COMPARISON OF MAX30100 BLOOD OXYGEN DETECTOR RESULTS WITH SMART WATCH

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ABSTRACT

The development of modern component technology makes it possible to create practical, compact, reliable, effective, and efficient equipment/instrumentation. The health sector as an essential component of life is also not spared from technological support. One significant indicator of oxygen supply in the body is oxygen saturation. Because oxygen saturation can show whether hemoglobin can bind oxygen or not. So that the lack of oxygen which is at risk of damage to essential organs in the body can be overcome. By using the max30100 sensor is a detection tool that will be used to detect oxygen levels with saturation levels, namely, normal and abnormal, and the tool is controlled by Arduino Nano as the controller of the entire circuit. With the output displayed on the Oled LCD, ten tests have been carried out. times and compared with the results using a Smart Watch with an average difference of 0.73%.

Keywords*: Arduino Nano, Max30100 sensor, Lcd Oled, Oxygen levels.*

1. INTRODUCTION

The development of modern component technology makes it possible to create practical, compact, reliable, effective and efficient equipment/instrumentation. The health sector as an important component of life is also not spared from technological support. This can be seen from the work that used to be done manually, now it has been replaced by electronic equipment. One very important indicator of oxygen supply in the body is oxygen saturation. Because oxygen saturation can show whether hemoglobin can bind oxygen or not. So that the lack of oxygen which is at risk of damage to important organs in the body can be overcome. Especially in patients who have just had surgery, or who have respiratory and cardiovascular problems, really need monitoring of oxygen saturation (Nugroho, 2019).

In previous studies, there have been many studies on measuring blood oxygen levels, including Pulse Oxymetry: Understanding the basic principles makes it easy to appreciate its limitations (Chan et al., 2013), Pulse Design and Development Oximeter Using Blynk Application (Yulianti & Prakoso, 2023), Telemonitoring SPO2 Levels on Symptoms of Silent Hypoxia Covid-19 Based on IoT (Khoerunnisa et al., 2022), Monitoring System for Heart Rate and Blood Oxygen Based on LoRa (Sofiani et al., 2021), Measuring Oxygen Saturation Using a Pulse Oximeter Based on Fuzzy Logic (Ateş & Polat, 2012), Design and Development of IoT-Based SpO2 Heart Rate and Body Temperature Monitoring System for COVID-19 Sufferers (Tachiyat et al., 2020), A new principle for measuring arterial blood oxygenation, enabling powerful remote monitoring (Van Gastel et al., 2016), Measuring device for detecting blood oxygen saturation, heart rate , and human body temperature (Suprayitno et al., 2019). And several previous studies that used the Max 30100 sensor for other case studies including

Analysis of the use of the max30100 sensor in the blynk IoT- Based heart rate detection system (Harianto et al., 2021).

While what is being done here is to design a device for detecting oxygen levels in the blood using the max30100 sensor, this tool can measure the level of oxygen levels in the blood through infared (infrared) light so that the results of reading these levels will be displayed on the LCD, using two categories, namely , if the oxygen level is> 85% then it is categorized as normal and vice versa if it is <85% then it is categorized as Upnomal. So that these results appear on the LCD and then the results obtained will be compared with the measurement results using the Smart Watch.

2. RESEARCH METHODS

Tools and materials

The tools and materials needed in designing a device for detecting oxygen levels in the blood and heart rate using the Arduino-based Max30100 Sensor consist of hardware and software, including:

Table 1. Hardware Components

No	Component name	Function
1	Max30100 sensors	as a component of detecting oxygen levels in the blood
2	Arduino	as a controller for the components in the design of a device for detecting oxygen levels in the blood using the max30100 sensor
3	OLED LCD	as a place to display the character object / result
4	Lithium ion battery	as a power supply for the device to be used
5	Watch Straps	as an attachment to the wrist

Tool Chart

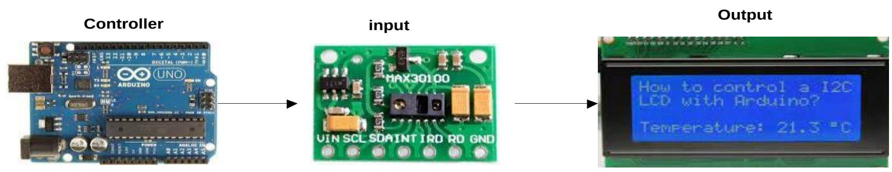


Figure 1. Tool chart

Information

1. Arduino functions as a component controller
2. The Max 30100 sensor functions as input or detects oxygen levels in the blood
3. LCD functions as a result of sensor readings

Flowcharts

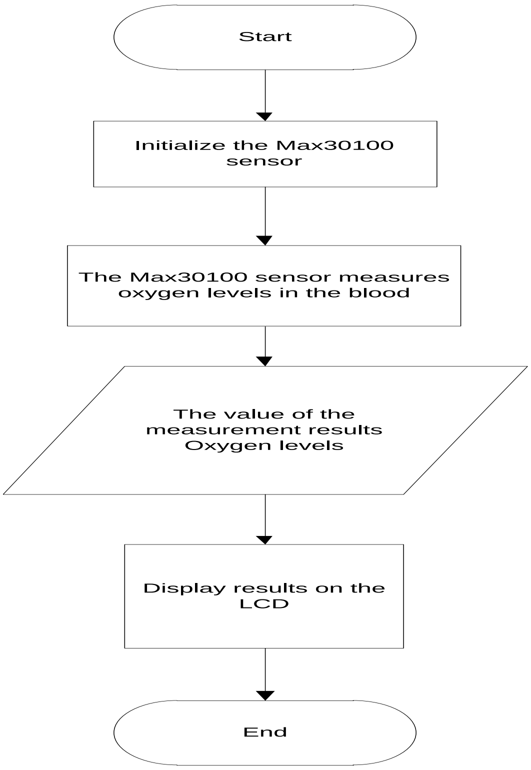
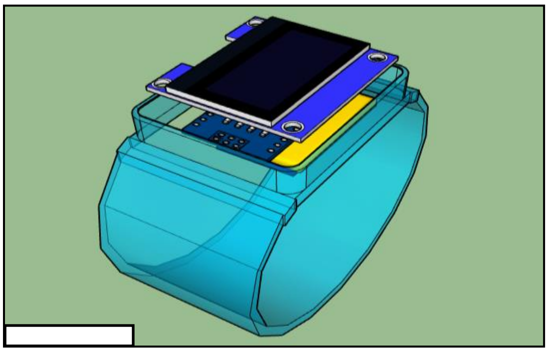


Figure 2. tool flowchart

From figure 2 above, starting with starting to run, and initializing the max30100 sensor, the sensor will measure oxygen levels in the blood. If the sensor measures oxygen levels below 90%, it is categorized as upnormal and when the sensor measures 90% and above, it is categorized as normal and can be seen on the LCD screen and it's finished.

The results of the software design in this study include the design of an oxygen saturation measuring instrument (O2) with units (%). This value is obtained after successfully carrying out software design by entering the appropriate source code into the Arduino IDE, after success it will appear on the LCD screen. The % results are obtained from the calibration between oxygen saturation (O2) and blood.

Tool Sketch



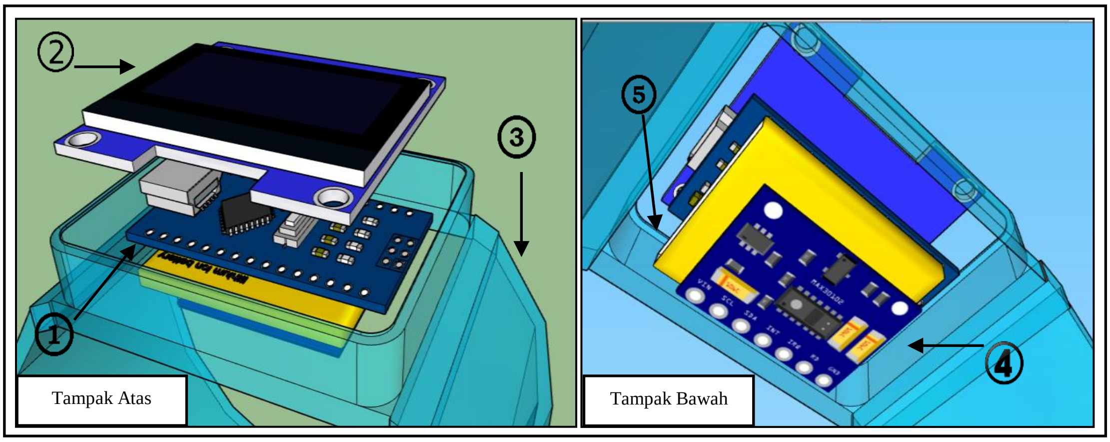


Figure 3. Tool Sketch

Information :

1. Arduino Nano
2. OLED LCD
3. Watch Strap
4. Blood Oxygen Sensor Max30100
5. Lithium Ion Battery

3. RESULTS AND DISCUSSION

Series of Components for Detectors of Oxygen Levels

When all the components are connected to one another, the Arduino which functions as the controller of all components will start the command to run all the components, then the max30100 sensor will start detecting oxygen levels in the blood and the results of the sensor readings will be sent to the OLED LCD in the form percent and description normal or abnormal. The series of tools can be seen in Figure 4 below.

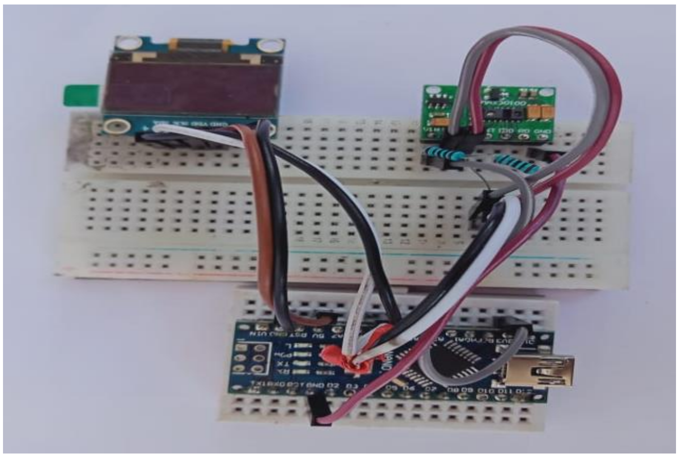


Figure 4. The overall series of components

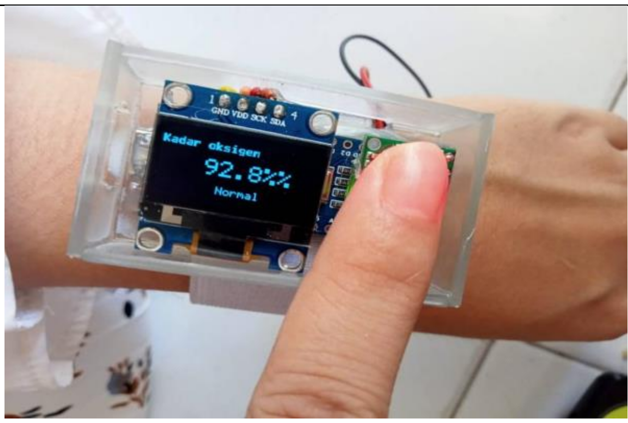


Figure 5. The results of a series of tools

Tool Testing Procedures

After the system has been created, it is necessary to test the system. Then the sensor will detect oxygen levels in the blood, where the fingertip is placed above the Max30100 sensor and if the Max30100 sensor detects oxygen levels <85% then the description of the oxygen level is Upnormal (lack of oxygen levels) and vice versa if the sensor detects oxygen levels> 85 then the information levels the oxygen is Normal and the results of the sensor readings will be displayed on the LCD. Here the author conducted research for 10 days in 1 day carried out 3 times.

An oxygen measuring instrument using the Arduino-based max3010 sensor has been compared starting from reading the accuracy of the sensor and the response level of the sensor in reading oxygen levels, in research that has been carried out a comparison between the tools is carried out by comparing the oxygen measuring instrument using the Arduino-based max3010 sensor with a smart watch, in In this test, the difference in readings between the tool and the smart watch is around 1%, and the response rate of the tool in reading the max3010 oxygen level sensor is faster in reading oxygen levels than the smart watch.

As in the picture below.

Figure 6. Comparison of Tools with Smart Watches

The following is a table of results of comparative testing of tools that have been carried out using an oxygen meter using an arduino-based max30100 sensor to detect oxygen levels in the blood and a smart watch.

Table 2. Tool comparison testing

Testing	**Tool comparison**			**MSE Value**	
	Max3010 sensors	**Max3010 sensors response**	**Smart Watch**	**Difference**	**Difference Squared**
1	94,14 %	2 sec	95 %	-0,86	0,73
2	92, 8 %	2 sec	93 %	-0,2	0,04
3	93,2 %	2,5 sec	94 %	-0,8	0,64
4	92, 7 %	2 sec	93 %	-0,3	0,09
5	94,3 %	3 sec	95 %	-0,7	0,49
6	94,7 %	2 sec	96 %	-1,3	1,69
7	93,15 %	4 sec	94 %	-0,85	0.72
8	93,22 %	3 sec	94 %	-0,78	0,60
9	94 ,23 %	2 sec	95 %	-0,77	0,59
10	93,44 %	3 sec	95%	-1,56	2,34
			Total	-8,12 / 10	7,34 / 10
			MSE		0,734

After testing the comparison of the two devices using a smart watch which has been recognized for its accuracy, the results of the comparison show the level of readings, and the response of the readings from the two devices in reading oxygen levels in the blood, the Max30100 sensor reads oxygen levels with an average difference not too far from smart watch, as well as the response rate in reading oxygen levels, the max30100 sensor is faster in the process of detecting oxygen levels with a time span of 2-4 seconds, while the response rate for reading oxygen levels using a smart watch is around 2-4 minutes and the process of reading oxygen levels using a smartwatch is faster. time compared to the max30100 sensor, and to determine the value of the average difference, the test results will be formulated using the MSE (Mean Squared Error) formula as in the table above.

4. CONCLUSION

After carrying out the design and realization of the oxygen level detector device and then testing the device, both testing in the form of each series and the overall sensor readings. Then it can be concluded:

1. The results of each sensor reading will be displayed on the LCD so that the oxygen level detected by the sensor can be known.
2. Of the ten long tests the results of readings measuring oxygen levels in the blood are an average of 2-4 seconds.
3. Out of ten tests, an error rate of 0.734 was obtained

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