Implementation and Monitoring Heart Rate and Body Temperature using IoT

Nurul Fahmi[1][a], Fahrul Shobri[2] and Eko Prayinto[1]
[1]*Politeknik Negeri Bengkalis, Jl. Bathin Alam, Sungai Alam, Bengkalis, Riau, Indonesia*
[2]*Department of Informatics Engineering, Indonesia*

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Abstract: Health is one of the most important things for human life. One of the most important components of health is the heart and body temperature. The normal heart rate is in the range of 60-110 beats per Minute, while the normal body temperature is between 35 - 38 Celsius. Therefore, a device that can monitor heart rate and body temperature is proposed based on IoT, this system will be built using Arduino Uno, Pulse Sensor to detect heart rate and DS18B20 sensor to detect body temperature, and Mini PC as a Web Server. Based on testing of 5 patients over 60 years of age, the heart rate data collection used a pulse sensor and Smart Watch M4 as a comparison, with an average difference of 8.6 and a percentage of deviation of 9.76. Meanwhile, for data collection at body temperature using a temperature sensor ds18b20 and a Digital Thermometer as a comparison, with an average difference of 0.75 and a percentage of deviation of 2.06.

1 INTRODUCTION

The development of the world of technology is currently developing very rapidly, especially in the health sector. Advances in technology create tools that can be used for health. This is related to the importance of health for human life, especially the elderly. One of the most important components of health is the heart and body temperature. at this time if the patient wants to check his heart rate and body temperature, he must first go to the hospital to be checked and of course it costs money. Therefore, a system that can monitor heart rate and body temperature is proposed in a portable manner.

Some researchers have researched Internet of Things (IoT), such as Environmental Monitoring (Fahmi, Al Rasyid, & Sudarsono, 2017), agriculture monitoring (Mendez & Mukhopadhyay, 2013)(Fahmi, Huda, et al., 2017), Fire Forest (Kadir, Rosa, & Yulianti, 2019), Wireless Body Area Network (Udin, Al, & Lee, 2015), Military(Huda, Sudarsono, & Harsono, 2016; Sudarsono, Huda, Fahmi, Udin Harun Al-Rasyid, & Kristalina, 2016) and so on. Udin Harun at.al (Udin et al., 2015), Implementation an E-Health to monitoring body temperature and blood oxygen to check personal health based on Wireless Body Area Network (WBAN). The data showing to patient based on Web Based Application. Chao Li, et al (Li, Hu, & Zhang, 2017), monitoring heart disease for pervasive healthcare service using IoT technology. The system to monitoring blood pressure, ECG, SpO2, heart rate, pulse rate blood fat and blood glucose. The result from all sensors will be show to the mobile phone. Based the information's all the data sensor are presented with taking patient risk, medical analysis, communication and computing resource.

Salih Ali, et al (Ali, Alyasseri, & Abdulmohson, 2018), show the real-time heart pulse monitoring technique using wireless sensor network and mobile application to monitoring data Heart Pulse (HP) for patients. In this paper, proposed to monitoring and display the data HP using mobile phone applications. T A. Mahgoub, et al (Mahgoub, Khalifa, Sidek, & Khan, 2016), proposed to remote Pulse Oximetry system for show the health patient. Photoplethysmography is a technique to collected data patients, compare and monitoring in order to alert important personnel in the case of an emergency. All data will be show to application smartphone.

In this paper shows the information health patients to monitoring heart rate and body temperature using

[a] https://orcid.org/0000-0002-5415-2697

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IoT. Pulse sensor to detect heart rate and temperature to detect body temperature and mini PC using as a web server. All data heart rate and body temperature will be showing at web-based application

2 THE SYSTEM DESIGN

2.1 General Architecture

The materials used in this study are data obtained from the results of the Pulse Sensor and the DS18B20 Temperature Sensor which detects the heart rate and body temperature of the elderly and will then be processed on a microcontroller sent via a USB cable. The data contained on the microcontroller will then be sent to the mini pc, then the data will be parsed using the python programming language and then saved to the database then sent to the website and displayed to the LCD as an application of IoT technology with the output results in the form of heart rate and body temperature data.

In Figure. 1 there is a power bank which will be used to turn on the microcontroller (Arduino UNO), after the microcontroller is turned on, the Mini PC (Raspberry Pi) and other components are connected to the microcontroller automatically. Pulse Sensor and Temperature Sensor DS18B20 will detect heart rate and body temperature, after the sensor detects it will send data to Arduino, after Arduino receives data from the sensor, Arduino will send the result data from the sensor to the Mini PC then the data is sent into the database. By using IoT technology the data will be continued to the website and LCD which will display data from heart rate and body temperature.

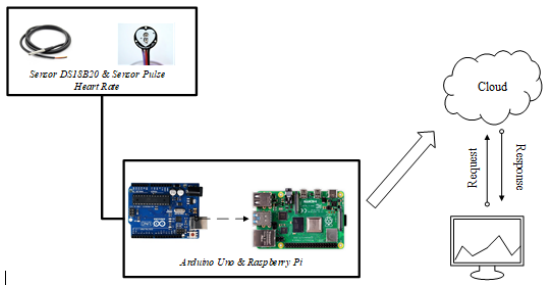

Figure 1: General Architecture.

2.2 Component

The tools used in this research are Hardware / Hardware and Software/ Software:

a. Hardware
- ASUS Intel(R) Celeron(R) CPU N3350
- Memory 2GB
- Harddisk 500GB
- Arduino UNO
- Raspberry Pi
- LCD
- Pulse Sensor
- Body Temperature ds18b20

b. Software
- Windows 10
- Raspbian Operation System
- Arduino IDE
- Sublime Text

Figure 2 shows the installation of a pulse sensor, ds18b20 temperature sensor, and LCD on an Arduino connected to a Raspberry Pi. The components used are a pulse sensor to detect heart rate, a ds18b20 temperature sensor to detect body temperature and an LCD to display heart rate and body temperature data.

Figure 2: Heart rate and body temperature monitoring prototype (External Display).

Figure 3: Heart rate and body temperature monitoring prototype (Inside Display).

2.3 Database Design

Table 1 shows the design database to collect data from data sensor. All data sensor will be process in

the gateway and saving to database MySQL.

Table 1: List of Database Design.

Id Field	*Type*
id	Int (5)
heart_rate	Varchar (10)
temp_body	Varchar (10)
time	Timestamp

3 RESULT AND TESTING

After the test preparation is complete, it is carried out directly on the patient. Testing using all the software and hardware components required in this study. The purpose of this test is to see the functionality of the prototype monitoring of heart rate and body temperature, and when the test is carried out, it can be seen whether or not the function of the equipment is good.

When testing, it can be seen that the prototype equipment has gone well in accordance with the design that has been done. The heart rate sensor can read the heart rate value by placing the index finger on the pulse sensor and the body temperature sensor can also read the body temperature value by clamping the ds18b20 temperature sensor on the armpit, also the LCD can display the value of heart rate and body temperature properly. Keep your text and graphic files separate until after the text has been formatted and styled. Do not use hard tabs, and limit use of hard returns to only one return at the end of a paragraph. Do not add any kind of pagination anywhere in the paper. Do not number text heads-the template will do that for you. Figure 4 shows the patient's retrieval of data

Figure 4: Examination of the patient's heart rate and body temperature.

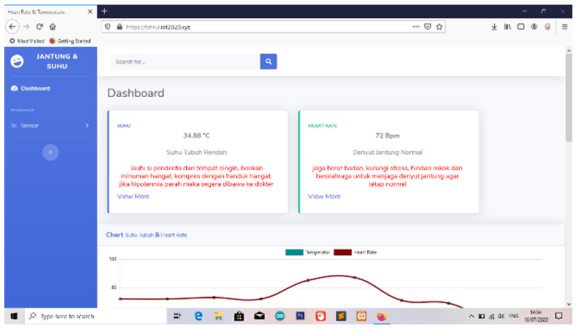

Figure 5: Display of heart rate conditions and body temperature on the website.

Figure 5 shows the results of one minute of data retrieval by displaying the value of heart rate and body temperature along with conditions and descriptions.

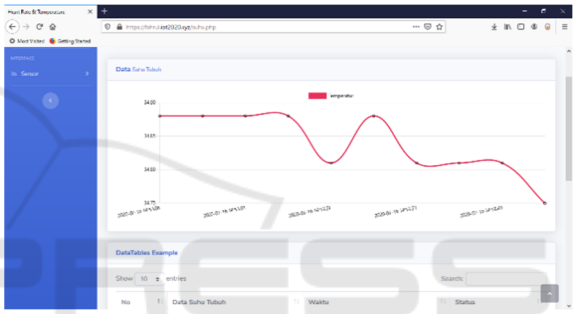

Figure 6: Display the patient's temperature on the website.

Figure 6 is a graph display of body temperature in patients taken for one minute.

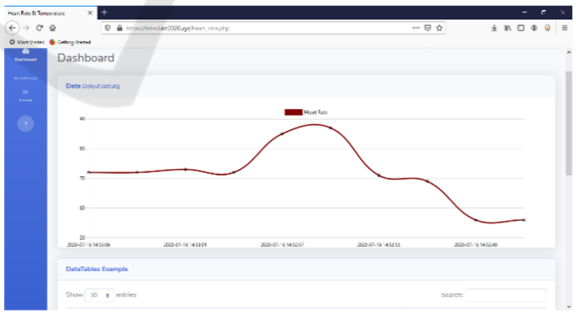

Figure 7: Display the patient's heart rate on the website.

Figure 7 shows a graph of the patient's heart rate taken for one minute.

Table 2: List of Database Design.

No	Name	Age (years)	Heart Rate (bpm)	Body Temperature (°C)	Time (m)
1	Rosaini	68	87	36.00	1
2	Ramlah	60	82	35.75	1
3	Rudianto	60	71	35.25	1
4	Awa Marlina	61	78	35.44	1
5	Mine	72	83	35.69	1

The results of the examination of heart rate and body temperature conditions were carried out randomly by involving 5 elderly people as samples taken on July 23, 2020. Examination of heart rate and body temperature was carried out using a pulse sensor and a temperature sensor ds18b20. Each examination was carried out with a duration of one minute.

The value of the calculation results is used as the value of the patient's heart rate and body temperature when checked using the pulse sensor and temperature sensor ds18b20. The values for the patient's heart rate and body temperature were checked using a pulse sensor and a temperature sensor ds18b20 can be seen in Table 3.

Table 3: Comparison of the accuracy heart rate value from pulse sensor using M4 Smart Watch.

No	Name	Age (years)	Heart Rate (bpm)	Smart Watch M4 (bpm)	Deviation (bpm)	Error (%)
1	Rosaini	68	87	92	5	5.43
2	Ramlah	60	82	91	9	9.89
3	Rudianto	60	71	84	13	15.47
4	Awa Marlina	61	78	85	7	8.23
5	Mine	72	83	92	9	9.78
Average					8.6	9.76

Table 4: Comparison of the accuracy temperature value from temperature value using digital thermometer.

No	Name	Age (years)	Body Temperature (°C)	Thermometer Digital (°C)	Deviation (bpm)	Error (%)
1	Rosaini	68	36.00	36.30	0.3	5.43
2	Ramlah	60	35.75	36.30	0.55	9.89
3	Rudianto	60	35.25	36.30	1.05	15.47
4	Awa Marlina	61	35.44	36.70	1.26	8.23
5	Mine	72	35.69	36.30	0.61	9.78
Average					0.75	2.06

Based on testing of 5 patients over 60 years of age, the heart rate data collection used a pulse sensor and Smart Watch M4 as a comparison, with an average difference of 8.6 and a percentage of deviation of 9.78. As for data collection at body temperature using a temperature sensor ds18b20 and a Digital Thermometer as a comparison, with an average difference of 0.75 and a percentage of deviation of 2.06.

4 CONCLUSIONS

This paper is able to detect heart rate and body temperature in the elderly as seen from the trials that have been conducted by taking samples of two elderly people over 60 years of age. The pulse sensor functions as a sensor used to detect heart rate (BPM), the ds18b20 temperature sensor is used to detect body temperature and the LCD functions to display the output of heart rate data and body temperature and conditions. Displays the value of heart rate and body temperature on the website after data is taken for one minute, there are also conditions whether the heart rate or body temperature is low, normal, or high and also information / suggestions that heart rate and body temperature should be done in low conditions, normal, or high by web-based applications. This system can help work for hospital staff and can be used as a reference for future developments.

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