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ABSTRACT

Thermoxymeter is a health device that can assist people who have COVID-19 symptoms and people who have already been infected by COVID-19 throughout the occurrence of this Coronavirus outbreak. The research conducted on this project aims to develop an IoT -based health measurement device system that is capable of measuring human body temperature, heart rate, and oxygen saturation using a single device with multiple sensors. The system is designed with an Organic Light Emitting Diode (OLED that will display the measured body temperature, heart rate, and oxygen saturation with one touch on the sensor, these measurements will also be displayed on the mobile application named Thermoxy App on the smartphone. The Internet of Things (IoT) technology that has been used in this project is the Arduino Nano which will be connected with various sensors such as an Infrared thermometer non-contact sensor (MLX90614) and Pulse oximeter & Heart rate sensor (MAX30100). The user is required to install the Thermoxy App on their smartphone to keep track of their health check data whenever they use Thermoxymeter. The user's health check data will be recorded on the Thermoxy App and the data will also be saved as history in the application. Throughout the outbreak of this Coronavirus, Thermoxymeter and Thermoxy App are guaranteed to help people to be more sensitive and more vigilant about their health. It is also hoped to reduce the transmission of Covid-19 outbreaks to others.

Keywords: Coronavirus Patients, Reduce, Sensitive, Biomedical.

INTRODUCTION

The Covid-19 outbreak was first identified in Wuhan, China, in December 2019. Attempts to curb the outbreak failed, making the virus quickly spread around the world including Malaysia. On the 25th of January 2020, the first case of COVID-19 was detected in Malaysia and traced back to 3 Chinese nationals who previously had close contact with an infected person in Singapore. The longer this epidemic last, the more rampant it spreads to all

parts of Malaysia. This has caused fear in the community as the number of cases of Covid-19 infection is increasing day by day.

Although many health procedures have been introduced by the MOH, this case is still widespread due to the attitude of some people who are not sensitive to the health procedures and are not aware of the symptoms of the Covid-19 infection that they have experienced. This has led to the spread of the Covid-19 infection around them. Fever, cough, tiredness, and loss of taste or smell are the most common symptoms of Covid-19 infection. People who have not and are already infected with Covid-19 symptoms need to be sensitive to their body temperature, pulse rate, and oxygen saturation.

The instrument known as a pulse oximeter is often worn on a fingertip. It calculates the pulse rate and oxygen saturation of blood using laser beams. The quantity of oxygen transported by the blood is revealed by oxygen saturation. Without taking a blood sample, the pulse oximeter can determine the quantity of oxygen in the blood. A pulse oximeter typically displays two or three values. The oxygen saturation level, which is the most crucial figure, is typically abbreviated as SpO2 and shown as a percentage. The abbreviation for the pulse rate, which is akin to heart rate, is PR, and there may occasionally be a third digit indicating signal strength. Most healthy people have oxygen saturation levels between 95% and 100%, although patients with lung issues can have lower numbers. Higher altitude residents often have somewhat lower oxygen saturation levels.

With the inclusion of sensor technologies, external temperature measuring has evolved technologically, boosting patient comfort, enhancing accuracy, and producing better monitoring tools. Its information may be essential to patients with a range of illnesses, including infections and hypothermia. Body or skin temperature sensors can be used to monitor the temperature of the body's surface. NTC (negative thermal coefficient) thermistors, thermopiles, and digital temperature sensors are produced by TE Connectivity (TE) to satisfy the wide variety of accuracy, packaging, and performance requirements among the many applications. Accurate non-contact temperature measurement in medical applications is made possible by infrared (IR) temperature sensors. The most typical uses for this kind of temperature sensor are for monitoring skin, forehead, or ear temperatures. The infrared energy of an item is measured by the sensing element, which is made up of many thermocouples on a silicon chip. To meet client demands, TE customizes and packages thermopiles in a range of package sizes and wire lengths.

Thermoxymeter is a health device that was developed with multiple sensors to measure the body temperature, pulse rate, and oxygen saturation of the human body. Thermoxymeter is a health device that can reduce one's expenses in this Covid-19 era. Thermoxymeter is also a health device that does not take up much space when being carried anywhere and makes it convenient to use because there were three functions in a device. Thermoxymeter is a health device that was developed with an IoT mobile application that can record the data of a user’s health check and send warning signs to the users. With the record, it will help them to stay alert to Covid-19 symptoms and distance themselves from others. Thermoxymeter is suitable for use by people who have COVID-19 symptoms and people who have been infected with COVID-19.

METHOD

There are two parts involved in this project which are hardware and software. For the hardware, this project uses Arduino Nano, Infrared Thermometer Non-Contact Sensor, Pulse Oximeter & Heart Rate Sensor, and OLED Display. While for the software is used to program the coding to the Arduino Nano and Sensors to make the sensors measure the body temperature, heart rate, and oxygen saturation. An Arduino Nano is used as a microcontroller. The Infrared thermometer non-contact sensor (MLX90614) and Pulse oximeter & Heart rate sensor (MAX30100) will be used as sensors to measure body temperature, oxygen saturation, and heart rate. For the plastic part, material plastic will be used in this project because it is light enough to be picked up and moved easily. Figure 1 below shows the block diagram of the overall activities in developing the Thermoxymeter. The process consists of hardware development.

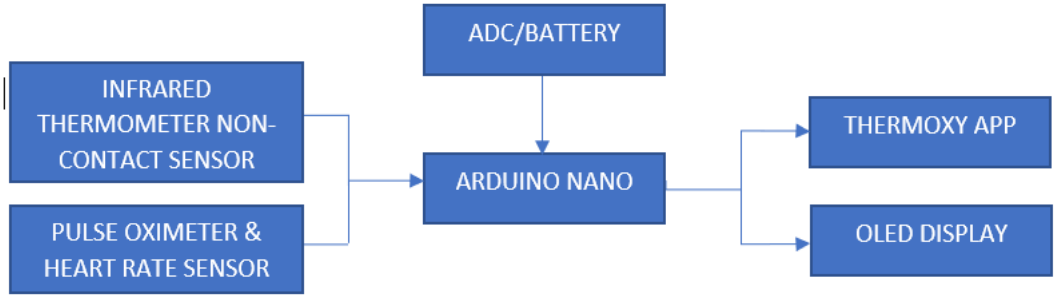


Figure 1. Block Diagram of the Project

This block diagram shows the process of hardware development. The Infrared thermometer non-contact sensor (MLX90614) and Pulse oximeter & Heart rate sensor (MAX30100) is programmed in C++ language and connected to the Arduino Nano controller. The Infrared thermometer non-contact sensor and Pulse oximeter & Heart rate sensor was powered by a 5V power supply connected through the Arduino Nano. The results of the body temperature, oxygen saturation, and heart rate are displayed on the 16×2 OLED Display. The results were also displayed on the IoT mobile application named Thermoxy App on the smartphone.

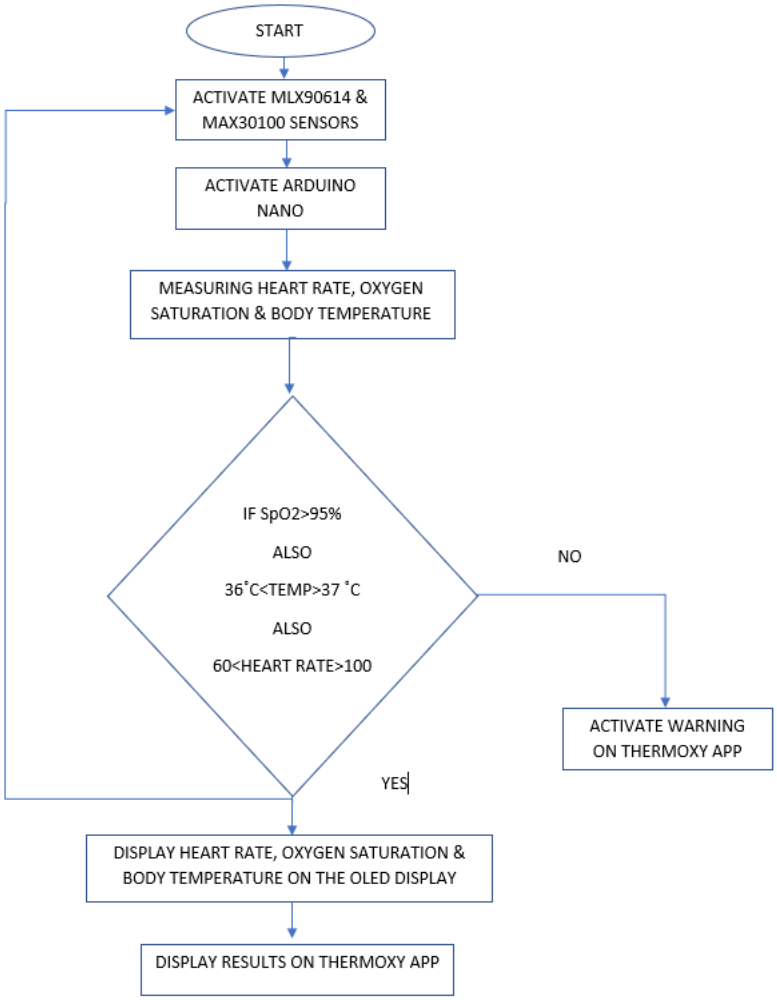


Figure 2. Flowchart of the IoT System

This flowchart shows the process of software development. When the Thermoxymeter was started, Body Temperature Sensor (MLX90614), and Pulse Oximeter & Heart Rate Sensor (MAX30100) were activated. Next, the Arduino Nano was also activated. When the finger was placed on the sensors, the sensors will start to measure the heart rate, oxygen saturation, and body temperature of the human body. In the Arduino Nano, it will be programmed as, if the oxygen saturation is more than 95%, if the body temperature is not less than 36˚C and not more than 37˚C, and if the heart rate is not less than 60, and not more than 100. If the data was right, then the results of the heart rate reading, oxygen saturation reading, and body temperature reading will be displayed on the OLED Display. Then the results will be also displayed on the Thermoxy App. However, if the oxygen saturation is less than 95% if the body temperature is less than 36˚C and more than 37˚C, and if the heart rate is less than 60 and more than 100. Then the warning sign will be activated and sent on the Thermoxy App.

HARDWARE DEVELOPMENT

Design development will be applied to this project. One of the most important parts of implementing the Thermoxymeter is the designing process. Hardware used in this project is divided into 5 types which are Infrared Thermometer Non-Contact Sensor, Pulse Oximeter & Heart Rate Sensor, ADC/Battery, Arduino Nano, and OLED Display The Infrared thermometer non-contact sensor (MLX90614) and Pulse oximeter & Heart rate sensor (MAX30100) is programmed in C++ language and connected to the Arduino Nano controller. The Infrared thermometer non-contact sensor and Pulse oximeter & Heart rate sensor was powered by a 5V power supply connected through the Arduino Nano. The results of the body temperature, oxygen saturation, and heart rate are displayed on the 16×2 OLED Display. The results were also displayed on the IoT mobile application named Thermoxy App on the smartphone.

Figure 3 below shows the circuit diagram of the IoT Thermoxymeter.

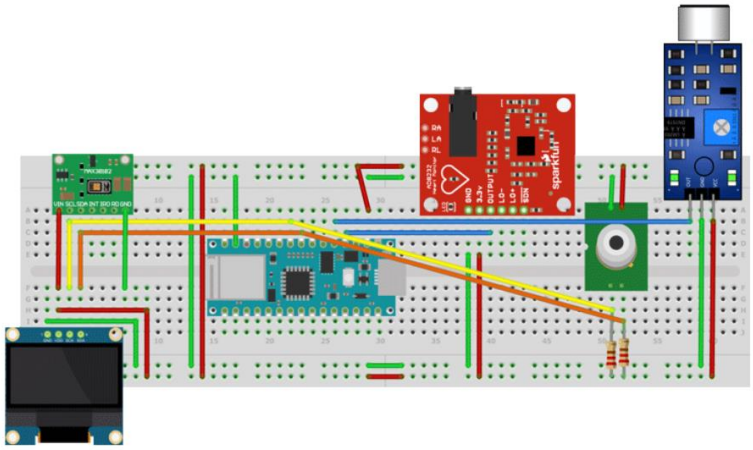


Figure 3. Circuit Diagram of IoT Thermoxymeter System

PROJECT DESIGN

Figure 4 shows the design of the Thermoxymeter. I used AutoCAD to design the project. The project consists of a Thermoxymeter and a smartphone. The smartphone is connected to the project and the device operation is controlled by using the Themoxy application in the smartphone.

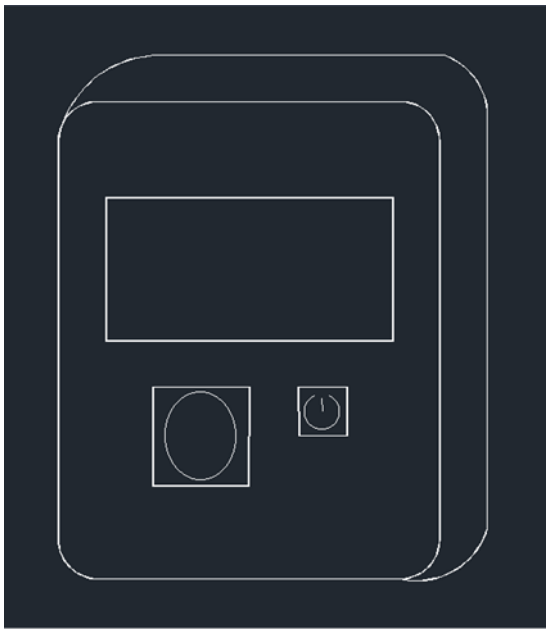
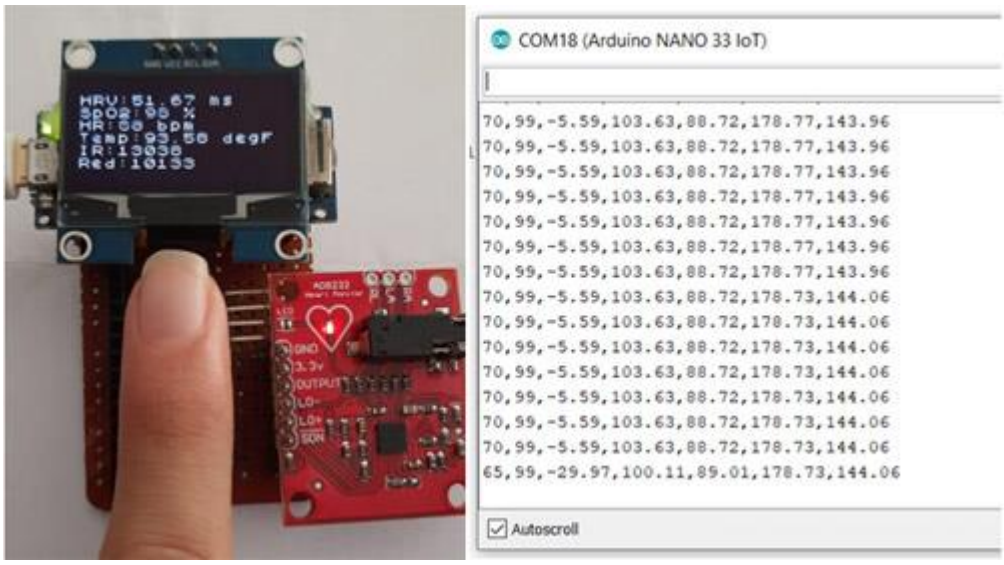
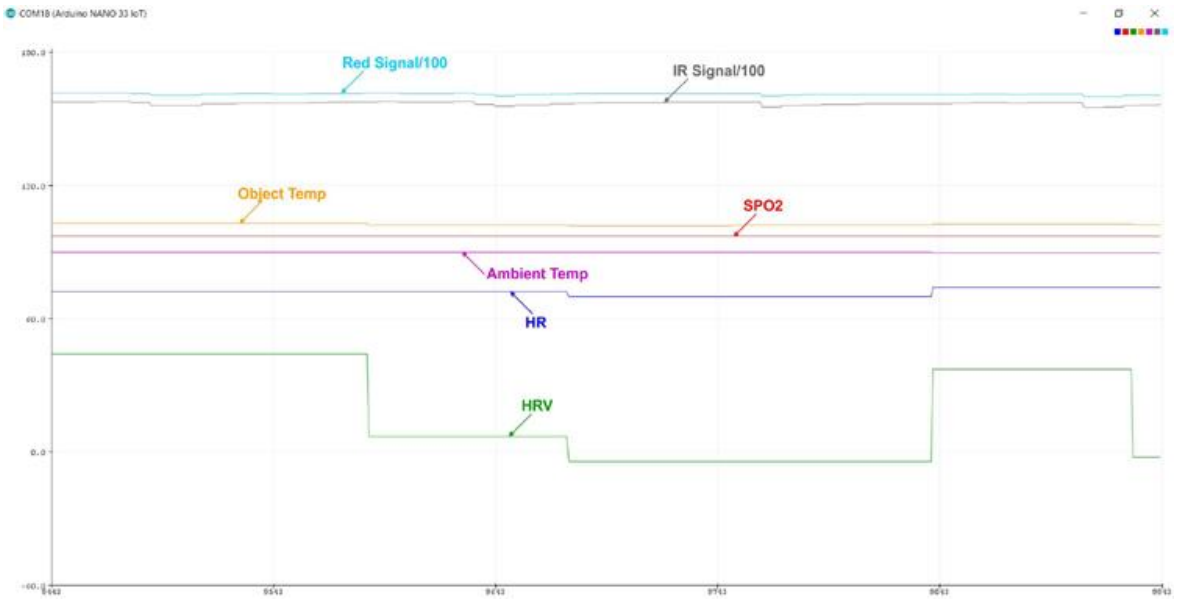


Figure 4. Design

EXPECTED RESULT & DISCUSSION



The serial plotter output for the same is shown below. The color key is shown on the upper right corner and is in the order of telemetry (hr, spo2, hrv, object_temp, ambient_temp, ir_signal/100, red_signal/100) from left to right. After plotting the data in the serial plotter window looks like the image below.



CONCLUSION

In conclusion, the objective of the project is achieved. The Thermoxymeter has been designed and developed as an effective vital measurement device. After that, the expected result has been analyzed through the result above. Last but not least, IoT technology is successfully implemented in the project using Thermoxy application. At the same time implementing this vital measurement device and IoT technology, it helps the user carry the device everywhere with its light and simple design. This project will assist people who have COVID-19 symptoms and people who have been infected with COVID-19.

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