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:art and Temperature Monitoring Design and Testing Over the Internet

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ABSTRACT

Design and testing of a heart rate monitoring system and human body temperature using an Arduino-based internet network, which aims to monitor heart conditions and body temperature on the internet network. This monitoring system tool is designed using Arduino with two measurement parameters, namely a heart rate sensor and a human body temperature sensor with the results displayed on the LCD, internet web, and android application. The research method used is to measure heart rate (BPM) and human body temperature compared with standard equipment in hospitals, by taking measurements of five patients with five measurements each. This study also aims to make it easier for medics to monitor patient conditions remotely. Based on measurement data for five patients who have been measured using a design tool, the relative error value for heart rate is less than 3% and body temperature with a correction factor of 1% and percentage below 2%. This value indicates that the designed tool functions quite well.

Key words: Arduino, Health Monitoring, Internet of Things, User Testing

1. INTRODUCTION

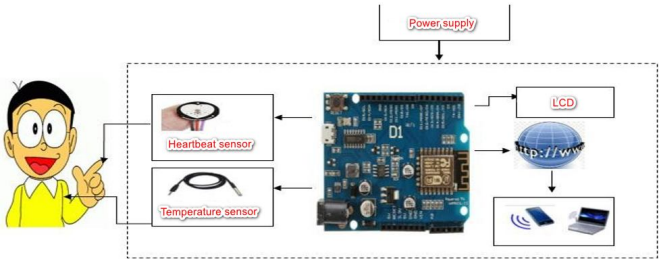
The normal heart rate in humans ranges from 60-100 BPM at rest [1]–[3]. A heart rate of 60 BPM at rest indicates a very healthy body condition. However, a heart rate that exceeds 100 BPM at rest indicates a possible heart disorder and this should not be underestimated because heart disease is one of the leading causes of death in the world. In 2014, the death rate in Indonesia was 1,551,000 people, of which 37% of the death rate was caused by heart disease [4]–[7].

The heart is one of the most important organs of the human body, because the heart functions as a pump for the entire body through blood vessels. When blood is pumped out of the heart in an artery it will feel a pulse wave and can be palpated at the place where the artery crosses a bone that is located near the surface of the skin, such as the dialysis artery in the wrist, temporal artery in the wrist. over the temporal bone, or the dorsalis pedis artery in the ankle [8], [9]. What is palpable is not the blood pumped by the heart into the aorta but the pressure waves that are diverted from the aorta and propagate faster than the blood itself. In addition to the heart, which must be considered is body temperature. Changes in body temperature are closely related to excessive heat production, maximum heat production and excessive heat expenditure [8].

By utilizing internet connectivity, we can do remote monitoring and can be used for patients who have difficulty mobility or difficulty being able to attend the hospital, several previous studies have shown that using the internet for remote monitoring of health can help patients and the medical team in treatment which they do [10]–[14].
Therefore, we need a device to detect the heart rate and human body temperature. With technology, the process of monitoring heart rate and body temperature can be done remotely so that the monitoring process becomes more efficient.

2. RESEARCH METHODOLOGY

This monitoring tool design research was conducted at Columbia Asia Pulomas Hospital, Jakarta. From assembling tools to designing tools for monitoring heart rate and body temperature. Where the data obtained from research at this hospital is data on heart rate measurements and data on measuring human body temperature. The block diagram of a heart rate monitoring system and human body temperature



using an Arduino-based internet network is shown in Figure 1.

Figure 1: Block diagram of system architecture

The following is a brief explanation of how the block diagram in Fig. works. 1 based on each block.

1. A 220-volt AC power supply enters the power supply of the equipment to activate all the components in the tool.
2. Arduino board is a data processing source that will control the work of this design tool. The Arduino board module will control the work functions of the LCD, heart rate sensor, temperature sensor, and the internet. And process the data that has been obtained to be displayed on the LCD, web and android applications.
3. The heart rate sensor here serves to detect the human heart rate. Where the data that has been obtained is sent to Arduino to be reprocessed and displayed on the LCD
4. The thermocouple sensor as a temperature sensor will function to read body temperature from the condition of the patient being examined. The temperature measurement results obtained will be sent to the Arduino and the data is displayed on the LCD.
5. Arduino internet sends data that has been obtained to a cellphone to be displayed on an android application that has been programmed and the data is displayed on a computer web to make it easier for doctors, nurses, and families to monitor patient conditions.

While the process flow of the hardware made in this study can be seen in Fig. 2.

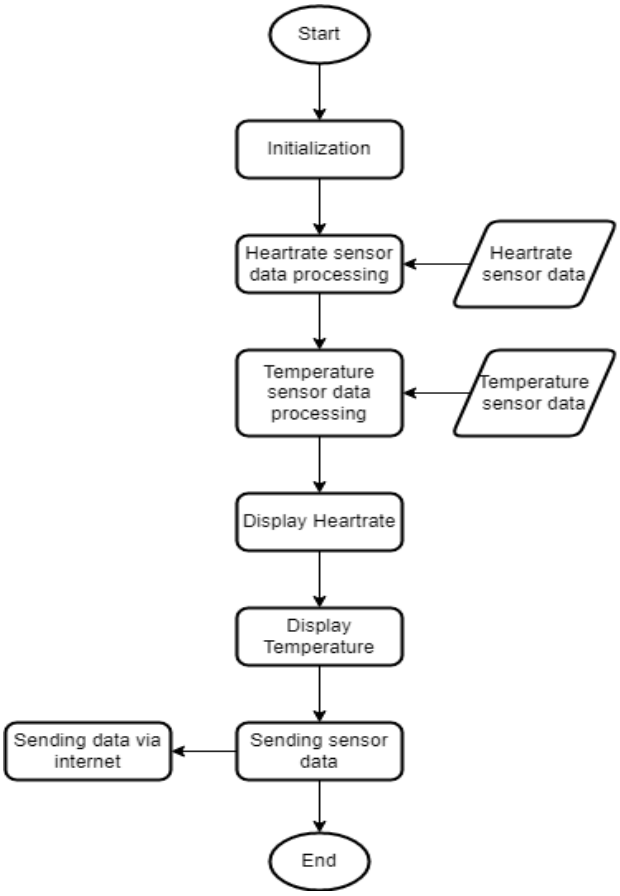


Figure 2: Hardware flowchart

3. RESULTS AND DISCUSSIONS

The device made in this study can be seen in Fig. 3. The device that has been designed is based on the research needs that have been obtained in the formulation of the problem and the background of this research.

Figure 3: Product of this research

The test was carried out on five participants, from the five participants data were taken from two categories of data, namely the heart rate and body temperature of the

participants. The data from the tool made were compared with the tools available in the hospital as a gold standard comparison. Then calculated the percentage of tool correction and the relative error of the tool made with gold standard medical devices in the hospital.

In Table 1 are the results of the average heartrate measurement of each patient in five times measurements.

Table 1: Attributes of Cleveland dataset

Patient	Average heartrate on proposed hardware (BPM)	Average hearthrate on medical instrument (BPM)	Correctio n value (%)	Relative error (%)
1	70	68.6	2	2.91
2	97	94.6	2.47	2.61
3	88	86.8	1.36	1.56
4	88.8	87	2.02	2.32
5	93.8	95.8	2.13	2.41

In Table 2 are the results of the average body temperature measurement of each patient in five measurements.

Table 2: Attributes of Cleveland dataset

Patient	Average temperature on proposed hardware (^oC)	Average temperature on medical instrument (^oC)	correction value (%)	relative error (%)
1	36.82	36.56	0.7	1.91
2	36.4	36.34	0.16	0.44
3	36.28	36.26	0.05	0.13
4	36.12	36.1	0.05	0.13
5	36.54	36.42	0.32	0.87

The data in Table 1 is the value of the average calculation result between the data from the time measurement of the heart rate monitoring tool and the patient monitoring measurement. The results of the design of the Heart Rate and Body Temperature Monitoring tool using an Arduino-based Internet network from the five measurements of the patient obtained a relative error of less than 3% and a tool correction of less than 3%.

In Table 2 are the results of the average measurement of each patient in five measurements and obtained a correction factor of 1% and the percentage of the relative error value is below 2%. The relationship between the temperature readings of the body temperature monitoring tool and the temperature readings on the thermometer.

4. CONCLUSION

From the research that has been done, it can be concluded as follows. The design of the tool that makes measurements for heart rate and body temperature is in accordance with standard tools in the hospital. From the results of the design of the tool that has been made, it can display the measurement results on the LCD quickly according to the existing display on the comparison of patient monitors. The application of heart rate and body temperature is in accordance with the heart rate sensor correction value and the relative error is less than 3% and the human body temperature correction value is 1% with a percentage below 2%.

Suggestions to continue this research is to use a sensor that is better to minimize errors that occur and is better than the error value of the hardware proposed in this study. That way we can monitor the body's vital values from afar and can be used for patients who have difficulty mobility.

REFERENCES

1. J. Alcantara et al. **Impact of using different levels of threshold-based artefact correction on the quantification of heart rate variability in three independent human cohorts,** J. Clin. Med., vol. 9, no. 2, p. 325, 2020.
2. C. Wang, T. Pun, and G. Chanel. **A comparative survey of methods for remote heart rate detection from frontal face videos**, Front. Bioeng. Biotechnol., vol. 6, p. 33, 2018.
3. S. Ecker and A. Lykins. **Effects of Short-Term Human-Horse Interactions on Human Heart Rate Variability: A Multiple Single Case Study**, People Anim. Int. J. Res. Pract., vol. 2, no. 1, p. 2, 2019.
4. D. Purnamasari. **The emergence of non-communicable disease in Indonesia**, Acta Med. Indones., vol. 50, no. 4, p. 273, 2019.
5. T. A. Wihastuti, F. Fajaruddin, T. H. Nasution, K. Kumboyono, and Y. C. Lestari, **Analysis of Related Factors with Anxiety Occurrence in Population with the Risk of Coronary Heart Disease in Indonesia**, SCOPUS IJPHRD Cit. SCORE, vol. 10, no. 7, p. 626, 2019.
6. K. R. M. Nur. **Illness perception and cardiovascular health behaviour among persons with ischemic heart disease in Indonesia**, Int. J. Nurs. Sci., vol. 5, no. 2, pp. 174–180, 2018.
7. O. Lilyasari et al. **Clinical profile and management of rheumatic heart disease in children and young adults at a tertiary cardiac center in Indonesia**, Front. Surg., vol. 7, 2020.
8. E. Mejía-Mejía, J. M. May, M. Elgendi, and P. A. Kyriacou. **Differential effects of the blood pressure**

state on pulse rate variability and heart rate variability in critically ill patients, NPJ Digit. Med., vol. 4, no. 1, pp. 1–11, 2021.

9. R. Latha and P. Vetrivelan. **Blood Viscosity based Heart Disease Risk Prediction Model in Edge/Fog Computing**, in 2019 11th International Conference on Communication Systems & Networks (COMSNETS), 2019, pp. 833–837.
10. N. Azman, M. H. Satria, M. Z. Mukaram, and M. K. Abd Ghani. **Development of Embedded System for Centralized Insomnia System**, in 2018 5th International Conference on Electrical Engineering, Computer Science and Informatics (EECSI), 2018, pp. 451–455.
11. N. Azman, M. K. Bin Abd Ghani, S. R. Wicaksono, B. Kurniawan, and V. V. R. Repi, **Insomnia analysis based on internet of things using electrocardiography and electromyography**, Telkomnika, vol. 18, no. 3, 2020.
12. S. Myers, R. W. Grant, N. E. Lugn, B. Holbert, and J. C. Kvedar. **Impact of Home-Based Monitoring on the Care of Patients with Congestive Heart Failure**, Home Health Care Manag. Pract., vol. 18, no. 6, pp. 444–451, Oct. 2006.
13. [13] N. Azman, M. K. A. Ghani, S. R. Wicaksono, and L. Salahuddin. **The Development of IoT Tele-Insomnia Framework to Monitor Sleep Disorder**, Int. J. Adv. Trends Comput. Sci. Eng., vol. 8, no. 6, pp. 2831–2839, 2019.
14. M. Suarez-Giron et al. **Mobile health application to support CPAP therapy in obstructive sleep apnoea: design, feasibility and perspectives**, ERJ open Res., vol. 6, no. 1, pp. 220–2019, Feb. 2020.