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Heart Rate Monitoring Robot by Using Arduino and NodeMCU ESP8266

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Abstract: Nowadays, most electronic devices are wireless, and most industrial sectors also have already adopted industrial 4.0. This Arduino and NodeMCU ESP8266 Heart Rate Monitoring Robot helps to continually observe users remotely. People remain at home, avoid others, and change routine activities such as school and work in ways never imagined. The aim is to reduce direct human contact. This project will use a robot to automatically monitor the heart rate of patients at a hospital or clinic. The heart rate measuring code is written in Arduino IDE and uploaded to the Arduino UNO and NodeMCU ESP 8266 boards. The data will be transferred to the cloud for doctor monitoring.

Keywords: Heart Rate, Arduino UNO, NodeMCU ESP8266, IoT

1. Introduction

A routine medical check-up is a periodic check-up that monitors an individual's health to identify abnormalities. Regular health check-ups have many purposes, including screening for risk factors and diseases, providing proper preventive advice and treatments, and evaluating the health of asymptomatic individuals who are unaware of their health problems. The Internet of Things (IoT) is a fast expanding technology that includes sensors and cyber systems. A mobile robotic system platform, a health monitoring system, and other ICT solutions have been created to measure health data in this project. This project uses heart rate sensors to monitor the patient's heart rate. A line follower robot is an autonomous guided robot that follows a visible line placed on the ground. A line follower robot requires the user to stay in a specific position while transporting the equipment to monitor heart rate.

Improper monitoring of patients' can always happen. Ideally, every patient needed to be observed throughout of their pre- and early in- hospital for effective treatments. In both public and private hospitals, between 2016 and 2018, the number of cases involving inappropriate surgery, unexpected retention of foreign objects (URFOs), transfusion and medication errors, and patient failure almost

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quadrupled, according to official numbers from the Ministry of Health [1]. Next, a lack of health workers. Population increase, increasing consumer activism, rapid medical technology advancements, and rising disease burden have all raised the demand for nurses. According to R.hirschmann, Malaysia had 107.83 thousand registered nurses in 2019 [2]. Nurses make up 0.33 percent of Malaysia's population of 32.75 million [3]. As a result, a lack of timely medical assistance during crises would arise. Finally, typical medical check-ups lack reliable data analysis from patient health records. Some data will be saved in hardcopy on a card or book. Some medical cards or files will be kept at the medical facility and others by the patient. Some records may be lost and difficult to recover.

1.1 Previous study of related the previous project.

In 2015, the researcher in [4] has propose the Android Based Health Care Monitoring System. The system consists of three parts: a sensor that gathers data and analyses, a controller that processes the obtained data, and storage that saves it. An android phone will use the Bluetooth module to receive data from the controller storage and then send the data to a web server for remote access for the next procedure. The LM35 temperature sensor will be utilized in this project. Pulse oximetry is a non-invasive, simple-to-use, and continuous measuring of oxygen saturation and heart rate. The pulse oximeter calculates the absorption ratio by detecting the light absorption from two wavelengths following the volume of oxygenated arterial blood.

In 2017, An IoT Patient Health Monitoring System using Arduino UNO has been proposed by [5]. The ESP8266 has an unrivaled capacity to build Wi-Fi functionality into other systems. Self-contained, it delivers a comprehensive Wi-Fi networking solution. Depending on the needs, it may run the program itself or delegate control of Wi-Fi networking to another CPU. With the help of a Wi-Fi module, It may access the data collected by the Arduino on the IoT Thinkspeak Website.

Heartbeat and Temperature Monitoring System for Remote Patients using Arduino has been proposed in 2017 by [6]. The temperature and heartbeat sensor is utilized in the transmitter portion to detect the temperature and heartbeat of the patient's body, and the data sensed by the sensor is transferred to the ATMEGA 328. When a patient's body temperature is measured, the data from the sensor is displayed on an LCD by an antenna attached to the end of a transmitter. When the data from the sensor is transmitted to the receiver end, the shared information can be encoded into serial data and transmitted over the air by a nRF module.

The author proposed A Health Monitoring System For Vital Signs using IoT [7] on 2019. Blood pressure, heart rate, and temperature are supervised through a sensor interface. The data acquisition and processing of an embedded platform, in this instance a Raspberry Pi 3{RPi3), is responsible for data collecting and processing. Data connectivity, in which the RPi3's on-chip BLE and Wi-Fi modules and USB ports to interface with GSM were selected for multimode connection. As opposed to GSM, which sends data in the short form to a configured mobile number with limited text, Bluetooth, which receives data in the streamlined form at a BLE open Terminal application in a standard format, and Wi-Fi, which sends data in a streaming form to a cloud-based web server and displays it on a web application.

In 2020, IoT Based Health Monitoring System has been proposed by the author on [8] . In this system, patients' temperature and heartbeat are detected by sensors that have been implanted in their bodies. It is necessary to install two more sensors at home to monitor the humidity and temperature in the patient's room. Each of these sensors is connected to a control unit that adds the data from each of the four sensors together. This information is then sent to the base station through an Internet of Things cloud. Following that, the doctor may obtain the values from any location other than the base station. Consequently, the doctor may identify the patient's state and provide appropriate therapies based on readings taken by the temperature, heart rate, and room sensor sensors.

2. Materials and Methods

The study began with the project planning and development of the monitoring system and IoT platform using several components. The entire designing, preparation, data monitoring, testing process explains the project and its subtask to fulfil the objective of this project.

2.1 General block diagram

Specifications and properties of materials, equipment, and other resources used in the current study should be Based on Figure 3,4 show a simple system block diagram that was applied in the Heart Rate Monitoring Robot by using Arduino and NodeMCU ESP8266. The Arduino UNO ATMEGA328 is connected with the infrared sensor, NodeMCU ESP8266, and motor driver. While the NodeMCU ESP8266 is connected to an IoT platform which is Blynk, pulse sensor, and heart rate sensor.

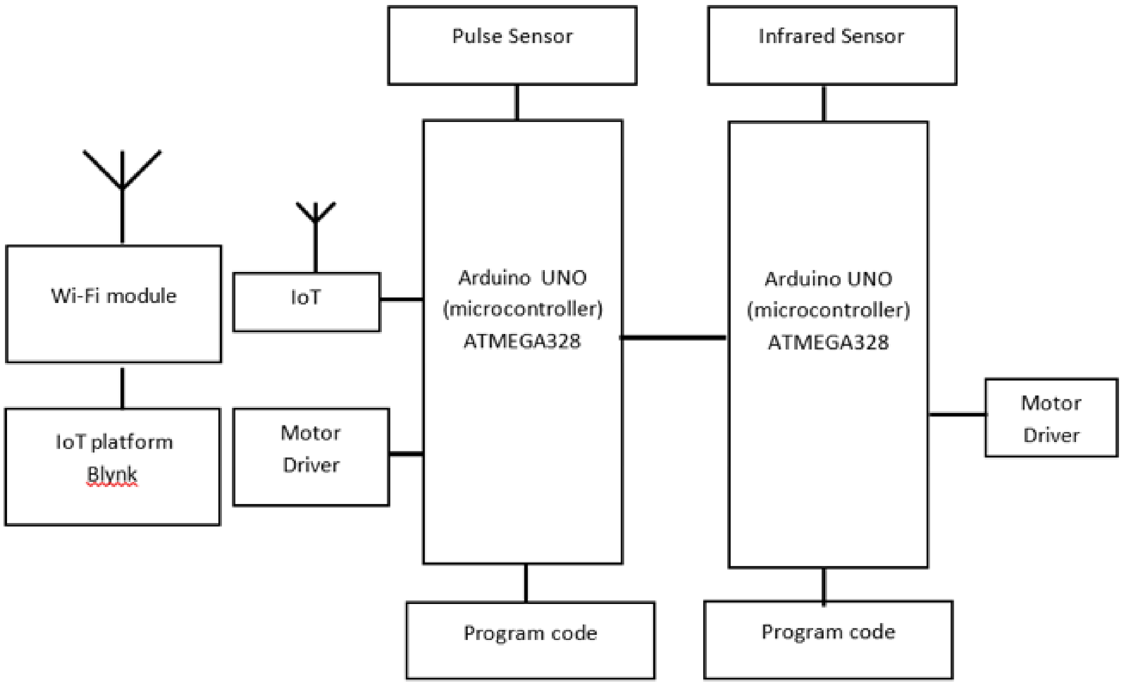

Figure 1: Block diagram of the project

2.2 Flowchart of the proposed system.

Before constructing this locking system, a flow chart of the system needs to be constructed as an overview of the working principle. It is crucial to have a flow chart to ensure that the system will provide a performance that meets the requirement in order to achieve the objectives of the project. On top of that, this ensures the procedure of making this project is being built accordingly which would save time and cost that will be managed precisely. The flow chart summarizes the whole process of the system to enable users to understand the working principle of the system. This process will determine the efficiency of the project to be completed. Generally, the system will start when the circuit is complete. To control the open and close loop of the project will be using a switch connected to the power supply. After completing the circuit loop, it will start initializing the system, including connecting to the IoT platform. The IoT platform can control whether to turn on or turn off the motor. After that, the system will wait until the push button is pressed to read the heart rate and display the data on the IoT platform and the LCD as shown in Figure 2.

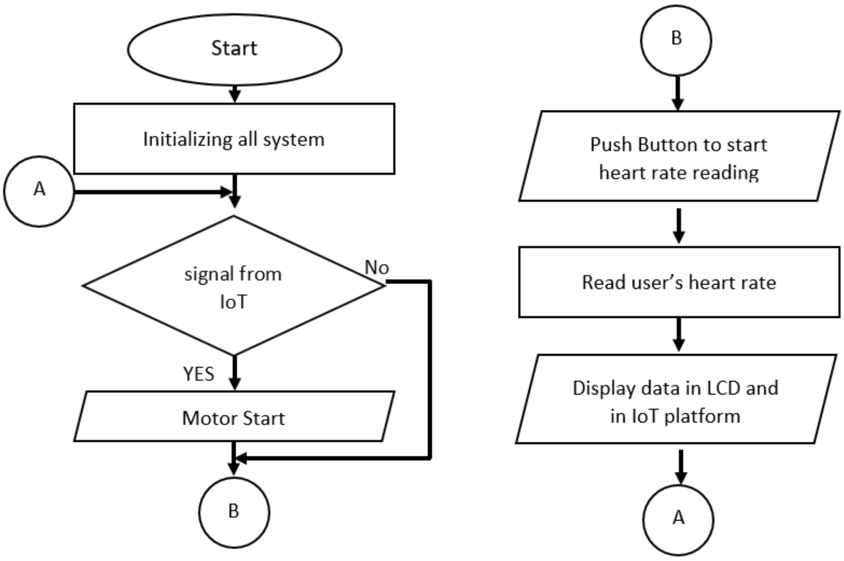

Figure 2: Flowchart of the proposed system

3. Results and Discussion

This section shows the result after completing the proposed system prototype. The project has been developed and completed, has been evaluated to measure the effectiveness and the effectiveness and to ensure that it has been successfully met the outlined goals and objectives.

3.1 Complete circuit diagram

The circuit diagram that was shown in Figure 3 as followed. The NodeMCU ESP8266 microcontroller will be regulated by a 9V battery supply to supply to the switch, LED, LCD, and pulse sensor. The switch's first pin is connected to the 3volt, and the second pin is connected to the anode pin of LED and pin D8 of NodeMCU. LED cathode pin is connected to the resistor and the resistor connected to the ground. LCD has four pinouts: GND, VCC, SDA, and SCL. The VCC and GND are connected to 5volt from NodeMCU ESP8266, while SDA and SCL are connected to D1 and D2 of the microcontroller. Next, the pulse sensor has three pinouts: VCC, GND, and signal. VCC and GND pinout is connected to 3volt from NodeMCU, while the signal pin is connected to A0 on the microcontroller. After that, there are mechanical systems that control the motor. Firstly, D6 from NodeMCU is connected to pin two Arduino UNO. After that, the connection of the motor driver that has eight pins. 12V pin is connected to external power supply, 5V and GND pin are connected to Arduino UNO power supply while IN1, IN2, IN3, IN4, ENA, ENB are connected to pin 10, 9, pin 8, pin 7, pin 6 and pin 5 of Arduino UNO. Next, OUT1 and OUT2 connected to motor A while OUT3 and OUT4 connected to motor B. Figure 3 show the actual complete circuit of the project.

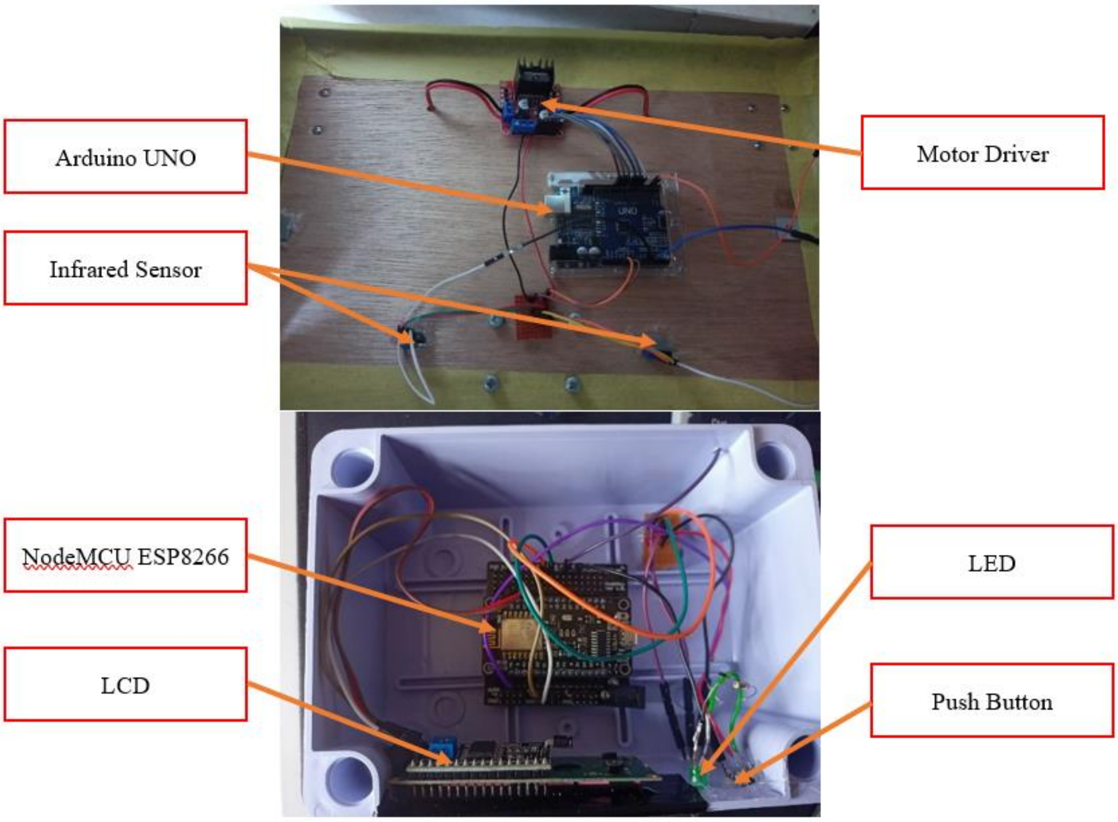

Figure 3: complete circuit

3.2 Testing prototype of the project.

The complete hardware project consists of the electrical and mechanical system shown in Figure 4. The project will be run to evaluate the data gathered from the project. The interface of the Blynk platform is illustrated in Figure 5.

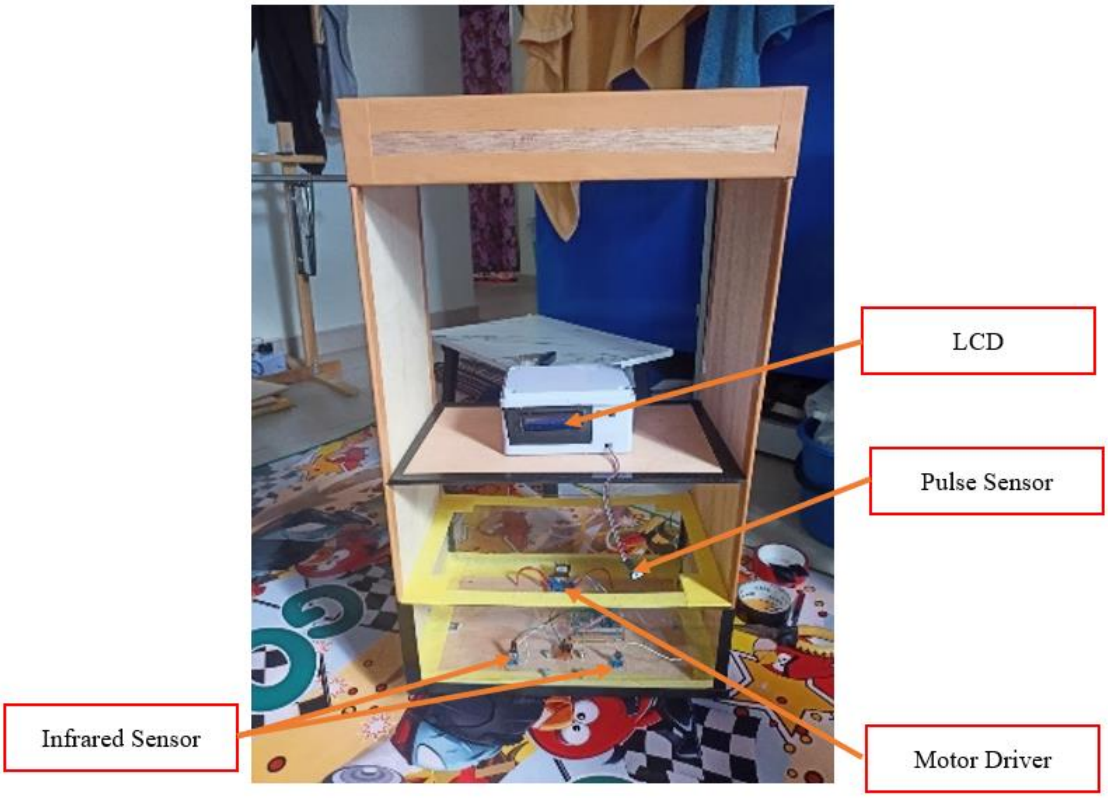

Figure 4: Complete hardware of the project

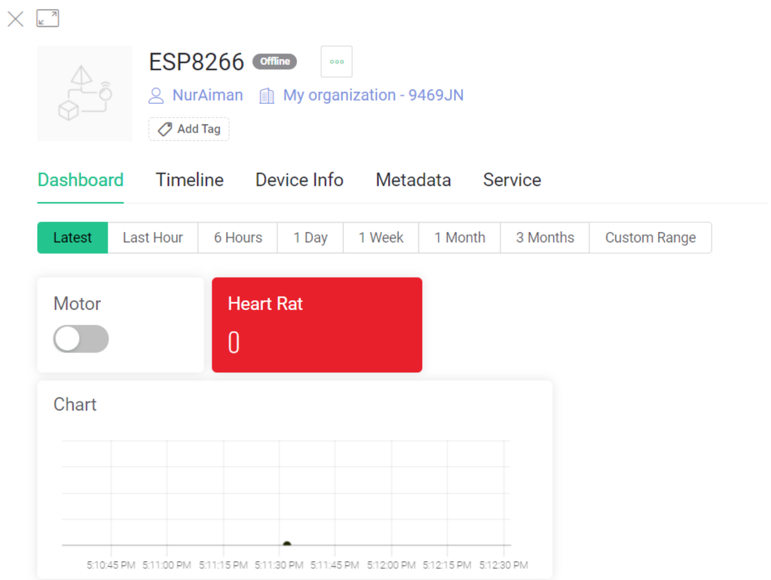

Figure 5: Bylnk interface for the system

The project was tested using single-person data. Figure 6 shows the software "MONITORING BPM" starting up the program. The system will then attempt to connect to Blynk. If the Blynk connection is successful, the LCD will show Figure 7. However, if it fails, it will show Figure 8.

Figure 6: Start-up display

Figure 7: System successful connecting to Blynk

Figure 8: System failed to connect to Blynk

To start the reading the push button needed to be pressed, while the push-button green LED will turn on shown in Figure 9 and the system will start counting the heart rate shown in Figure 10. The countered heart rate will then display on LCD and save in Blynk as Figure 11.

Figure 9: Push-button of the system being pushed

Figure 10: System counting the heart rate

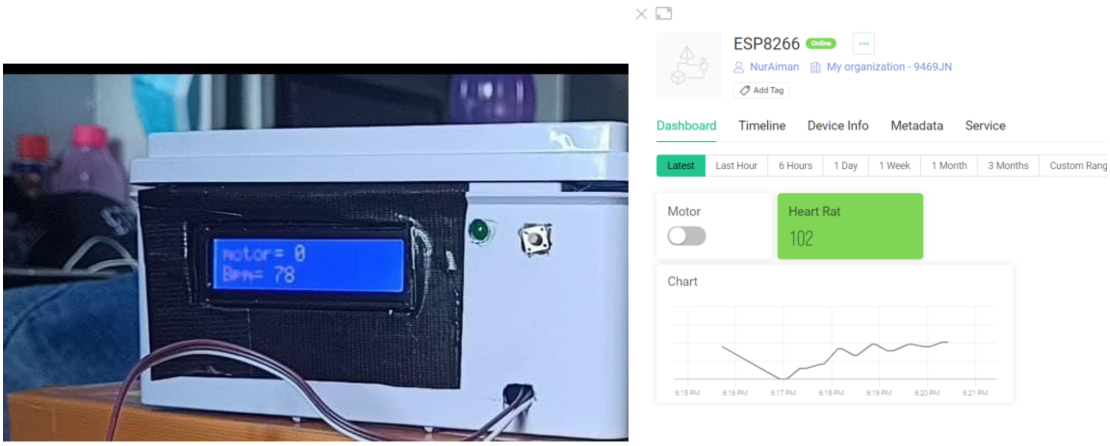

Figure 11: Heart rate being displayed on LCD

The motor only can be started through a virtual switch on Blynk. If the switch is LOW it is shown as in Figure 7 while if the virtual switch is HIGH the LCD will display "motor = 1" as shown in Figure 12. Figure 13 shows the interface of Blynk when the virtual switch is HIGH. Figure 14 shows when several data were collected in Blynk.

Figure 12: LCD when the virtual switch is HIGH

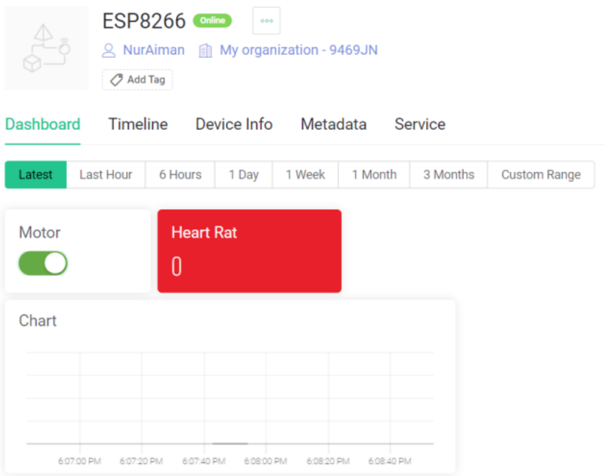

Figure 13: Blynk interface when switch HIGH

Figure 14: Bylnk interface several data being collected

4. Conclusion

Summing up the process, the heart rate monitoring robot using Arduino UNO and NodeMCU ESP8266 has been developed successfully. This system which consists of microcontroller NodeMCU ESP8266 and Arduino UNO is compatible with C language and Arduino IDE that will help run, analyze data, and transfer data from the sensor and give the desired output signal. The system used pulse sensor as major input data while Blynk as main output data. The constructing of the project system was successfully obtained and met the requirement of the proposed project proving that the objective has been achieved.

Acknowledgement

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