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PULSE MEASURING APPLICATION USING ARDUINO WITH PULSESENSOR BASED ON ANDROID

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ABSTRACT

Pulse is an important factor in the health sector which serves to determine the health condition of a person's body. The method of measuring the number of pulses is currently still using the manual method, namely by counting the pulse beats per minute. To find out a person's pulse, it is necessary to take measurements in a hospital, so not everyone can measure their pulse independently. The solution to this problem is to make a pulse measuring application using Arduino with an Android-based pulse sensor. This tool serves to calculate the pulsewith the main device consisting of a pulse sensor max30100, arduino nano and bluetooth module HC-05. The measurement data will be displayed through an application that has been installed on an Android smartphone that is connected via an Arduino device.

Keywords:**"android app","pulse measuring","pulse sensor","Arduino device"**

INTRODUCTION

The heart is an organ of the human body that functions to pump blood throughout the human body, in that blood there is food and oxygen for all cells and tissues. When the heart does not function normally, various body functions will be disrupted. Given the importance of the function and role of the heart, information about heart health conditions is very important.

The pulse rate describes the frequency with which the arteries (clear blood vessels) expand and contract in one minute in response to the heartbeat. Through the pulse, you can also find out the heart rate, heart rhythm, to the strength of the heart. So, checking the pulse can be a sign of whether the heart is working properly or not. Everyone's pulse rate will vary. This depends on several factors that can affect, such as age, physical activity, fitness level, air temperature, body position, emotions, body size, and consumption of certain drugs.

In general, the following is the normal number of pulses per minute according to age, infants up to the age of 1 year 100-160 beats per minute, children aged 1-10 years 70-120 beats per minute, children aged 11-17 years 60-100 times per minute minutes and adults 60-100 times per minute. Compared to adults, the pulse rate of infants and children tends to be higher. The reason is because they need more blood supply, so the heart has to work harder and beat faster to meet these needs. However, this heart rate can also change, depending on physical activity and health conditions. For example, when a child is very active, in pain, has a fever, or is dehydrated, his pulse may increase sharply. Pulse rate can also be a picture of the heart rate. Therefore, a pulse that is too slow or too fast needs to be watched out for. Because,

Arrhythmias are problems with the heart's rhythm when it beats too fast, too slowly, or irregularly. Some types of arrhythmias to watch out for include Bradycardia, a condition in which the heart beats more slowly or irregularly, Heart block, a condition in which the heart beats slower and can cause a person to faint. Supraventricular tachycardia, a condition in which the heart beats abnormally faster, Atrial fibrillation, when the heart beats very fast even though You are resting, Ventricular fibrillation is a condition where the heart beats too fast and irregularly. In severe cases, this condition can cause loss of consciousness or sudden death. Calculation of pulse in the field of medicine is currently still using the manual method, namely by measuring using a stethoscope.

Therefore, the author wants to make a tool so that it can be used to measure the pulse itself, without having to go to a doctor. Although now many pulse measuring devices are sold or android applications on smartphones, they can only measure the average value of the pulse. This tool will be designed using a pulse sensor as a pulse detection device, Arduino nano as an activity controller in the system and using an Android smartphone as a system base that is applied to operate and display pulse data. The connection system between the device and the Android smartphone uses Bluetooth

media.

LITERATURE REVIEW

The devices needed in this study used software and hardware.

a. Software
   1. Windows 10
   2. Arduino IDE
   3. APP Inventor

b. Hardware
   1. Arduino nano
   2. Pulse Sensor Max30100
   3. Bluetooth HC-05
   4. Jumper Cable
   5. 5V DC Step Down Transformer
   6. Slide Switch
   7. 9V . battery

Block Diagram

In the control system of the pulse measuring application, in general, there are several parts of the circuit that will be made or commonly referred to as a block diagram.

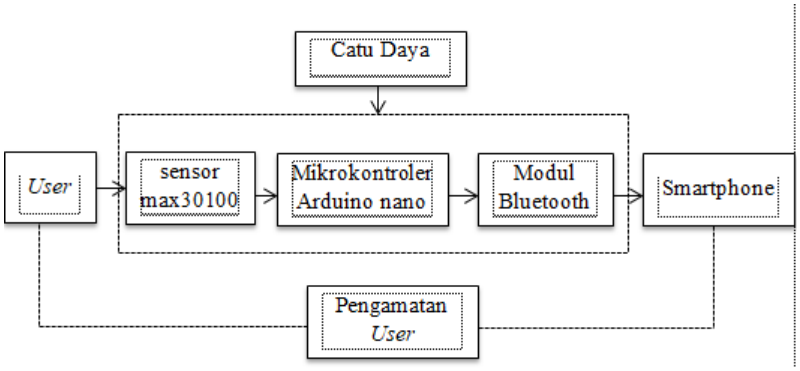

Figure 1. Block Diagram

How the System Works

This tool is designed to monitor the pulse in real time and continue using the pulse max30100 sensor as a pulse reader sensor. This pulse sensor works by emitting light at the fingertips which is then reflected back to the light detector. The data from the pulse sensor is processed by Arduino nano and then the data will be sent to an Android smartphone with the HC-05 Bluetooth module. After the data processing runs well, the pulse data will appear in real time so that the amount of pulse data can be displayed every time on an android smartphone.

METHODS

After designing the hardware of all the components and materials used, the entire system circuit will look like the image below.

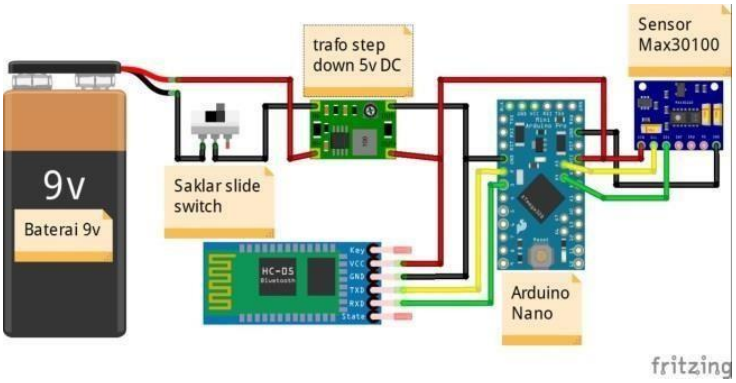

Figure 2. Toolkit Design

In this series of pulse monitoring tools using 4 main components consisting of an Arduino Nano microcontroller, a Bluetooth module type HC-05, a max30100 sensor and a 9V battery, which will be connected to each of the pins on the device. The pins on the I/O port that will be used in the design are as follows:

1. The arduino nano GND pin and the max30100 sensor GND pin are connected in one circuit
2. Pin A4 arduino nano is connected to pin SDA Sensor max30100
3. Arduino nano A5 pins are connected to SCL pin pins
4. The arduino nano VCC pin is connected to the VIN Sensor max30100 pin and the HC-05bluetooth VCC pin and to the pin out plus a 5v DC step down transformer.
5. The arduino nano's GND pin is connected to the bluetooth GND pin and the 5v DC step down transformer min out pin.
6. Pin 2 of the Arduino Nano is connected to the TXD pin of the Bluetooth HC-05.
7. Pin 3 of the Arduino Nano is connected to the RXD Bluetooth HC-05 pin.
8. 9v battery connected with 5v step down transformer9.

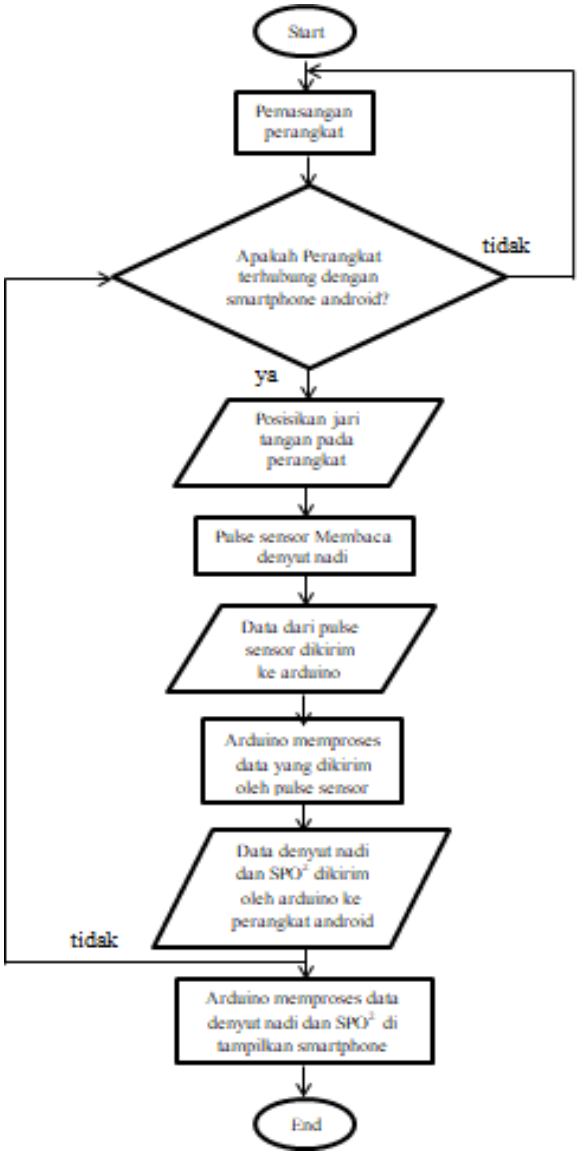

Figure 3. Flowchart

RESULTS AND DISCUSSION

The assembled device consists of a max30100 pulse sensor, arduino nano, bluetooth HC-05,jumper cable, 5v DC step down transformer, slide switch, 9v DC battery and Android application.

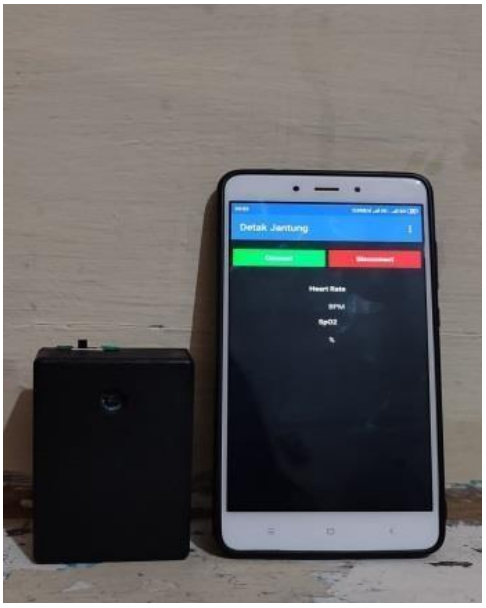

Figure 4. Android Devices and Smartphones

1) Results and discussion 1

After designing and installing components, the next step is to carry out a series of tests on hardware and software with the aim of getting the specifications conformance and the desired results.

1. HC-05 . Bluetooth Transmission Testing

The HC-05 Bluetooth Transmission Test was carried out to measure the distance capability required by the bluetooth HC-05 when sending commands from the rduino nano device to the android smartphone. More details on Connectivity Testing on Bluetooth HC-05 can be seen in Table 1.

Table 1. Testing Connectivity on Bluetooth HC-05

NO	STANCE	WITHOUT OBSTACLE	WITH OBSTACLE
1	1 Meter	SUCCESS	SUCCESS
2	2 Meters	SUCCESS	SUCCESS
3	4 Meters	SUCCESS	SUCCESS
4	6 Meters	SUCCESS	SUCCESS
5	8 Meters	SUCCESS	UNSUCC ESSFUL
6	10 meters	NO SUCCESS	NO SUCCESS

7	12 meters	NSUCCESSFUL	UNSUCCESSFUL

Based on the table above, the effective distance that can be reached by Bluetooth HC-05 toconnect with a Smartphone is about 8 meters. Bluetooth can be connected directly *horizontal*as well as vertically.

2) Results and discussion 2

2. Overall Tool Test

Overall design testing is carried out to test as a whole whether the tool system can function properly. The test is carried out at home, the test is carried out on 4 people. To use it, first slide the switch to the on position. To find out the tool is alive, you can see the light on the sensor is on. More details can be seen in Figure 5.

Figure 5. The device is on

Then turn on the bluetooth HC-05 smartphone, then open the pulse application on the smartphone. The application display can be seen in Figure 6.

Figure 6. Display of applications on smartphones

Then click connect and it will show connecting bluetooth on the smartphone. More details can be seenin Figure 7.

Figure 7. display of connecting bluetooth on a smartphone

Then select Hc-05, the smartphone and arduino are connected. To use it, place your fingertip on thepulse sensor as shown in Figure 8.

Figure 8. Testing of tools

For the measurements I took from 4 people aged 15 years, 26 years, 55 years and 78 years. The results can be seen in table 2.

Table 2. Device Test

Den yut pulse/ minute	AGE							
	15		26		55		78	
	BPM	SPO2	BPM	SPO2	BPM	SPO2	BPM	SPO2
1	0	0%	0	0%	0	0%	0	0%
2	0	0%	0	0%	0	0%	11.98	0%
3	0	0%	0	0%	0	0%	25.48	0%
4	12.29	0%	6.58	0%	7.02	0%	0	0%
5	12.29	0%	0	0%	7.02	0%	0	0%
6	0	0%	33.16	0%	41.15	0%	25.48	0%
7	46.30	0%	50.67	0%	55.90	0%	42.61	0%
8	64.94	52%	64.34	95%	66.96	11%	57.32	97%
9	85.94	66%	65.34	95%	71.96	32%	68.74	97%
10	94.95	72%	73.63	95%	71.96	68%	74.71	97%
11	89.96	97%	75.17	95%	73.96	85%	53.84	97%
12	86.96	16%	50.66	96%	73.96	07%	47.53	97%
13	90.96	66%	64.28	96%	73.97	29%	50.49	97%
14	89.96	51%	76.44	96%	71.97	65%	81.21	96%
15	88.96	91%	81.16	94%	71.97	72%	70.44	96%
16	94.96	43%	69.08	97%	73.97	28%	63.74	96%
17	97.96	22%	43.76	96%	71.97	99%	73.34	97%

In the test results in the table data above, the experiment was carried out for 17 seconds by placing the fingertip on the Max30100 pulse sensor which was carried out on 4 people of different ages. From this test the results obtained with a normal pulse (60-100 BPM) and SPO2 (95% - 100%) at 8 seconds and so on.

CONCLUSION

Based on the results of the design and implementation of the system that has been carried out, several conclusions can be drawn including the following:

[1] An overview of the measurement of the pulse rate in an adult human normally ranges between 60-100 BPM. While the SPO2 ranged between 95% - 100%.
[2] The application of the application to measure the pulse rate and oxygen levels in the blood using Arduino Nano which can be monitored via an Android smartphone.
[3] The pulse measurement application using an android-based pulse sensor can work normallyfor 8 seconds and so on.

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