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IoT Oxymeter Starter Prototype As An Employee Health Monitoring Tool In The Blynk Integrated Palm Industry

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Abstract. *One of the main challenges faced by workers in the palm oil industry is routine health monitoring. Therefore, innovation is needed in the form of health monitoring tools that can facilitate and increase the efficiency of employee health monitoring. The Internet of Things (IoT) has become an increasingly popular solution to overcome these challenges. The use of this technology is expected to increase employee health resilience, detect potential health problems early, and provide a quick response to health conditions that require medical attention.*

Keyword : *IoT Oxymeter Starter Prototype, Employee Health, Palm Industry*

BACKGROUND

One of the main challenges faced by workers in the palm oil industry is routine health monitoring. The diverse and often remote conditions of work environments make it difficult to carry out health monitoring with conventional systems. Therefore, innovation is needed in the form of health monitoring tools that can facilitate and increase the efficiency of employee health monitoring. The Internet of Things (IoT) has become an increasingly popular solution to overcome these challenges. The IoT oximeter starter prototype is an implementation of IoT technology that can be used to monitor employee health in real-time to measure oxygen saturation and heart rate. The oxymeter is used to measure oxygen levels in the blood, and integration with the Blynk platform enables remote monitoring via a mobile device or computer.

The use of this technology is expected to increase employee health resilience, detect potential health problems early, and provide a quick response to health conditions that require medical attention. By utilizing IoT technology and integration with the Blynk platform, it is hoped that this prototype can be the first step towards more effective and efficient health monitoring in the palm oil industry, thereby improving the quality of life and productivity of employees.

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THEORETICAL REVIEW

Internet of Things (IoT)

Internet of Things (IoT) is a concept where objects have the ability to send data over a network without requiring human-to-human or human-to-computer interaction. Simply put, the Internet of Things can be interpreted as the connection of various objects around you with an internet network (Sabila et al., 2022). The use of IoT is often found in various activities, for example in online transportation, e-commerce, online ticket ordering, live streaming, e-learning and others. Even tools in certain fields such as remote temperature sensors, GPS tracking, and in the educational field IoT are very necessary to carry out all activities using the right filing system. Therefore, IoT makes things easier.

Health of Palm Oil Industry Employees

Workers in the palm oil industry are of course very familiar with activities and activities that equire physical strength. So the health of employees before work certainly needs to be ensured first. As a step to avoid work accidents caused by unstable health.

Oxygen Saturation

Hemoglobin that completely binds oxygen is called HbO2 (Oxyhemoglobin). Hemoglobin that does not completely bind oxygen is called Hb (deoxyhaemoglobin). SaO2 is the oxygen saturation of arterial blood vessels. SpO2 is oxygen saturation detected by a pulse oximeter. For normal oxygen saturation, the percentage of hemoglobin that binds to oxygen in the arteries is between 95% – 100%. The heart's relationship to oxygen saturation is that the heart is a pump, blood vessels are pipes, and blood is flowing water (Santika Hyperastuty & Mukhammad, 2021).

NodeMCU V3 Board

The NodeMCU can function as a complete standalone system or as a slave device to a host MCU by reducing communications stack overhead on the main application processor. NodeMCU can interface with other systems to provide Wi-Fi and Bluetooth functionality via SPI/SDIO or I2C/UART interfaces. This device uses a standard micro USB connector which is its characteristic (Santika Hyperastuty & Mukhammad, 2021)

METHODS

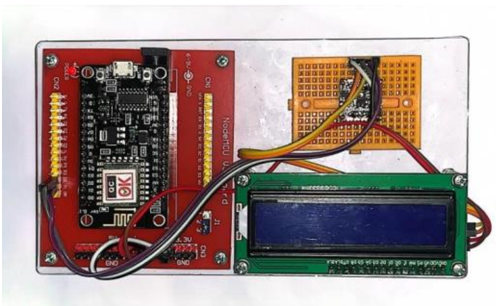
In designing a prototype system for controlling blood oxygen levels for palm oil industry employees. Required tools and materials used in making the system. Before the system is assembled, it is necessary to collect the required tools and materials. The hardware design for the SpO2 and BPM monitoring tool consists of several basic components, namely the Max30100 sensor, NodeMCU V3 board, ESP8266 module, and 16x2 LCD. The sensor used is Max30100 because the level of accuracy is good because this sensor is a digital sensor so it is easy to calibrate.

Based on the flowchart above, the steps can be explained as follows:

1. Start by activating the tool, then the pin initialization process for all sets of tools. This tool uses a sensor, namely the MAX30100 sensor. This sensor works by emitting infrared light to detect hemoglobin.
2. Next, the results of the hemoglobin detection in the body's blood are converted into saturation, then sent to the microcontroller and converted from analog data to digital.
3. The sensor detection results sent to the ESP8266 microcontroller are converted into BPM (beats per minute) units for heart rate and into percent units (%) for oxygen saturation.
4. The resulting data will be displayed on the LCD in digital data using BPM and % units.
5. Then the data is sent to the smartphone via the ESP8266 Module on the NodeMCU V3 in the blynk application with a network/WIFI connection.

Results and Discussion

The prototype of the tool made is a system assembled on acrylic, where the ESP8266 Module on the NodeMCU V3 as a processing unit will be connected to the LCD and MAX30100 sensor using jumper cables. Later the sensor value data will be processed by NodeMCU into digital data which will be displayed on the LCD and sent to the blynk application.



Picture 1. Prototipe Starter IoT Oxymeter

This test was carried out to determine the accuracy of BPM and SPO2 measurements by the MAX30100 sensor. When the test was carried out, respondents were asked to place their finger for 1 minute on the MAX30100 sensor on a designed device that was connected to the USB port on the laptop with the aim of reading data on heart rate (BPM) and blood oxygen levels (SPO2). When testing takes place, the design tool and the smartphone that has the Blynk application installed must be ensured to be connected to the internet network so that the data can be displayed via the Blynk application.

Table 1. Testing the MAX30100 sensor for heart rate (BPM)

No	Respondents	Age	Heart Rate (bpm)					Average (bpm)
			1	2	3	4	5	
1	Abud	18	90	92	89	92	95	91,6
2	Fajar	19	87	90	90	89	92	89,6
3	Isma	19	89	90	92	90	92	90
4	Maudy	19	92	90	90	93	91	91,2
5	Farodis	23	87	85	90	92	89	88,6

In Table 1 it is shown that each respondent has 5 data (changes in values) for heart rate calculations carried out in 1 minute. And the average value obtained will be calculated.

Table 2. MAX30100 sensor analysis results for heart rate (BPM)

No	Respondents	Age	Information
1	Abud Fajar Isma	18	Normal
2	Maudy	19	Normal
3	Farodis	19	Normal
4		19	Normal
5		23	Normal

In Table 2 it is shown that the analysis results of each respondent for testing heart rate data are normal. Because the normal heart rate for an adult human at rest is between 60-100 BPM. Data from the MAX30100 sensor reading test results for reading blood oxygen saturation (SPO2) data is shown in Table 3.

Table 3. Results test for reading blood oxygen saturation (SPO2)

No	Respondents	Age	oxygen saturation (SpO2)					average (SpO2)
			1	2	3	4	5	
1	Abud	18	90	95	96	97	98	95,2
2	Fajar	19	95	94	97	98	97	96,2
3	Isma	19	93	96	96	97	98	96
4	Maudy	19	94	96	98	96	97	96,2
5	Farodis	23	96	94	96	95	98	95,8

In Table 3 it is shown that each respondent has 5 data (changes in values) for the calculation of oxygen saturation (SpO2) which is carried out in 1 minute. And the average value obtained will be calculated.

Table 4. Results from respondents for testing oxygen saturation (SpO2) data

No	Respondents	Age	Average
1	Abud Fajar Isma	18	Normal
2	Maudy	19	Normal
3	Farodis	19	Normal
4		19	Normal
5		23	Normal

In Table 4 it can be seen that the analysis results of each respondent for testing oxygen saturation (SpO2) data are normal. Because the normal arterial blood oxygen saturation level in humans is 95% -100%. If the level is below 90%, it is considered low.

Blynk Application Appearance

The application display was created using the Blynk platform. Apart from being simple, this platform was chosen because it has complete features. This application will later be installed on the cellphone of the supervisor or officer. Where the application will display the heart rate (BPM) and blood oxygen levels (SpO2), LED to display the normal or abnormal status of the BPM and SpO2 values, Chart to display graphs and store BPM and SpO2 value data, Eventor to display routine equipment conditions, and Notification to create messages/warnings when there are abnormal values in BPM and SpO2 measurements. The user interface that is built can communicate with devices using WiFi (personal hotspot) media on cellphones.

The image below shows the appearance of the application created.

CONCLUSIONS AND RECOMMENDATIONS

Based on the test results on the ESP8266-based MAX30100 sensor, it can be concluded that the system created can work well. During testing the MAX30100 sensor was accurate in detecting oxygen saturation (SpO2) and BPM. Based on the results of research and testing, the normal arterial blood oxygen saturation level in humans is 95% -100%. Voltage measurements on the pulse oximetry device show that the device is still working well. If the level is below 90%, it is considered low. In the pulse oximeter design, the blynk application is used as an additional output to view measurement results in real time via a smartphone connected to a wifi internet network. Based on experiments on the use of the design, the sensor is suitable for use to build an oximeter system as a tool for monitoring the health of employees who will work. especially in the palm oil industry which requires good physical health. In writing this paper, the author would like to provide the following suggestions:

1. To correct the measurement error percentage value, you can use a sensor such as a bedside monitor, because the location of the transmitter and receiver is under the finger, right on the artery. So that the measurement results are better or you can also use an easy plug in sensor because the sensor uses an absorption method so the readings are more stable.
2. For more accurate test results, the test should be carried out using an SpO2 and heart rate calibrator.

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