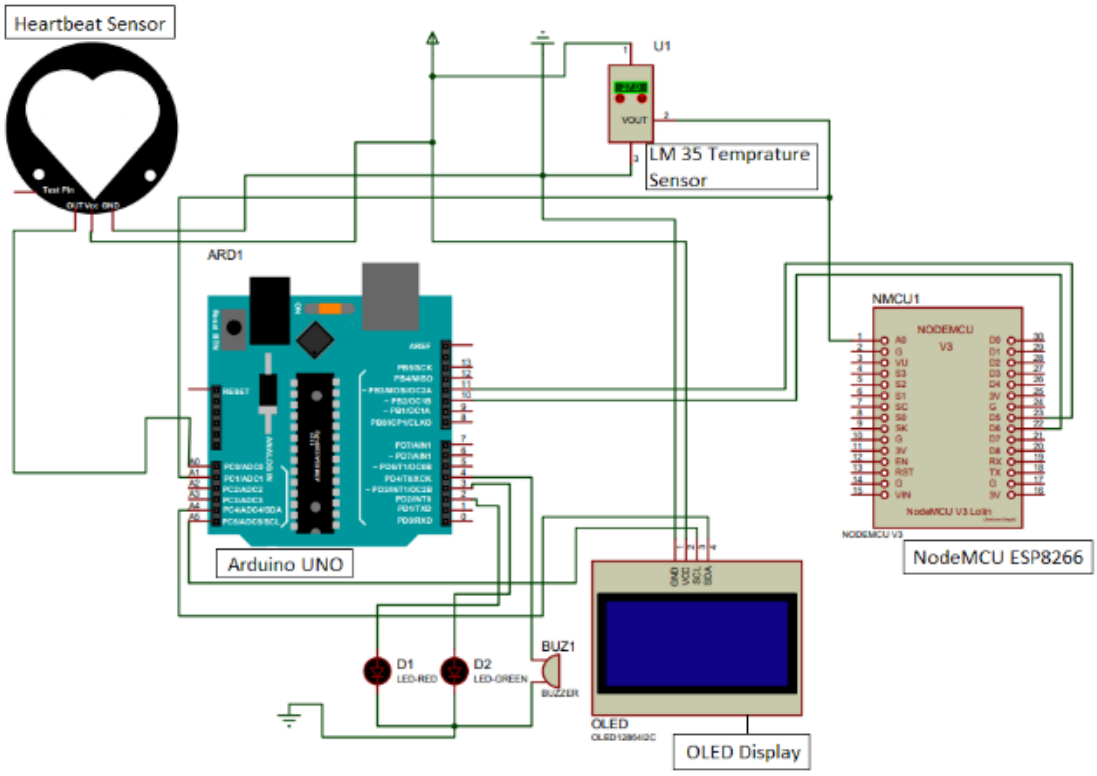

Fig6. Model of Project in Proteus Software

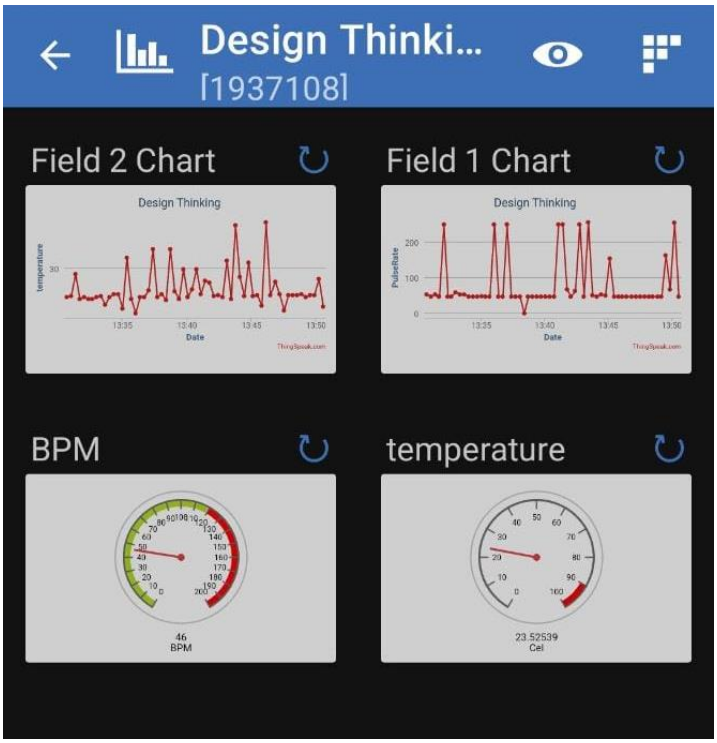

Fig7. Output of Project in Mobile Application

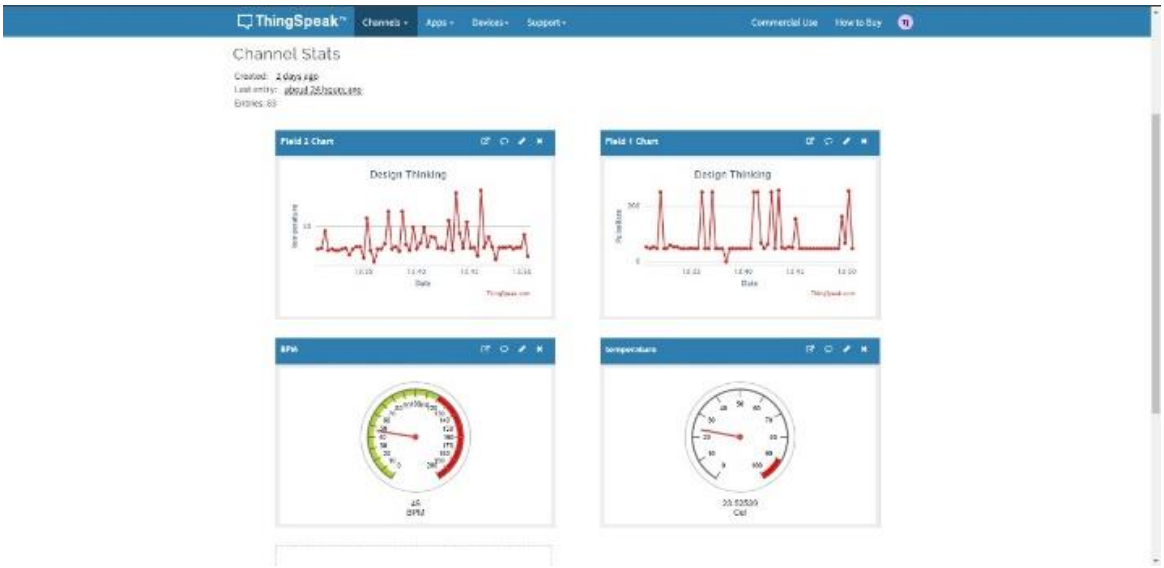

Fig8. Output of Project in Mobile Application

IV. Conclusion

In village areas it's hard to monitor the health condition of animals. So, in this paper we worked on it. As our project mainly focuses on health monitoring, using various sensors like temperature sensor, Heartbeat sensor we can monitor the health of animals. This will really help farmers, people who herd animals and useful for the forest department to monitor the health condition of animals. Through this, farmers will get information related to health conditions of their livestock.

There is a need for a novel system that combines both animal health tracking and monitors the movement of livestock, which has not been implemented so far. And, hence it is best to integrate two existing modules developed in different platforms and technology to a single module and platform. As this paper does not include location tracking of animals. So, in next work we will also be able to make it. Our model will surely work as a strong backbone in case of monitoring any health-related issues for livestock.

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V. Reference

[1] Bardhan. D., Satyapal, Neeraj Kumar, Rizwan Khan and Sanjay Kumar. 2020. Trends and Patterns of Major Animal Diseases in India. Int.J.Curr.Microbiol.App.Sci. 9(07): 453-471.

[2]R.K.Parate, S.J.Sharma “Design of a Portable Health Monitoring System Based on Node MCU” International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-9 Issue-2, December, 2019

[3]K. B. Saçan and G. Ertaş, "Performance assessment of MAX30100 SpO2/heartrate sensor," 2017 Medical Technologies National Congress (TIPTEKNO), 2017, pp. 1-4, doi: 10.1109/TIPTEKNO.2017.8238126.

[4]N. B. Ahmed, S. Khan, N. A. Haque and M. S. Hossain, "Pulse Rate and Blood Oxygen Monitor to Help Detect Covid-19: Implementation and Performance," 2021 IEEE International IOT, Electronics and Mechatronics Conference (IEMTRONICS), 2021, pp. 1-5, doi: 10.1109/IEMTRONICS52119.2021.9422520.

[5]Oyebola, Blessed and Toluwani, Odueso, LM35 Based Digital Room Temperature Meter: A Simple Demonstration (October 15, 2017). Equatorial Journal of Computational and Theoretical Science, 2(1)

[6]Jahan, Esrat & Barua, Tilottoma & Salma, Umme. (2020). AN OVERVIEW ON HEART RATE MONITORING AND PULSE OXIMETER SYSTEM.

[7]Sunitha, R & Prathyusha, K. (2014). Microcontroller based Heartbeat, blood pressure and body temperature monitoring and alerting system using GSM modem. IOSR Journal of Electronics and Communication Engineering. 9. 100-104. 10.9790/2834-0963100104.

[8]E.M. Dogo, F. Sado, S.M. Adah (2013). Design of a Simple and Low-Cost Microcontroller Based Medicare Device for Heart Beat Monitoring. Afr J. of Comp & ICTs. Vol 6, No. 5. Pp 121-128.

[9]A. M. Ghosh, D. Halder and S. K. A. Hossain, "Remote health monitoring system through IoT," 2016 5th International Conference on Informatics, Electronics and Vision (ICIEV), 2016, pp. 921-926, doi: 10.1109/ICIEV.2016.7760135.

[10] Chellappa, Muthu & Madasamy, Shanmugaraj & Prabakaran, R.. (2011). Study on ZigBee technology. 297-301. 10.1109/ICECTECH.2011.5942102.

[11] Sali, Sharanbasappa & Parvathi, C & Assistant,. (2017). Integrated Wireless Health Monitoring System for Elderly People. International Journal of Innovative Research in Computer and Communication Engineering. 32975. 480-490.

[12] C. Liu, W. Ren, B. Zhang and C. Lv, "The application of soil temperature measurement by LM35 temperature sensors," Proceedings of 2011 International Conference on Electronic & Mechanical Engineering and Information Technology, 2011, pp. 1825-1828, doi: 10.1109/EMEIT.2011.6023459.

[13] A. Škraba, A. Koložvari, D. Kofjač, R. Stojanović, V. Stanovov and E. Semenkin, "Prototype of group heart rate monitoring with NODEMCU ESP8266," 2017 6th Mediterranean Conference on Embedded Computing (MECO), 2017, pp. 1-4, doi: 10.1109/MECO.2017.7977151.

[14] Fezari, Mohamed & Al Dahoud, Ali. (2018). Integrated Development Environment "IDE" For Arduino.