Advances in Engineering Research, volume 208
Proceedings of the International Conference on Innovation in Science and Technology (ICIST 2020)

Design and Development of LIVE Monitoring Heartbeat and Body Temperature Using the Internet of Things

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***Abstract*—Vital signs in the human body are statistical measures that determine health status, including heart rate per minute (BPM) and body temperature. Those two parameters correlate with a symptom of exposure to covid-19. Vital signs on patients with unstable health conditions should be checked regularly to determine preventive measures. This study aimed to design a device to monitor heart rate and body temperature using the Internet of things technology. The system can monitor the patient's heart rate and body temperature in real-time and record the vital sign's condition. The system uses a DSB1820 sensor, pulse sensor, and a Node MCUV3. The patient's heartbeat data and body temperature monitored using the LCD and web service with the Internet of things technology. The system test results show that the hardware system could monitor the data through web service. The system is useful as a health monitoring device for covid-19 patients without symptoms**

Keywords—live monitoring heartbeat, body temperature, body heart rate per minute (BPM), internet of things (IoT)

I. INTRODUCTION

The vital sign on the human body is a quantitative number that indicates a person's health status. Two of the vital signs are heart rate and body temperature. In the pandemic era caused by Covid-19, these two parameters have a relationship with symptoms of exposure to the virus. The person confirmed exposure to the covid-19 virus could show symptoms or even without symptoms. Monitoring heart rate and body temperature regularly can prevent terrible conditions on someone's health. Therefore, it is necessary to record body temperature over a certain period

Technological developments are currently developing rapidly, such as smartphones, which greatly simplify human work and one of the Internet of Things (IoT) technologies. Internet of Things is a concept in which particular objects can transfer data over a network without requiring human-to-human or human-to-computer interaction [1]. There is a demand for a device that could monitor heart rate and body temperature regularly [2,3].

Several studies develop devices that can monitor heart rate and body temperature. Research conducted by Miah et al. (2017) combines an android device with the Arduino system. In this study, the optical sensor TCRT5000 as a heart rate sensor and LM35 for measuring body temperature. Data transmission uses a Bluetooth signal to an android device [4].

Wajih Alam et al. developed the recording of heart rate and body temperature using photodiode and bright LED sensors to measure heart rate and IC LM35 to measure body temperature. The data is then sent to the mobile device using a GSM module. After that, the data transferred to the PC [5]. Research by Vikramsingh develops a device for monitoring heart rate and body temperature. The 358 sensors measure heart rate, while the LM35 use to measure body temperature. The measurement result data displayed on the LCD, and there is no additional device to monitor the measured value [6].

The development of a heart rate measuring device using an IR base sensor and Arduino Uno has been carried out by Pawar et al. This device can measure heart rates from infants to adults. The percentage of errors calculated from the readings and the maximum and minimum errors are 6.49% and 4.1%, respectively [7]. Another development, namely the heart rate measurement, has been carried out by Kavsaoglu et al., 2014 by measuring the heart rate using the photoplethysmography method [8]. In 2016, Bandana Mallick et al. developed real-time heart rate monitoring using fingertips and Arduino Uno. The results can monitor the heart rate then send it via Short Message Service (SMS) [9]. Stojanovic et al. made a headset to track covid-19 symptoms. They used a built-in microphone on mobile phones as a sensor to detect breathing problems, respiration rates, and cough. This device was simple but only limited to the symptoms mentioned before [10].

This study aimed to design a device to monitor heart rate and body temperature directly using the Internet of things

technology. The system can monitor the patient's heart rate and body temperature in real-time and record the vital sign's condition. The heart rate and body temperature monitoring devices mentioned above do not consider data storage in real-time. That is why we need a device that can monitor heart rate and body temperature in real-time to take preventive action immediately.

There is a need to develop a heart rate measuring device that makes it easy for users and on a small scale, such as in households. The tool should also be able to present information in real-time so that in the event of abnormal conditions can be taken immediately.

II. Design

The patient grasped the sensor and touched the pulse sensor with a pointing finger for a few seconds to obtain the body temperature and heart rate parameters. NodeMCU V3 ESP8266 as the microcontroller to acquisition parameters and transmit data to an LCD and web service interface.

A. The Diagram Block

The system specifications was: 7.4 VDC source and 10cm length x 10cm width x 8cm height dimensions. The heart rate and body temperature monitoring system showed in block diagrams in Figure 1. As shown in Figure 1, the system starts reading the temperature and heart rate value from sensors. Node MCUV3 acquired the data and then sent it to the database via Wi-Fi module ESP 8266 and shown on LCD.

B. The Hardware Circuit and Component

The hardware circuit and component showed in Figure 2. This study uses the DS18B20 as the temperature sensor. The DS18B20 sensor is a digital sensor that has an accuracy +/- 0.5-degree. This study uses a pulse sensor for heart rate parameters. The parameter value was then shown on an LCD and sent to the Wi-Fi module database on Node MCU V3.

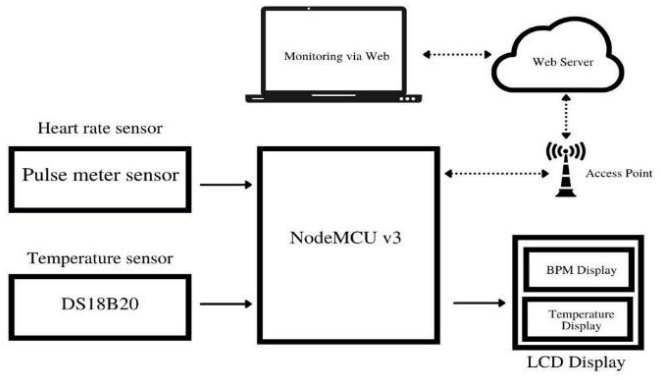

Fig. 1. The Diagram block of design of live monitoring heartbeat and body temperature using the Internet of Things (IoT).

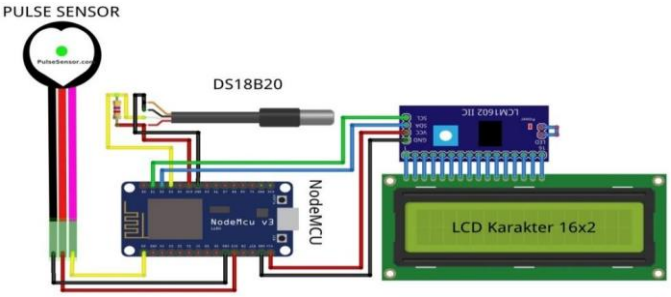

Fig. 2. The hardware circuit and component of live monitoring heartbeat and body temperature using the Internet of Things (IoT).

III. Design Hardware and Preliminary Testing

The system hardware realization, the functions, and explanations in each part of the system showed on in Figure 3. Figure 3 shows the live monitoring heartbeat and body temperature system, which consists of 1). Switch button for heart rate and body temperature menu selector. 2) USB to OTG connector to connect a device with 9VA adapter, 3) Pulse Meter Sensor, 4) Body Temperature Meter Sensor, 5) LCD Display.

The approach of preliminary testing was for hardware and the Internet of Things (IoT) Interface. The hardware testing to check the system functions whether it can work properly. IoT testing by sending and storing sample data to the database.

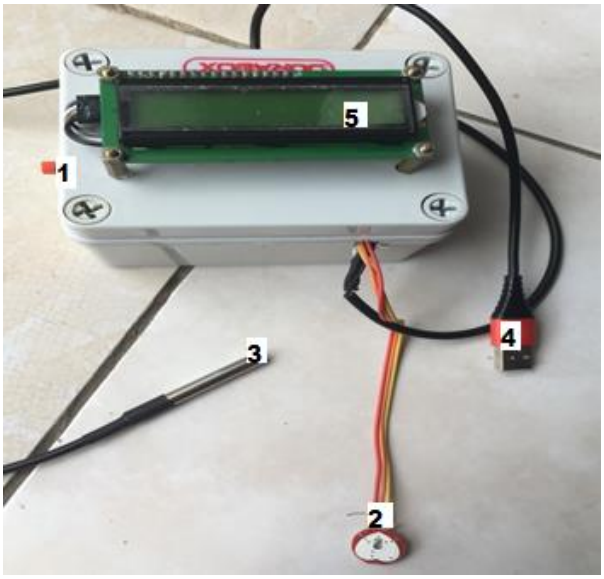

Fig. 3. The live monitoring of heartbeat and body temperature using the Internet of Things System.

1) Hardware testing: Hardware testing conducted by measuring heart rate and body temperature and the testing results showed in Figure 4 and Figure 5.

Fig. 4. Results of hardware testing on body temperature.

Fig. 5. Results of hardware testing on and heartbeat measurement

Figure 4 shows the body temperature value on the LCD while the patient's grasp the sensor. Figure 5 shows the heartbeat value when the patient touch the pulse meter sensor with his finger. From the results in Figure 4 and Figure 5, the measured parameter values shown on the LCD; this means the hardware works well**.**

2) Testing the Internet of Things (IoT) interface: Purpose of the test was to check whether the data successfully sent to web service. Figure 6 shows the reading of the data web service, the data sent in only 2 seconds**.**

A history check on the system's data showed that the data storage to database works properly. Figure 7 shows the data stored history.

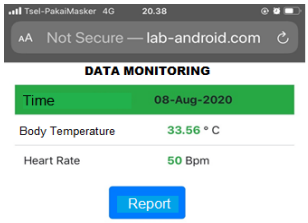

Fig. 6. Results of testing IoT interface on web service.

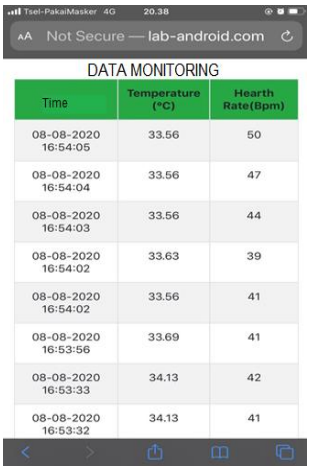

Fig. 7. Results of testing database storage monitoring on the internet.

The test results shown in Figure 6 and Figure 7 show the system is working correctly and can be monitoring data in real-time**.** The system could measure the heart rate and body temperature value from the testing hardware and IoT interface testing results as the data could also monitor in real-time.

IV. Conclusion

This research aims to design a device to monitor heart rate and body temperature directly using the Internet of things technology, and the device could work well. This data technology was useful for patients who do not show any symptoms of Covid-19. This tool can be used easily by patients and monitored by medical personnel without the need for direct contact with the patient.

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