# TANAUAN CITY COLLEGE

**School of Engineering**

# A WEARABLE DEVICE FOR SMART HEALTHCARE MONITORING AND TRACKING SYSTEM

A Design Project Presented to
the Faculty of the School of Engineering
Tanauan City College

In Partial Fulfillment of the
Requirements for the Degree
Bachelor of Science in Computer Engineering

By


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## Approval Sheet

This Design Project hereto is entitled:

**A WEARABLE DEVICE FOR SMART HEALTHCARE MONITORING AND TRACKING SYSTEM**

prepared and submitted by **Milena Lyn Dolar, Jayson S. Garcia, Harish A. Gonzales, Edzel V. Manaog** and **Monalisa C. Mendoza** in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Engineering has been examined and recommended for acceptance and approval for Oral Examination

**Ralph Laurence G. Visaya, ECE**
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## ENDORSEMENT FORM

In partial fulfillment of the requirements for the Degree of Bachelor of Science in Computer Engineering, this design project entitled: **A Wearable Device for Smart Healthcare Monitoring and Tracking System,** prepared and submitted by **Milena Lyn Dolar, Jayson S. Garcia, Harish A. Gonzales, Edzel V. Manaog** and **Monalisa C. Mendoza** is hereby recommended for oral examination.

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## ABSTRACT

People with diseases such as high blood pressure, which can lead to heart attacks, fever, hypertension, and even seizure, must constantly monitor their health condition not only to observe their health issues but also to inform themselves and their relatives that something is happening in their bodies that need to be attended to immediately. This project represents a health monitoring device that tracks the patient's vital signs such as heart rate and body temperature. This device uses Wi-Fi to track the patient's location. If the device senses that the patient is in critical condition, the Blynk application will notify the relatives of the wearer. The components used in this project include a Wemos D1 Mini, a temperature sensor and oximeter (MAX30102), a USB module, Lipo Battery, and Blynk App. The study was conducted in Tanauan City due to the concern raised by Tanauan City Health Office regarding the slow response of some hospitals to emergency cases. Another concern is an alternate means to track the place and time an accident may occur. The objective of this project is to create a device that will track the user's specific location to monitor when he or she is in a bad health condition. The researchers conducted a survey questionnaire for 100 respondents who are aged 7 to 90 years old and who lives in Brgy. Balele and Brgy. Maria Paz. The said survey questionnaire contains 10 questions that are needed for the study. For the future developments of this study, the researchers will introduce the

device to different people in two barangays of Tanauan City. This data can be viewed in Table 6, entitled *MAX30102 Sensitivity Graph*. It is concluded that it can be implemented using a Wemos D1 Mini Wi-Fi Module and the Arduino IDE as the programming language to build a system that will provide a fast response once an accident may occur.

**Keywords:** Wemos D1 temperature sensor (MAX30102), USB module, Lipo Battery, Blynk App, Arduino IDE wearable device, monitoring, and tracking

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## THE PROBLEM AND ITS BACKGROUND

### Introduction

Nowadays, many people are very conscious of their health. This factor is one of the most important things that people need to take care of. Good health is fundamental to human happiness and well-being. This contributes greatly to success, wealth, and even economic growth since healthier people are more active, save more, and live longer. According to the World Health Organization, health is a condition of full physical, mental, and social well-being and not just the absence of illness or infirmity. The reach of technological innovation continues to grow, changing all industries as it evolves. In healthcare facilities, the technology significantly increases its role in almost all the processes. From patient registration to data monitoring and from lab tests to self-care tools [1]. Even today, this concept is important as a prerequisite for optimal health and well-being. The International Research Journal of Engineering and Technology (IRJET) mentions about the first things to secure and monitor when a person got sick. It is necessary to ascertain the cause of the illness, the cause of accident, or the other factors that contribute to it. For heat stroke and pneumonia, the body gets a higher health status reading than the usual. Some complications, such as hypothermia and some kind of shock, the body is caused to be colder than the usual. The issue with the patient can be defined, by assessing the temperature of the body. A shift in the body temperature of the person means that the medication being used is successful. Temperature variations in the human body are typically a reaction. The fever suggests that the immune system is fighting off the infection. The temperature of the body is one of four important signs that indicate the identification and diagnosis of nearly all illnesses and conditions, the remaining three being blood pressure, heart rate, and breathing rate.

The coronavirus disease 2019 (COVID-19) has been declared a pandemic by the World Health Organization. To stop the virus from spreading further, a global concerted effort is required. Social isolation is the primary method of limiting the virus's spread [2]. In some cases, people must always monitor their health condition not only to observe their health issues but also to inform themselves and their relatives that something is happening in their body that needs to be resolved immediately. Examples include people with diseases such as high blood pressure, which can lead to a heart attack, fever, hypertension, and even seizure, and those isolated Covid-19 patients who are in a critical condition.

According to the Handbook of Biomedical Instrumentation by R.S. Khandpur (2015) Measurement of heart rate and pulse oximetry are very important factors to access the condition of the human cardiovascular system. Heart rate is formerly measured by placing the thumb over the arterial pulsation and counting the pulses usually in a 30-second period. Heart rate is then found by multiplying the obtained number by 2. This method although simple is not accurate and can give errors when the rate is high. In a clinical environment, heart rate is measured under controlled conditions like blood measurement, heart voice measurement, and Electrocardiogram (ECG). ECG is one of the frequently used and accurate methods for measuring heart rate. But ECG is not economical. The heart rate of a healthy adult at rest is around 75(±15) (or greater for females) beats per minute (bpm). Athletes normally have lower heart rates than less active people. Babies have a much higher heart rate at around 120 bpm, while older children have heart rates at around 90 bpm. Heart rate varies significantly between individuals based on fitness, age, and genetics. On the other hand, the percentage of arterial blood saturated with oxygen helps to determine the effectiveness of a patient's respiratory system. The technique by which blood oxygen saturation is determined is called pulse Oximetry [3].

Philippine Statistics Authority states that the preliminary number of registered deaths outside of their households from January to August 2020 reached 371,880. The preliminary number of registered deaths from January to June 2020 reached 259,426 and was lower than the registered deaths in the same months of 2019, numbering 309,010. Based on the preliminary number that the Philippine Statistics Authority had, the year 2019 has so many more registered deaths than the year 2020 [4].

**Background of the Study**

In January 2020, the country's first incidence of COVID-19 infection was discovered, and by March, the country had been placed under a severe community quarantine that restricted mobility and commercial activity. In the intensive care unit (ICU), family members play an important role because critically ill patients rely on them to make surrogate decisions and communicate their requirements.

Low health literacy, which leads to a lack of knowledge of health care information needed to make educated health decisions, is one known problem for family members in the ICU. Also, communication dissatisfaction delayed unfavorable prognostic communication at end-of-life (EOL), massive emotional pain, such as post-traumatic stress disorder (PTSD), and complicated mourning. In many institutions, visitor restriction measures were quickly and aggressively implemented to reduce the risk of potential

COVID-19 transmission. The COVID-19 pandemic has created further barriers to communication between healthcare workers and family members who are no longer able to be at the bedside.

Accidents or emergencies may occur, making it difficult or slow to locate the scene location. Time of arrival is an important aspect in the emergency medical system that can help the mortality rate of patient pre-hospital time intervals in trauma patient transportation by emergency medical service: relationship with the first 24-hour mortality. To reduce the problem of missing items, filling and alarming are required.

**Objectives of the Study**

The general objective of this study is to design and develop an Internet of Things based on smart health care monitoring and tracking system. Specifically, it aims the following:

1. To design and develop a device that will track the user’s specific location.
2. To create a device that will notify the relative of a critically ill isolated Covid- 19 patient via push notification and will notify the user's parameters (body temperature, heart/pulse rate, and oxygen level in the blood) via push notification in a real-time Android application.

3. To test and evaluate the functionality, efficiency, and usability of the device.

**Significance of the Study**

An accident is a sudden, unexpected event that usually results in injury, loss, or harm. Accidents can happen any time, including at home, on the road, or in the hospital. Many accidents can be avoided or prevented by taking safety precautions and being mindful of one's surroundings. System health monitoring is a set of activities performed to keep a system in working order. The integrated health management system requires a large number of sensors to offer a real-time structural integrity check. This chapter analyzes system health monitoring sensor technologies and proposes an energy-efficient decentralized detection strategy. A workplace hazard is a scenario in the workplace that has the potential to injure or harm people, as well as cause damage to the plant and/or equipment. Hazards exist in any job and can originate from a variety of places. Detecting and eradicating them is an important part of keeping the workplace safe.

**Patients.** A Wearable Device for Smart Health Care Monitoring and Tracking System assists patients in making it easier to respond to them when they require assistance through the help of the Blynk App. The device is capable of notifying if there is an abnormality in the patient’s parameters (body temperature, heart/pulse rate and oxygen level in the blood) and tracked the patient’s location.

**Doctors.** This device will greatly assist doctors in determining which patients require their assistance. They will be able to determine which patients have an abnormality in their parameters (body temperature, heart or pulse rate, and oxygen level in the blood) by using the Blynk App.

**Relative**. In this study, it will be a huge help for the patients' relatives to easily monitor them even though they are far apart. It will also notify the relatives of the patient's location or whether he or she had an abnormality in their parameters (body temperature, heart or pulse rate, and oxygen level in the blood)) using the Blynk App.

**Future Researchers.** The device will be used in this study to inspire other researchers to create a more effective and efficient monitoring and tracking systems. This project will also have a technological impact; in this case, the researchers want people to make better use of one of the most recent technologies.

**Scope, Limitations, and Delimitations of the Study**

The main focus of this project is to design an efficient wearable device for smart health care monitoring and tracking systems. It includes the Wemos D1

Mini as the main control unit of the device. This microcontroller has a built-in Wi-Fi module that will serve as the connection of all devices as an application for the internet of things. This also includes the pulse rate sensor for monitoring the heart rate, the pulse rate and temperature sensor for monitoring the temperature (MAX30102) of an individual. The Blynk App will be used for notification through the registered number account to the device when the health of the user becomes unusual. The notification provides details about the current vital statistics of the user. This will help patients notify their relatives if the patient's condition is stable. Below are the scope, limitations, and delimitations of the device.

**Scope.** The device will obtain the required parameters, which are body temperature, pulse or heart rate, and blood oxygen saturation. This work aims at designing and implementing a health monitoring system using a Wemos D1 mini microcontroller. The microcontroller will serve as the device's central processing unit powered by the Arduino IDE. Then, using the Blynk Application, the user can monitor the results of the tests performed by the sensors. It displays the current data on the webpage and sends signals according to the prediction in case of an emergency. It is composed of three main parts: the sensing system, the health status prediction system, and the emergency alert system. Body temperature sensing: body temperature is one of the most essential parts in monitoring one's condition since it gives the initial recording or baseline that will tell that a patient is in normal or unusual range. Body temperature is the decisive vital sign in the maintenance of homeostasis. The temperature measurement system is implemented by the sensor (MAX30102) and the value is converted to the form of Celsius. The sensor is attached to the skin of the patient as a probe and the temperature is collected periodically. The converted value is stored in the server in the Wemos D1 mini and further used later. The main components for body temperature detection are a sensor and the analog to digital converter setup. Heartbeat is a vital requirement for the good health of a human being. The monitoring of the electrical activity of the heart and the rhythm of the heartbeat is very important. The heartbeat sensing is implemented by the heartbeat sensor (MAX30102) and the value has converted the analog to digital converter. The value is collected periodically and stored in the server which is inbuilt available in the Wemos D1 mini. The heartbeat sensor is attached to the bed as a probe to the patient in an intensive care unit. The components which are essential in heartbeat sensing are sensor and analog to digital converter. The interfacing of sensors with the Wemos D1 mini. Even though the value collected from the sensor is displayed on the webpage, it will be even more efficient when the system predicts the abnormality of the patient and gives an alert.

**Limitations and Delimitations of the Study.** The system is extremely useful because it is difficult to determine whether an incident occurred in one of our relatives and where the location of an accident occurred. It is also difficult to notify the relatives of a Covid-19 patient who is critically ill because the relatives are not permitted to take care for a Covid patient. This study does not include CoVID-19 patients with asymptomatic symptoms. The available sensors that will be used in the creation of a device will be limited because some of the sensors or equipment required in the creation of a device are not available in a nearby electronic store. The person whose address is in Tanauan City but died outside the city is not included. To use the map widget of the Blynk application, the GPS capability of the phone must be turned on. The device will not automatically open unless the user slides the switch. The researchers considered working on this study to determine how it will benefit not only those with health conditions but also our society as a whole. Only Covid patients who are isolated, those with tight schedules, those who travel a lot, and users who require strict health monitoring are the primary users of the device. Before employing the equipment, hospitals must be consulted. There will be no device if there is no admission to the hospital and no consultation with a doctor.

**Definition of Terms**

For a better understanding of the study, the following terms are defined:

**Body Temperature.** A measure of your body's ability to generate and expel heat even when temperatures outside the body change dramatically, the body is very good at keeping its temperature within a safe range.

**Blynk App.** It enables the creation of one or more projects. Each project may include graphical widgets such as virtual LEDs, buttons, value displays, and even a text terminal, as well as interact with one or more devices.

**COVID-19.** An acute respiratory illness in humans caused by a coronavirus, capable of causing severe symptoms and, in some cases, death, particularly in the elderly and those with pre-existing medical conditions. It was discovered in China in 2019 and became the cause of the pandemic in 2020.

**Database.** A data structure that stores organized information. Any collection of data or information that has been specially organized for rapid search and retrieval by a computer, also known as an electronic database. Databases are designed to make it easy to store, retrieve, modify, and delete data in conjunction with various data-processing operations.

**GPS.** Global Positioning System is a type of radio navigation system. It transmits location and time information to any software that requires it via radio waves between satellites and a receiver inside your phone.

**Health Monitoring.** The assessment of physical, functional, and cognitive status to detect changes that may indicate health problems and to facilitate appropriate intervention.

**MAX30102.** It delivers a complete system solution to make designing mobile and wearable devices easier. The MAX30102 is powered by a single 1.8V supply and an additional 5.0V supply for the internal LEDs. A standard I2C-compatible interface is used for communication.

**Variable.** Not consistent or having a fixed pattern; liable to change.

**Wearable.** Denoting or relating to a computer or other electronic device that is small or light enough to be worn or carried on one's body.

**Wemos D1 Mini.** An open-source firmware for which open-source prototyping board designs are available.

## Chapter 2

## REVIEW OF LITERATURE

This chapter covers the theoretical background, related studies, synthesis, and conceptual framework that demonstrates the concepts and ideas used in the realization of the study.

### Theoretical Background

**Voltage Sensor.** Detects and measures the voltage level in an object. The AC or DC voltage level can be determined using voltage sensors. The voltage is the sensor's input, while, analog voltage signal, current signal, or audible signal are the sensor's outputs. Sensors are electronic or optical devices that can detect, recognize, and react to certain electrical or optical impulses. Voltage sensor and current sensor approaches have shown to be an excellent alternative to traditional current and voltage monitoring methods [5].

**Slide Switch.** The functioning of a slide switch distinguishes it from other mechanical switches. Because of the way they work, they are truly unique among switch types. It can be turned on and off with a slider, which is unusual. That makes switching it on and off or moving it between pickers with your fingertips a breeze. It can operate at 0.1 amps at 200 volts. However, the amount of current and voltage it can handle is determined by the switch's size. This switch is creating waves in the switch business for several reasons. They're notable for allowing current to flow through a circuit without requiring manual cutting or splicing. Switches that slide [6].

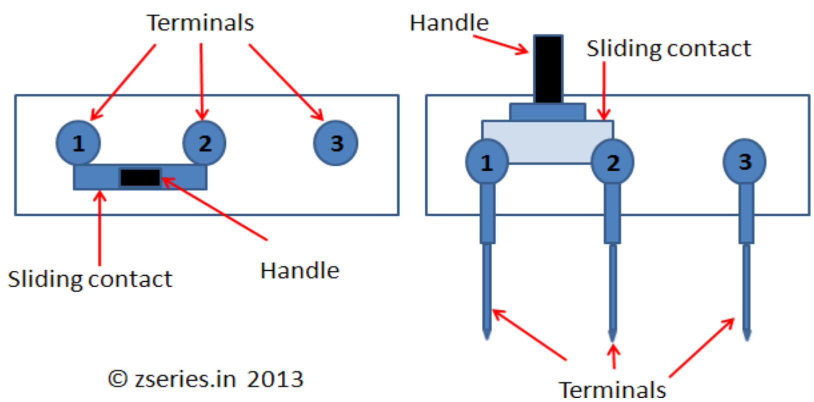


**Fig. 1 Slide Switch Diagram**

**MAX30102.** Can be used in wearable Devices, Fitness Assistant Devices, and Medical Monitoring Devices. The MAX30102 is a complete pulse oximetry and heart rate sensor system solution designed for the demanding requirements of wearable devices. The MAX30102 provides a very small total solution size without sacrificing optical or electrical performance. Minimal external hardware components are needed for integration into a wearable device. The MAX30102 is fully configurable through software registers, and the digital output data is stored in a 16-deep FIFO within the device. The SpO2 algorithm is relatively insensitive to the wavelength of the IR LED, but the red LED's wavelength is critical to correct interpretation of the data. The temperature sensor data can be used to compensate for the SpO2 error with ambient temperature changes. The MAX30102 integrates red and IR LED drivers to drive LED pulses for SpO2 and HR measurements. The LED current can be programmed from 0mA to 50mA (typical only) with proper supply of voltage. The LED pulse width can be programmed from 200µs to 1.6ms to optimize measurement accuracy and power consumption based on use cases [7]. The figure below shows that the sensor consists of a pair of light-emitting diodes that emits monochromatic redlight at a wavelength of 660nm and infrared light at a wavelength of 940 nm. These wavelengths are particularly chosen as at this wavelength oxygenated and deoxygenated hemoglobin have very different absorption properties.

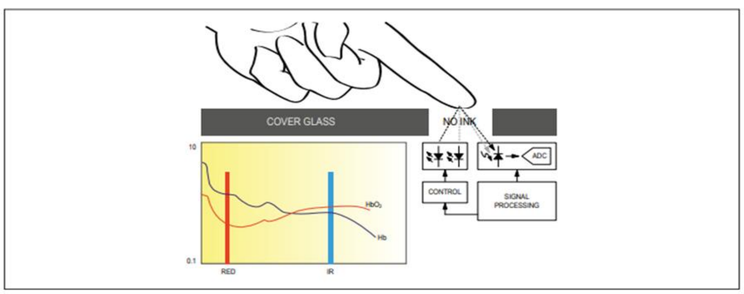


**Fig. 2 MAX30102 Diagram**

**Table1. MAX30102 Pinout**

| Pin Type | Pin Function |
|---|---|
| VIN | Voltage Input |
| SCL | I2C - Serial Clock |
| SDA | I2C - Serial Data |
| INT | Active low interrupt |
| IRD | IR LED Cathode and LED Driver Connection Point (Leave floating in the circuit) |
| RD | Red LED Cathode and LED Driver Connection Point (Leave floating in the circuit) |
| GND | Ground pin |

Table 1 shows the pin out configuration of MAX30102. It shows that the VIN is the voltage input, SCL is the I2C Serial Clock, SDA is the I2C - Serial Data, INT is the Active low interrupt, IRD is the IR LED Cathode and LED Driver Connection Point that is left floating in the circuit. RD is the Red LED Cathode and LED Driver Connection Point that also left floating in the circuit and lastly the GND that serves as a ground pin.

**WeMos D1 Mini**. An inexpensive ESP8266-based Wi-Fi board that is low-profile but just as powerful as any NodeMCU or ESP8266-based microcontroller. The D1 Mini is incredibly versatile because it is inexpensive, Wi-Fi enabled, and fully compatible with the Arduino platform. In this tutorial, the

ESP8266 library and board manager will be introduced to get the D1 Mini acting as an Arduino board. Then, a simple web page will be introduced to harness the Wi-Fi capabilities of the module. The D1 Mini will act as a web server, allowing any Wi-Fi connected device to interact with the board and control its pins wirelessly [8].

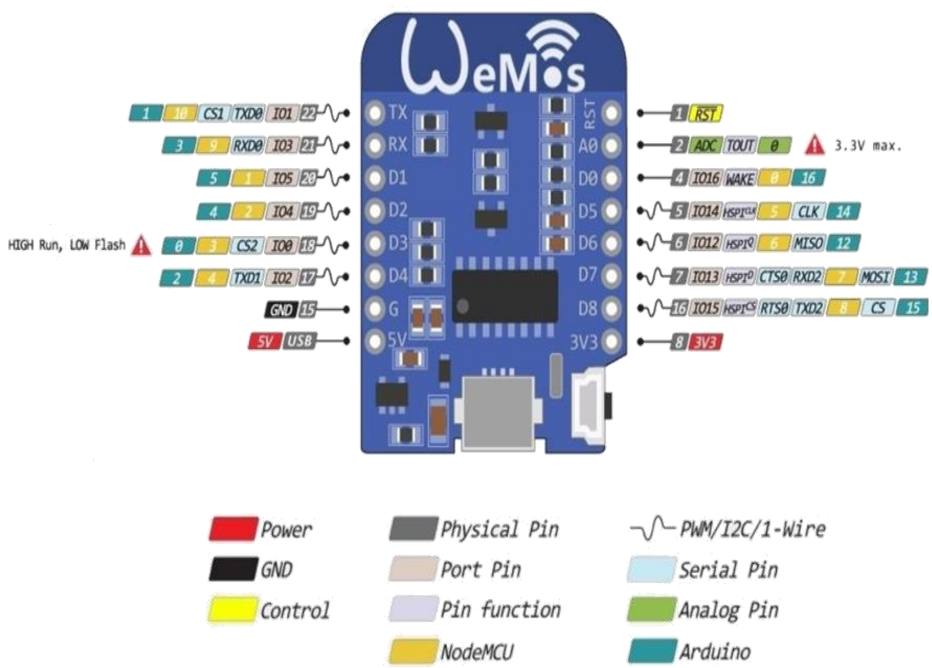


**Fig. 3 WeMos D1 Mini Diagram**

**Table 2. Wemos D1 Mini Pinout**

| Pin | Function | ESP-8266 Pin |
|---|---|---|
| TX | TXD | TXD |
| RX | RXD | RXD |
| A0 | Analog input, max 3.3V input | A0 |
| D0 | IO | GPIO16 |
| D1 | IO, SCL | GPIO5 |
| D2 | IO, SDA | GPIO4 |
| D3 | IO,10k Pull-up | GPIO0 |
| D4 | IO,10kpull-up, BUILTIN_LED | GPIO2 |
| D5 | IO, SCK | GPIO14 |
| D6 | IO, MISO | GPIO12 |
| D7 | IO, MOSI | GPIO13 |
| D8 | IO,10k pull-down, SS | GPIO15 |
| G | Ground | GND |
| 5V | 5V | – |
| 3V3 | 3.3V | 3.3V |

The Table 2 shows the pinout of the Wemos 1D Mini and its ESP-8266 Pin. The WeMos D1 Mini is based also on the ESP8266, the possible pinout would be the same as the NodeMCU. But the WeMos D1 Mini is more like a little version of the NodeMCU with fewer pins but still enough for basic projects [9].

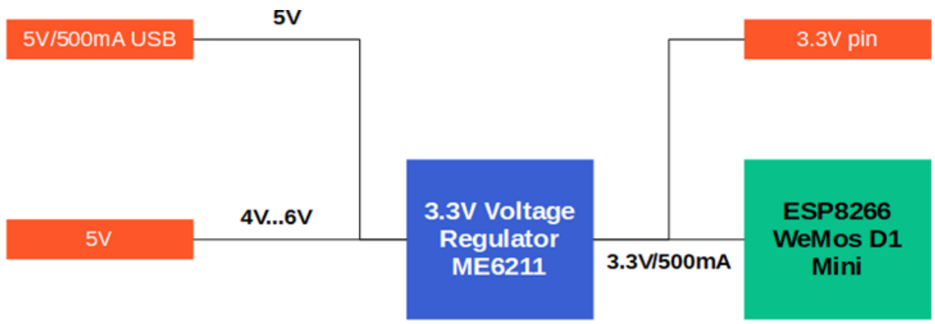


**Fig. 4 WeMos D1 Mini Voltage I/O Diagram**

Figure 4 shows the possibilities for a power supply of the WeMos D1 Mini. It clearly shows that it operates the WeMos D1 Mini on the 3.3 V input with 2.5V to 3.6V. It also operates the WeMos D1 Mini on the 5V input with 4V to 6V. Use a USB cable with 5V. A diode prevents current from the 5V input to the USB connection flows.

**Blynk**. Designed for the Internet of Things that controls the hardware remotely. It can display sensor, store, and visualize the data. The Blynk App allows the creation of interfaces for projects using various widgets provided and there are three major components in the platform. The Blynk Server is responsible for all the communications between the smartphone and hardware. It uses Blynk Cloud to run the Blynk server locally. The open-source could easily handle thousands of devices and can even be launched on a Wemos D1 Mini. Blynk Libraries are for all the popular hardware platforms that enable communication with the server and process all the incoming and outcoming commands. Blynk can control Digital and Analog I/O Pins on hardware directly. Anything that connects to the hardware will be able to access Blynk. With Virtual Pins, the device can send something from the app, process it on the microcontroller, and then send it back to the smartphone. Blynk can trigger functions, read I2C devices, convert values, control servo, and DC motors, etc. Virtual Pins can be used to interface with external libraries (Servo, LCD, and others) and implement custom functionality [10]. Hardware may send data to the Widgets over the Virtual Pin like in Figure 5 below:

```
Blynk.virtualWrite(pin, "abc");
Blynk.virtualWrite(pin, 123);
Blynk.virtualWrite(pin, 12.34);
Blynk.virtualWrite(pin, "hello", 123, 12.34);
```

**Fig. 5 Blynk App Syntax**

Blynk can be used in monitoring smartphone or other device's location data such as latitude, longitude, altitude, and speed. Figure 6 below shows the code for accepting the widget:

```
BLYNK_WRITE(V1) {
  float latitude = param[0].asFloat();
  float longitude = param[1].asFloat();
  float altitude = param[2].asFloat();
  float speed = param[3].asFloat();
}
```

```
BLYNK_WRITE(V1) {
  GpsParam gps(param);
  // Print 6 decimal places for Lat
  Serial.println(gps.getLat(), 7);
  Serial.println(gps.getLon(), 7);

  Serial.println(gps.getAltitude(), 2);
  Serial.println(gps.getSpeed(), 2);
}
```

**Fig. 6 Blynk App Syntax for GPS**

**Related Studies**

This chapter includes the ideas, finished thesis, generalization or conclusions, methodologies, and others. Those that were included in this chapter helps in familiarizing information that is relevant and similar to the present study. Almotri, Khan, and Alghamdi stated in their paper titled "Mobile Health (m-Health) System in the Context of IoT". Health is always a major concern in every growth the human race is advancing in terms of technology. Like the recent coronavirus attack that has ruined the economy of China to an extent is an example of how health care has become of major importance. In such areas where the epidemic is spread, it is always a better idea to monitor these patients using remote health monitoring technology. So, the Internet of Things (IoT) based health monitoring system is the current solution for it [11].

In this paper titled "Wearable Sensors for Remote Health Monitoring", Majumder, Mondal, and Deen stated that wearable devices can monitor and record real-time information about one's physiological condition and motion activities. Wearable sensor- based health monitoring systems may comprise different types of flexible sensors that can be integrated into a textile fiber, clothes, and elastic bands or directly attached to the human body [12].

In the study titled “Internet of Things-Based Monitoring System of Patients Using W1209 Digital Thermostat and Pulse Sensor," Anifa and

Rusimamto proposed the development of an Internet of Things (IoT) based measuring device for measuring body temperature and heart rate for patients. It is hoped that temperature and heart rate sensors will be attached to the patients so that the medical personnel can monitor the patient's temperature and pulse via the Internet via IoT remotely. This will minimize contact between patients and medical personnel, while the medical personnel are still monitoring the patient's condition well at all times [13].

In the study titled “Heart Rate Monitoring System using Pulse Sensor with Data Stored on Server”. Vinodhini and Puviarasi stated that they used a system with a heart rate monitoring model, this can be used in almost all the hospitals as well as for general purposes like residential areas are too used. In this system, we have used a pulse sensor to find the nearby or the actual value of the heartbeat rate of a normal person. By writing the separate code for the functioning of pulse sensor working models. While measuring the heart rate, the temperature of the body also plays a major role. ECG is also a common method for finding the pulse rate. In this project, the data can be stored for later use. To store the data, localhost software is used [14].

The vital signs of a patient are intricately linked, and together they give crucial information on the patient's hemodynamic and physiological status. Yet, in adults, the precise link between body temperature (T) and heart rate (HR) remains a key knowledge gap. Hospital Ambulatory Medical Care Survey (NHAMCS), a large CDC-sponsored weighted sample of U.S. hospitals. Extracting demographic and clinical data, including vital signs, from EDs and our own large tertiary care ED. Results: There were 8715 local ED visits and an estimated 123.3 million adult ED visits across the country. The average temperature was 36.9 °C, with 5.2 percent of patients having a temperature above 38 °C. The mean (SD) heart rate was 93.3 beats per minute, with 28% of participants having a heart rate of over 100 beats per minute. Males had a lower HR than females (coefficient - 1.6, 95 percent confidence interval -2.4 to -0. and age was adversely related to HR (coefficient -0.08, 95 percent CI -0.10 to -0.06). For national data, a 1°C increase in T linked to a 7.2 bpm increase in HR (95 percent CI 6.2 to 8.3). After correcting for age and gender, a 1°C increase in T resulted in a mean (95 percent confidence interval) increase in HR of 10.4 (9.5-11.4) and 6.9 (5.9-7.) locally and nationally, respectively. Conclusions: For every 1°C increase in T, the HR increases by around 7 bpm in adult ED patients across the country [15].

In the Paper, “MAX30102 Based Heart Rate and SPO2 Monitoring using IoT Oxygen”, Rodick, Kumar, Karthik, and Aravind stated that the Percentage of Oxygen in the blood plays a vital role as a parameter in determining one's health condition. This paper focuses on the effective monitoring of a person's oxygen concentration in the blood thereby acquiring and transmitting the data by wireless communication to personal cloud storage through IoT. The method of acquiring and monitoring data in the system is implemented using LabVIEW interconnected with my Rio. The data can be accessed at any time to observe the current status of the patient. In case of unusual behavior in the detected signals, the caretaker and doctors are notified immediately through a Short Message Service (SMS) via the GSM module. Cloud computing and password-protected accounts provide privacy and security of patient details by allowing restricted access to the database [16].

In this study titled "Design and Development of E-Health Monitoring System using IoT", Biswas, Haldar, and Dey explained, that a prototype has been designed and developed for real-time health monitoring using the Internet of Things (IoT). This system facilitates the process of performing diagnosis and treatment of patients suffering from heart diseases. Nonintrusive sensors DS18B20, MAX30102, and AD8232 are used for recording patients' health parameters like body temperature, heart rate, and ECG signals respectively. The data gathered is transmitted to the IoT cloud which can be visualized using a web-based server or any android-based application. Using this system, the physician can use the cloud platform to diagnose patients at remote locations (like home). The patients can also access their medical records via this cloud service [17].

This research titled “Monitoring the Heart Rate and Body Temperature Based on Microcontroller”, by Wijaya, Raharja, and Iswanto will discuss health services in the field of diagnostic tools and life support systems in the form of photoplethysmography. Systems designed a system capable of providing heart-pumping activity information through a phenomenon known as photoelectric so the user's health condition. Plus, parameter measuring human body temperature to determine the temperature of the current condition of the user. In collecting the data pulse using a heart rate sensor (fingertip sensor). This system works to retrieve data from the bloodstream on the index finger during the 60s, the data will be displayed through the LCD [18].

Islam and Ramahan stated in their paper titled “Development of Smart Healthcare Monitoring in IoT Environment” that healthcare monitoring system in hospitals and many other health centers experienced significant growth. Portable healthcare monitoring systems with emerging technologies are also becoming of great concern to many countries worldwide nowadays. The error percentage of the developed scheme is within a certain limit (< 5%) for each case. The condition of the patients is conveyed via a portal to medical staff, where they can process and analyze the current situation of the patients. The developed prototype is well suited for healthcare monitoring as proved by the effectiveness of the system [19].

In this study titled "IoT Cloud Data Logger for Heart Rate Monitoring Device" Hadi, Zaenir, Maulana, And Wibawa claimed that heart disease is often detected past the symptoms; one having sporadic heart rates. Therefore, this research aimed to design and build a heart rate monitoring device to detect the blood flow frequency in the pulse. The data is then delivered to a communication device using Wi-Fi. The heart rate monitor device contained a sensor block, signal conditioner block, and communication block using Wemos D1 ESP8266. After, Wemos D1 ESP8266 delivered the data to the smartphone. The data is also displayed on OLED. The data recorded was saved in the smartphone and can be used as a medical record [20].

In this paper titled "Design of Health Care Monitoring System Based on Internet of Thing (IoT)" Abdulameer, Ibrahim, and Mohammed stated that the internet has made the place a worldwide city and web of things (IoT) by allowing the range of captors and keen items to collect and process data for various use. In weakening the physical structures of the digital shrewd (IoT) shrewd items become a definitive building. The IoT has a variety of applications, including social security. Different restore and post-operative information should be screened [21].

**Table 3. Summary of Theoretical and Related Studies**

| | Title | Author | Description | Hardware | Software |
|---|---|---|---|---|---|
| 1. | **Voltage Sensor** | Electrical 4U | This sensor calculates and monitors the amount of voltage in a given object. | N/A | N/A |
| 2. | **Slide Switch** | Omron Corp. | Manually sliding the functioning section of a slide switch, so that electricity can flow in an electrical circuit. | N/A | N/A |
| 3. | **MAX30102** | Maxim | Focuses on the definition and functionality of the MAX30102 Heart/Pulse rate sensor | N/A | N/A |
| 4. | **WeMos D1 Mini** | J. Hrisko | Focuses on the definition, functionality, and pinout of WeMos D1 Mini Microcontroller | N/A | N/A |

| | | | | | |
|---|---|---|---|---|---|
| **5.** | **Blynk App (SMS)** | Blynk | Focuses on the functionality of the Blynk App and its uses as an SMS Notifier | N/A | N/A |
| **6.** | **Blynk App (GPS)** | Blynk | Focuses on the functionality of the Blynk App and its uses as a GPS tracker | N/A | N/A |
| **7.** | **Mobile Health (m-Health) System in the Context of IoT** | Almotri, Khan and Alghamd i | Presents mobile health communication devices to connect patients and providers remotely. | Wemos D1 Mini, ESP268 | Arduino IDE, Xampp, Java, Blynk App |
| **8.** | **Wearable Sensors for Remote Health Monitoring** | Majumde r, Mondal and Deen | Focuses on the purpose of a wearable device for patients who have health care and monitoring needs. | MAX30102, ESP268 | Arduino IDE, Xampp |

| | | | | | |
|---|---|---|---|---|---|
| **9.** | **Internet of Things-Based Monitoring System of Patients Using W1209 Digital Thermostat and Pulse Sensor** | Anifa and Rusimam to | Focuses on the efficiency of wearable healthcare and monitoring device that uses critical sensors. | Thermostat, MAX30102, ESP268 | Arduino IDE |
| **10.** | **Heart Rate Monitoring System using Pulse Sensor with Data Stored on Server** | Vinodhin i and Puviarasi | Resembles the Heart monitoring model. Has additional features that catches the pulse rate of the users and save the data using a Data Stored Server. | MAX3010 2, Wemos D1 Mini | Cloud, Arduino Ide, Blynk App |
| **11.** | **MAX30102 Based Heart Rate and SPO2 Monitoring using IoT Oxygen** | Rodick, Kumar, Karthik, and Aravind | Focuses on the use of MAX30102 for measuring the heart rate and blood oxygen of the user using IoT | MAX3010 2, Wemos D1 Mini | Arduino IDE, LABVIE W |
| **12.** | **Design and Development of E-Health Monitoring System using IoT** | Biswas, Haldar and Dey | Creates a prototype that has been designed and developed for real-time health monitoring using the Internet of Things (IoT). This system facilitates the process of performing | MAX30102, AD8232, DS18b20 | Arduino IDE, Blynk App |

| | | | | | |
|---|---|---|---|---|---|
| | | | diagnosis and treatment of patients suffering from heart diseases. | | |
| 13. | **Monitoring the Heart Rate and Body Temperature Based on Microcontroller** | Wijaya, Raharja and Iswanto | A device that can monitor users' body temperature, blood pressure, and heart rate using the web-based mobile application | ADC, Wemos, ATmega | Arduino IDE, Blynk App |
| 14. | **Development of Smart Healthcare Monitoring in IoT Environment** | Islam and Ramahan | Proposes a smart healthcare system in an IoT environment that can monitor a patient's basic health signs. Also, real-time reading of the room condition where the patient is. | MAX30102, Wemos D1 Mini | Arduino IDE, Blynk App |
| 15. | **IoT Cloud Data Logger for Heart Rate Monitoring Device** | Hadi, Zaenir, Maulana, And Wibawa | Aimed to design and build a heart rate monitoring device to detect the blood flow frequency in the pulse. The data is then delivered to a communication device using Wi-Fi. | Wemos D1 Mini, MAX30102, OLED | Arduino IDE, Web-Based Platform, Blynk App |

| | | | | | |
|---|---|---|---|---|---|
| **16.** | **Design of Health Care Monitoring System Based on Internet of Thing (IoT)** | Abdulameer, Ibrahim, and Mohammed | Monitors system that is used in the remote health care system using advanced information technology, new communication developments and remote physiological measuring technology. | Wemos D1 Mini, MAX30102 | Arduino IDE, Blynk App, Cloud |

**Synthesis**

The related studies and reviewed literature serve as the foundation of the present study since it attempts to discuss the A Wearable Device for Smart Health Care Monitoring and Tracking System.

According to Nilanjan Dey (2017), the conjunction of the internet of things technology and the medical field makes a great impact in the healthcare sector, a lot has physical devices networks, embedded systems, sensor servers, software, and network connectivity to communicate remotely and collect data from the system components. Lot integrates the automation, sensor networks, and embedded system. These facilities make alot of convenience [22].

Stephen A. Raymond, Geoffrey E. Gordonand , Daniel B. Singer (2015) proposed that a health monitoring system that tracks the state of health of a patient and compiles a chronological health history of the patient uses a multipara metric monitor which periodically and automatically measures and records a plurality of physiological data from sensors in contact with the patient's body. The data collected is periodically uploaded to a database in which it is stored along with similar health histories of other patients. David W. Baarman (2014) presented that a health monitoring system can include an intake tracker, an output tracker, a personal monitor, and a recommender. The health monitoring system can track food, exercise, and personal characteristics to provide health assessments and recommendations [23].

Sreekanth K U (2016) addressed the effectiveness of wearable healthcare gadgets such as watches, bracelets, rings, hair laces, health monitors, pedometers, activity trackers, virtual reality headsets brought a new way of continuous motorization of our health. They can monitor the health parameters such as heartbeat, blood pressure, body temperature, oxygen saturation level in blood with the help of wearable devices and their families can regularly check their health [24].

In addition, Luca Catarinucci (2015) proposed a system that collects the patient's health condition and environmental conditions in real-time and sends it to the control center where it is analyzed and sends an alert based on the emergency condition. But according to Punit Gupta (2016), who introduced a system that collects health parameters such as blood pressure, body temperature, and patient's heart rate. This system uses the smart sensor network which is later analyzed by medical experts. At the same time, this also maintains a database for the health record that gives a better track of the patient's health condition and improved examine of patients [25].

## Conceptual Framework

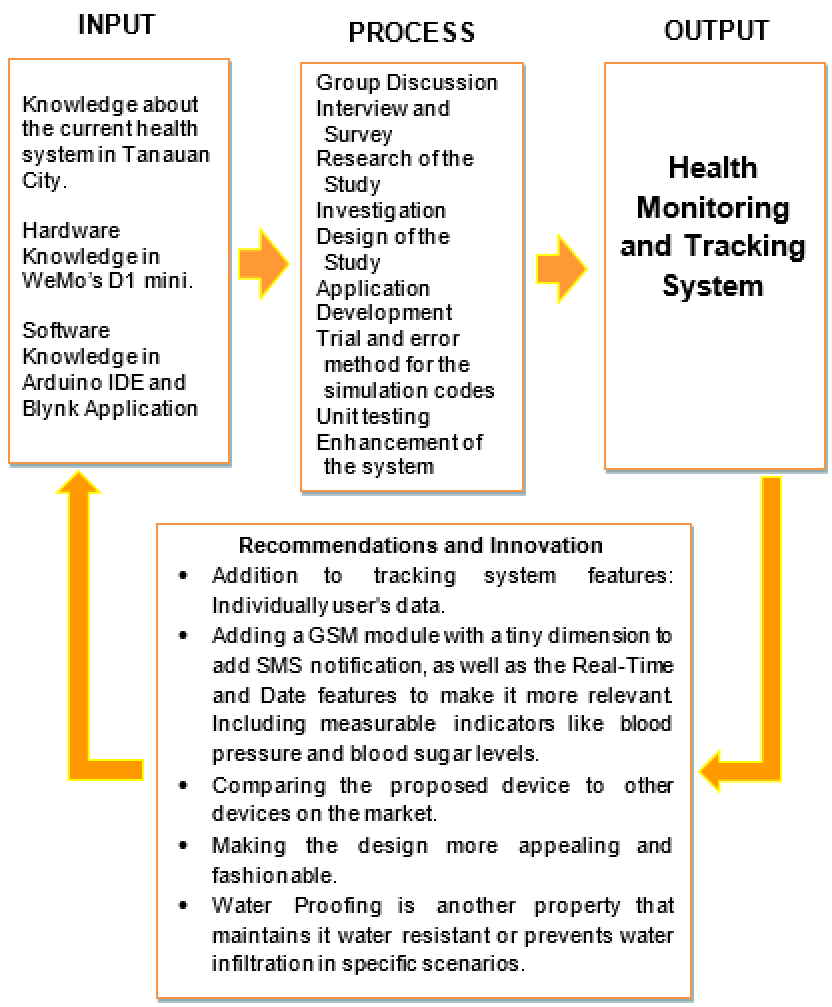


**Fig. 7 Conceptual Framework Diagram**

**Input.** For the study to be conceivable, first, the proponents had to know about Wemos D1 mini hardware as well as the software knowledge in Wemos D1 mini.

The declared inputs are considered as the most important part of the system for it will not work without the knowledge of these programs.

**Process.** The process of the system was considered as the development and procedure of the study. First, the proponents planned what would be the flow of the study and after forecasting, a group discussion was conducted. In this process, the proponents were able to gather data and ideas from each other. After the proponents had conducted discussions, they were able to research the study and analyze each detail that will be possible to use in the study. The design of the study was then made, and it has been implemented afterward. The study had been developed and a trial-and-error method for the simulation of codes had been done. In research, there are circumstances encountered wherein you should solve each aspect of it. After the simulation of the codes, testing had been made to know and indicate whether the encoded codes were possible and effective for the study. After testing the codes, the system had been enhanced for better outcomes and output for the study to be effective and feasible.

**Output.** The output of the study is considered as the outcome of the input and the process of the study. After all the inputs had been established and the process had been implemented, the researchers were able to surface the said study of the health monitoring and tracking system. The health monitoring and tracking system would not be conceivable if the said input and process were undone.

**Feedback.** The proponents used feedback as recommendations and innovations in order for the future developers to understand what will be the other outcome of the project. Especially, if it will be developed again and improved with more features.

**Chapter 3**

**RESEARCH METHODOLOGY**

This chapter covers the research design, which includes a conceptual diagram and discussion of major hardware components, the software used in system development, and the prototype development.

**Research Design**

The researcher used developmental research. To achieve a successful project, developmental research must be followed. Developmental research includes a simple instructional development with a systematic study of designing, developing, and evaluating instructional programs, processes, and products that must meet the criteria of internal consistency and effectiveness. Developmental research is particularly important in the field of instructional technology. Developing a project with this method will produce a much more efficient outcome.

Researchers used the methods of development research to obtain a possible result using the hardware and software components. Developmental research also focuses on developing a precise and accurate output of the proposed project. Due to its technicality and reliability in creating a technological instrument, developmental research can reach the needs of modern society. The researchers also consider the methods that can be used to attain the effectiveness of the study. Using the parameters that developmental research proposed can generate much better output.

**Predesign Stage**

The researchers will consider some factors in the pre-design stage. These factors are the sensors, the microcontroller, and the power supply that will be used to create an efficient result for monitoring the needed parameters. The table below represents the hardware components that are needed to design the system.

**Table 4. System Hardware Requirements**

| Hardware Component | Description |
|---|---|
| Voltage Sensor | This sensor calculates and monitors the amount of voltage in a given object. |
| Slide Switch | Controls the current flow through a circuit channel via an electromechanical device. Sliding a mechanical switch activates the devices in this series. |
| Heart/Pulse Rate Sensor/Temperature Sensor (MAX30102) | This sensor is responsible for determining and gathering the heart rate and body temperature of the user in degree Celsius. |

| | |
|---|---|
| Microcontroller (WeMos D1 mini) | A microcontroller that is used as the brain of the system. The researchers chose this microcontroller because of its compact size. The microcontroller also supports Wi-Fi features. |
| Power Supply (Lipo Battery) | The system will use a rechargeable compact Lipo Battery as the source of power supply. |
| Charging Module (TP4056) | This charging module will support the power supply. Its functionality is to recharge the Lipo Battery. |

**Design Stage**

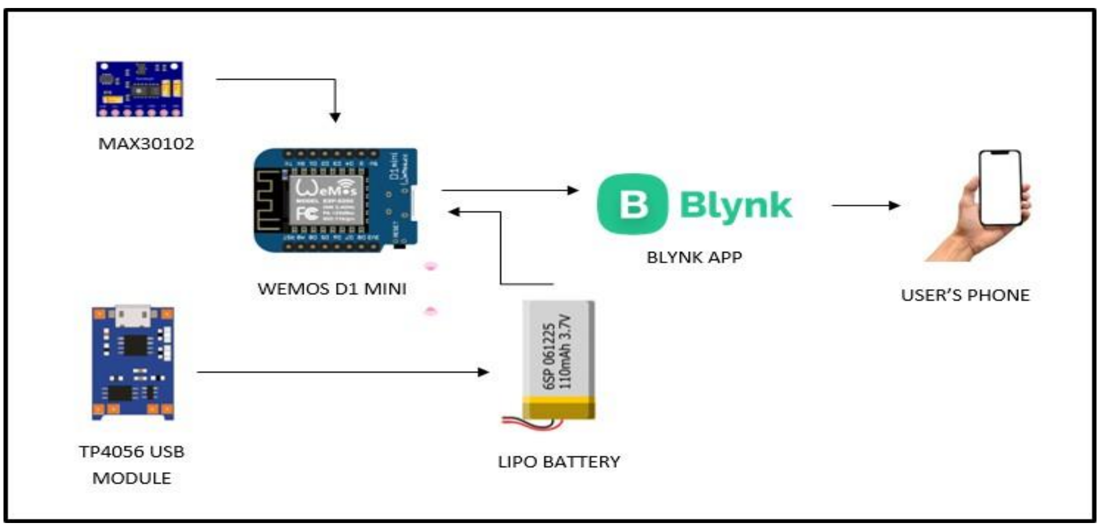


**Fig. 8 Conceptual Diagram**

The figure above shows the conceptual diagram. This was the system's setup, as well as the connection flow from the WeMos D1 Mini to the sensors to the user's phone. The MAX30102 heartbeat and oximeter sensor will measure the body temperature, heartbeat, and oxygen level in the blood of the wearer. The WeMos D1 mini will send the information gathered by the sensors via the internet, and the Blynk App server. Then if the gathered parameters are unusual, the Blynk App will send a push notification to the relative of the user. Also, with the help of the Blynk app, the relative of the user can identify the location of the user using its real-time GPS feature.

**Hardware Design and Implementation**

The Figure below represents the relationship between the hardware components and how they interact with each other. These include the power supply, computer system, sensors, I/O Interface, and Temperature and Heart Rate output.

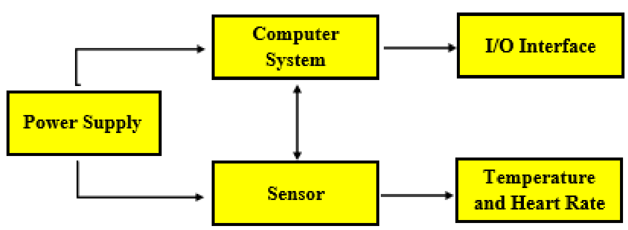


**Fig. 9 System Hardware Requirements Interconnection**

**Power Supply.** The system used a DC power supply. The microcontroller needs an accurate power supply of 3.7V-4.2V to perform the given task. The researcher used the Lipo battery (3.7V 50 mAh) because it can handle the powerful capabilities that are required to use the Wemos D1 Mini.

**Computer System.** The researchers used WeMos D1 Mini as the computer system. It functions as the microcontroller and the Wi-Fi module at the same time. It will also help the sensors identify the standard parameters in measuring the body temperature and pulse rate through the system.

**I/O Interface.** The system's I/O interface includes an android phone that will be generated by the Blynk Application. It is responsible for the graphical and visualization of the results that have been gathered throughout the process.

**Sensors.** The researchers will use the sensors as the system’s secondary input. The sensors in the system will be responsible for gathering the needed inputs for monitoring the user’s parameters.

**Temperature and Heart Rate Output.** These are the results that will be produced by the system's hardware. These results will always vary depending on the given inputs the sensor is sensing.

**Software Used in System Development**

In developing the system, various software was used; Arduino IDE for microcontroller coding and embedding, Blynk IoT for the android application, Blynk Cloud that served as a Web-Based System, server, location tracking, user interface designing, Fritzing for schematic, and Sketchup for prototype modeling. Each part of the system undergone the testing phase to verify its functionality, efficiency, and reliability.

Blynk was designed for the Internet of Things. Blynk can control hardware remotely and can display sensor data, can store data, visualize it, and do many other things. There are three major components in the platform; First, the Blynk App. This creates amazing interfaces for projects using various widgets provided. Second, Blynk Server. This is responsible for all the communications between the smartphone and hardware. It can use Blynk Cloud or run to private Blynk server locally. It is open-source which could easily handle thousands of devices, and can even be launched on microcontrollers. Third, the Blynk Libraries. For all the popular hardware platforms – this enables the communication with the server and processes all the incoming and outcoming commands. Now imagine, every press of a button in the Blynk app, the message travels to space, to the Blynk Cloud specifically, where it magically finds its way to the hardware. It works the same in the opposite direction and everything happens in a blink of an eye [26].

Arduino IDE is an open-source software designed for writing, compiling, and uploading of codes to almost all Arduino Modules. It is an official Arduino software, making code compilations too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. One can tell their board what to do by sending a set of instructions to the microcontroller on the board. To do so, one could use the Arduino programming language and Arduino software based on processing.

**Database Design**

The researchers proposed to use a Web-Based system. The needed parameters will be saved to the Blynk Cloud which will serve as the database of the system using a real-time cloud. To store the data that will be collected during the process of the system. The Blynk Cloud logs every event that happens through the device using the Automations Widget. This widget is responsible for sending the push notifications that can be set with the lowest limit of 1 minute per response.

The Fig. 10 below shows the configuration of the Event Automation. The developers set this automation to trigger with an interval of 1 minute per push notification. This will also varies depending on how many parameters have been triggered. The Blynk Cloud can only support the data process within a minimum time limit of 1 minute. The figure shows the real-time Notification chart of the proposed device. The data shows the real-time operation of the sensor. The bar with blue legend indicates the time when the sensor (automation) where triggered. Followed by the bar with an orange legend that indicates the time when the data was sent to the Blynk Cloud Server. Last is the bar with a gray legend that indicates the time when the data was received by the Blynk IoT. The figure shows the difference in terms of time while sending and receiving data through Blynk Cloud Server. This will prove the measurement of how the device implements in real-time.

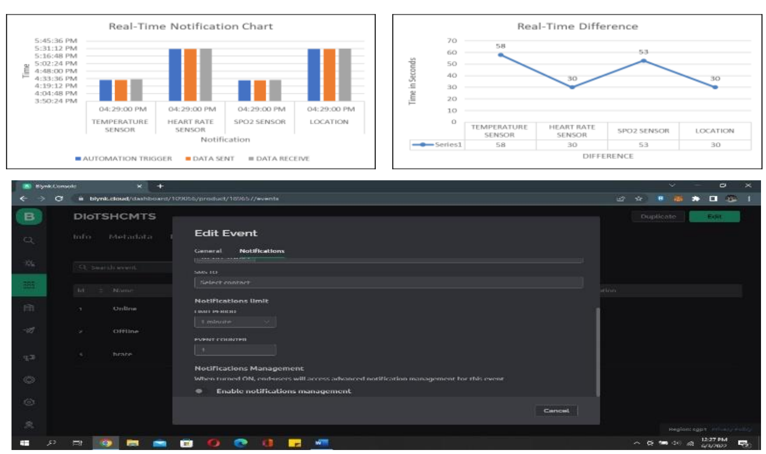


**Fig. 10 Device Real-Time Configuration**

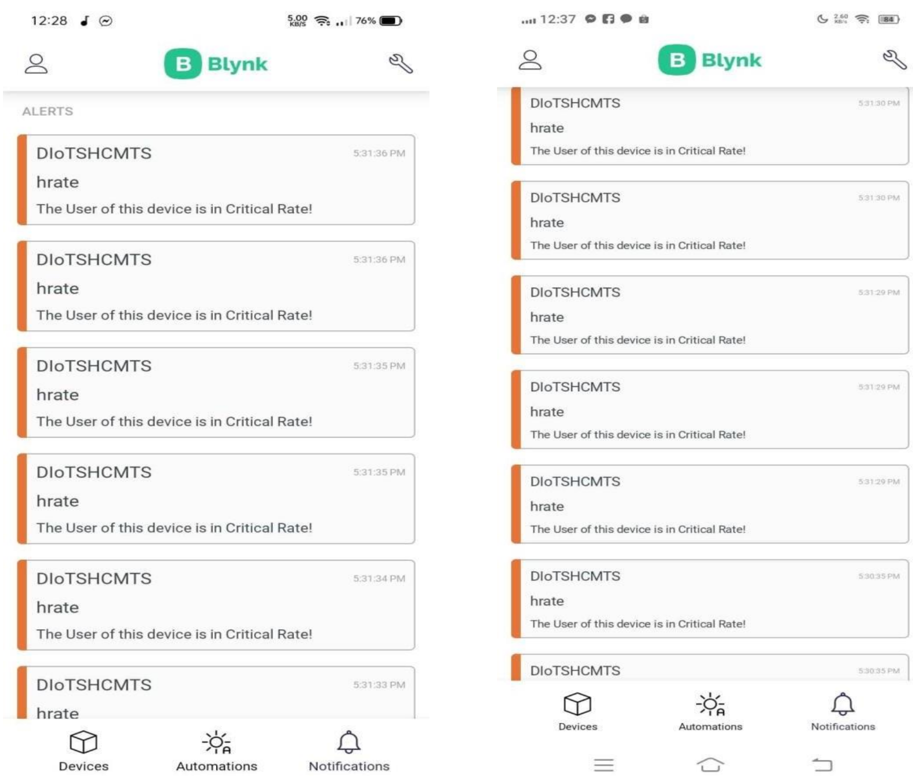


**Fig. 11 Notification Tab on the Relative's and the User's Phone**

Fig. 11 above shows the notification tab of the user and the relative's phone. This will show a real-time view of the notification interval. This also explains how the Blynk Cloud handles data to store into the data logs and then prints into the Blynk IoT app.

**Actual Design**

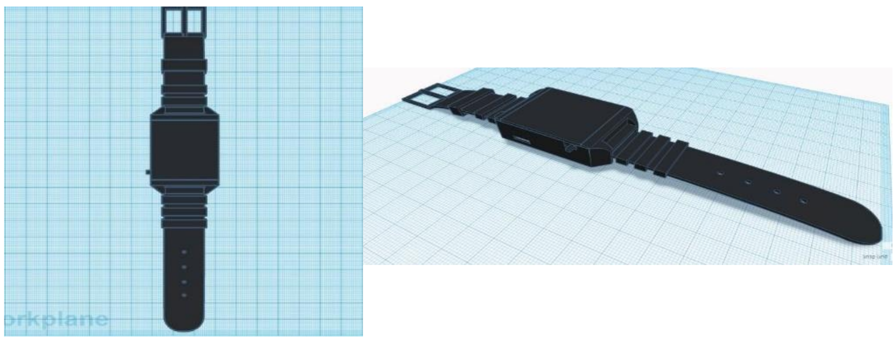

**Fig. 12 Actual Design**

Fig. 12 represents the isometric and top view of the actual design. The casing was made by a 3D printer synthetic polymer that is a good inductor of heat.

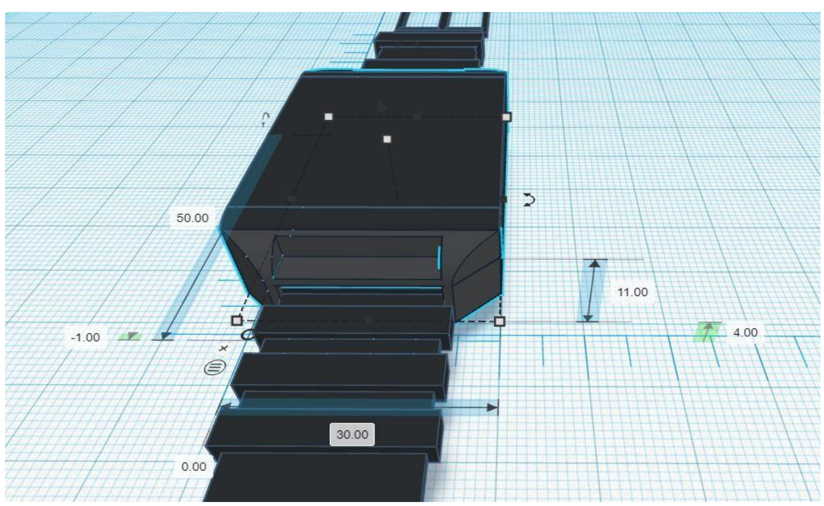


**Fig. 13 Actual Design Dimensions**

Fig. 13 shows the dimensions of the actual design. It provides a length of 48mm, a width of 32mm, and a height of approximately 12mm. This dimension is shown to provide a specific idea of how the hardware components will be inserted.

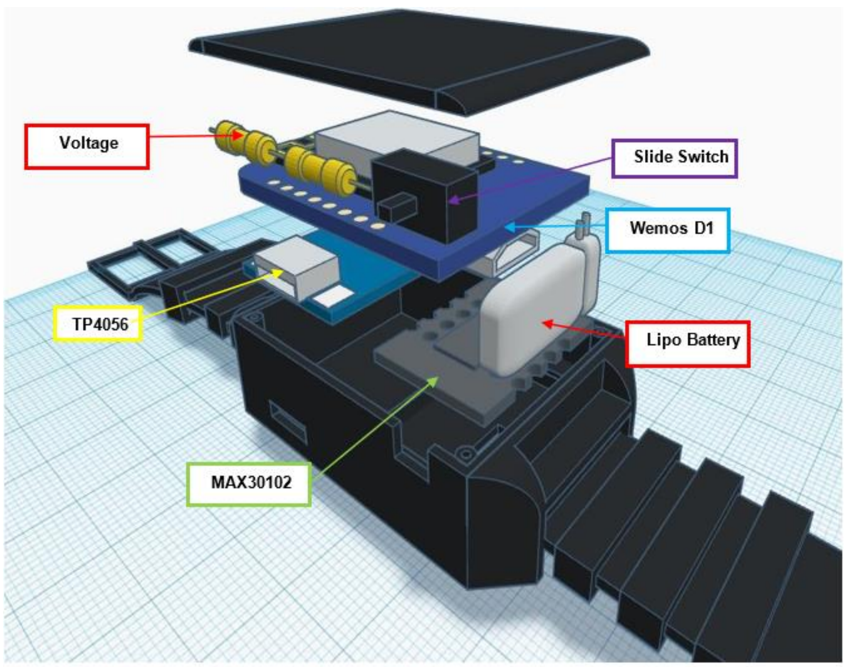


**Fig. 14 Actual Design (Exploded View)**

Fig. 14 represents the exploded view of the actual design. This is to show the position of the hardware components inside the device casing.

## Chapter 4

## RESULTS AND DISCUSSION

This chapter covers the consideration in developing the system, hardware component selection, and hardware components assembly, software requirements of the system, testing, and evaluation of the study.

**Considerations in Developing the System**

The researchers considered different aspects and elements before designing and developing the proposed project. The Wearable Device for Smart Healthcare Monitoring and Tracking System is a wearable device the circuit that is used was considered to be not harmful to any user. The device will be attachable to the wrist of the user since the pulse and body temperature was readable on the said body part. The researchers also considered the size of the device to be more compressed and precise than the usual smartwatch that everyone can buy on the market.

The researchers also considered the microcontroller used for the proposed project. Two microcontrollers were examined by its specification that reached most of the qualities that were needed throughout the project. The table below shows the comparison of the two microcontrollers.

**Table 5. Microcontroller Comparison**

| Microcontroller | Advantages | Disadvantages |
|---|---|---|
| NodeMCU ESP8266 | The NodeMCU chip is marketed as an "open-source, interactive, programmable, low cost, WiFi-enabled" controller. The controller has 10 GPIO pins that can be PWM, I2C, or 1-wire. There's also a built-in ADC for your analog devices. The NodeMCU has a slightly longer footprint than the Wemos D1 Mini at 48.0mm long by 23.88mm wide. And, it weighs about 50g vs the 3g of the Wemos D1 mini. | ▪ Large footprint and massive weight<br>▪ Reference code I/O not GPIO<br>▪ Prone to overheati ng |
| Wemos D1 Mini | The D1 Mini is a 4MB flash controller based on the ESP8266 chip. It includes 11 digital input/output pins (I/O) each with an interrupt, PWM, I2C (except D0). There's also 1 analog pin (A0). It's compatible with Arduino, NodeMCU, and MicroPython. And, it also has a built-in Micro USB port, which you can use for power or download programs. The controller weighs only 3g and has a very small footprint at 34.2mm long by 25.6mm wide. There is also an assortment of "shields" compatible with the Wemos, which are neat if you're looking to create a rapid prototype. | ▪ Not programma ble with Lua<br>▪ Pins aren't aligned with breadboard |

In this study, the Wemos D1 Mini was used in the device because it meets all the specifications needed while considering the size, weight, and the functionality of the microcontroller.

**Circuitry**. The figure below shows the connection of the circuitry of the proposed project and how the components are connected with each other. The components such as MAX30102 and TP4056 were interfaced with WEMOS D1 mini.

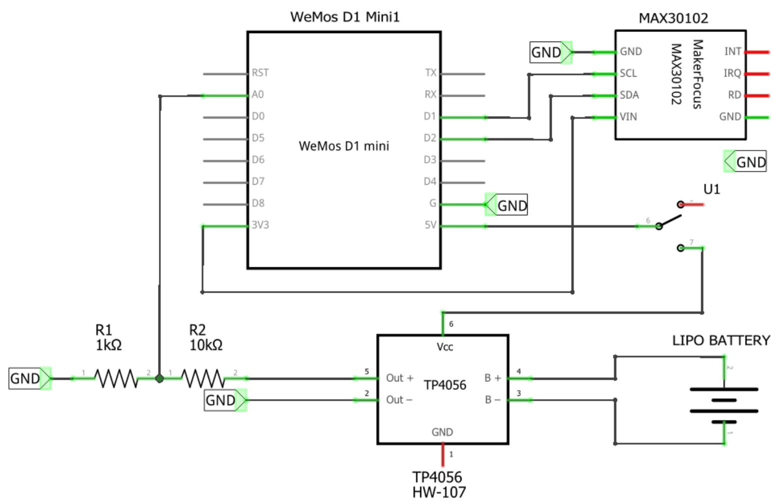


**Fig. 15 Interfacing with the WeMos D1 Mini**

Fig. 15 represents the interfacing of WeMos D1 Mini. Wherein the component MAX30102's SCL and SDA were connected into D1 and D2 of Wemos. The component's power source was connected to the Wemos 3V pin as positive and the GND pin as ground. Lastly the TP4056's OUT+ pin was connected to Wemos 5V pin and the OUT- was connected to the GND.

## Hardware Component Assembly

The main controller, particularly the WeMos D1 Mini, works with the different modules for the control operations of the entire system. The main controller is an ESP8266- based Wi-Fi board that is small but just as powerful as any NodeMCU on ESP8266-based microcontroller. It is Wi-Fi-enabled, and fully compatible with the Arduino platform. The ESP8266 library and board manager will be used to get the D1 Mini to act as an Arduino board. The D1 Mini has a web server, allowing any Wi-Fi-connected device to interact with the board and control its pins wirelessly. The main controller works with the sensors to detect vital points and send notification alerts.

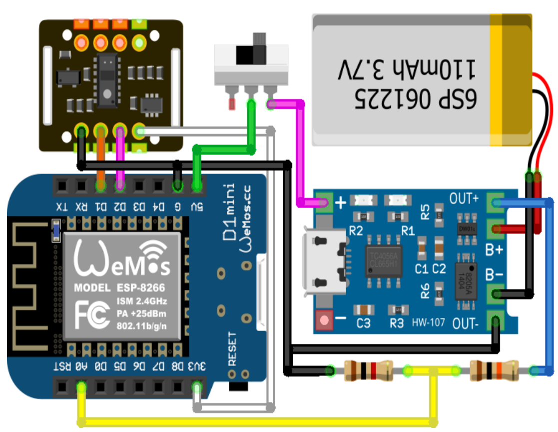

**Fig. 16 Wiring Diagram**

Figure 16 illustrates the wiring diagram. It represents a simple visual representation of the components' physical connections and physical layout.

**Software Requirements of the System**

For the operation of the system, along with the presented hardware components, the following software was used: Arduino IDE for microcontroller coding and embedding, Blink Application for android application user interface, and Blynk.Cloud for web server.

**User Interface**. The following figures show the actual android application user interface from displaying the real-time temperature and heartbeat as well as the oxygen level of the wearer of the device to sending alerts on the android phone, including the location of the user.


**Fig. 17 Main Screen**

Figure 17 shows the main screen UI, where the user can monitor the real-time temperature and heartbeat as well as the blood oxygen level (Spo2) of the wearer. The user can also view the voltage and battery percentage. This will help the user to know whether the device needed to be re-charged. Then the push message will pop up and notify the user and the relative when an abnormality in the parameters occurs.

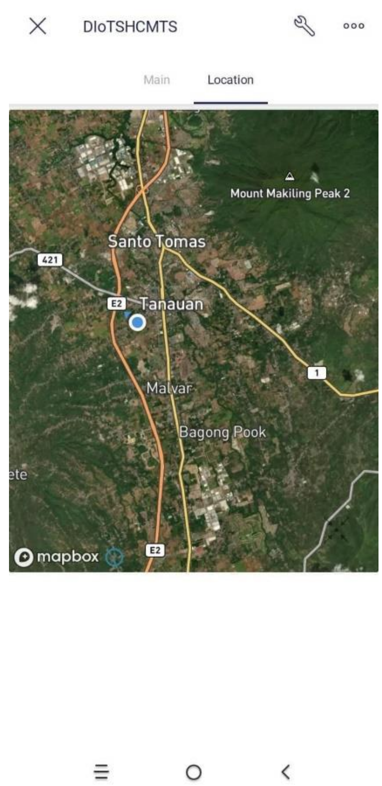


**Fig. 18 Location Tab**

Figure 18 shows Location Tab UI, where the user and the relative can monitor the real- time location of the wearer. This will be served as the tracking system.

```
// This section is responsible for displaying the exact coordinates of the USER
int index = 0;
float lat = " ";
float lon = " ";
myMap.location(index, lat, lon, "value");
//End of section
```

**Fig. 19 Location Mapping for Coordinates (Code)**

The figure above shows the code on how the developers will identify and show the exact coordinates of the user. This scopes the longitude and the latitude coordinates that can be view as one of the automations (event push notification). This will be added as a new parameter that will notify the relative of the user the exact coordinates on the real- time GPS Map.

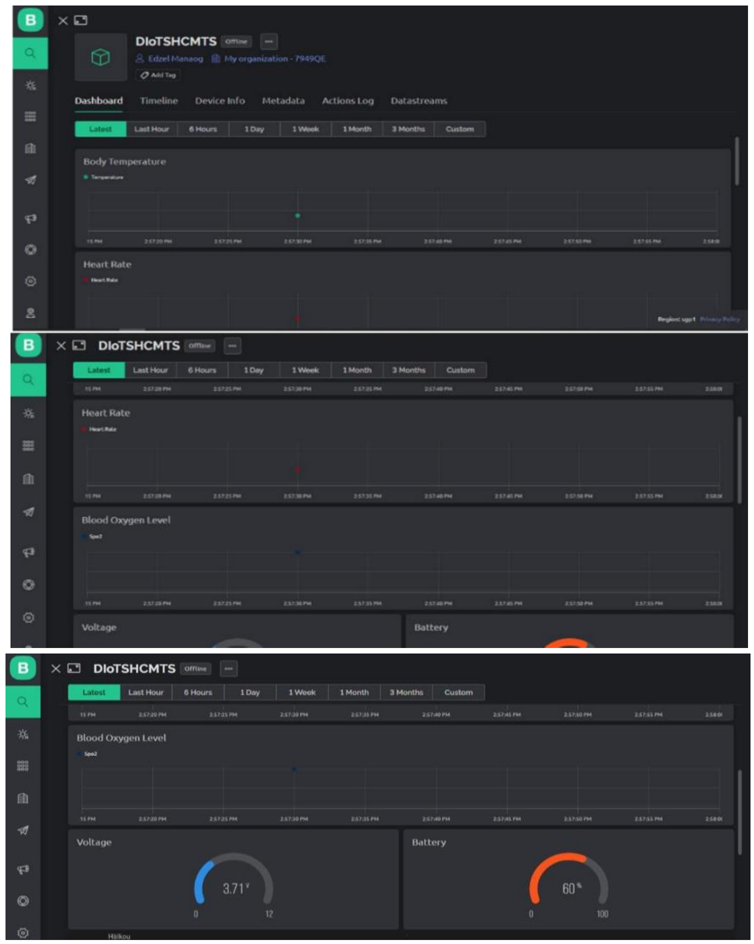


**Fig. 20 Blynk Web Server UI**

The Figure above shows the User Interface of the Blynk.Cloud(Web Server). The Blynk.Cloud is used to monitor, create, and delete devices in the Blynk Iot (app). This server is used as the admin of all the devices registered on one account.

## Testing and Evaluation

Following the development of the prototype, various tests of the system's functionality should be carried out. This will be done to ensure that each function produces a correct and accurate result in accordance with the system's design specifications.

**Initial Testing.** The Table below shows the sensitivity graph of the MAX30102 Pulse Oximeter Sensor that is used in the proposed system. This will identify the sensors' accuracy and efficiency.

**Table 6 MAX30102 Sensitivity Graph**

| Age | Temperature | | Heart Rate | | Spo2 | |
|---|---|---|---|---|---|---|
| | ISO | Temperature | ISO | Heart Rate | ISO | Spo2 |
| **7 – 12** | 35-36.83 | 36.12℃ | 80-120 | 88 Bpm | 95-100 | 100% |
| **13 – 25** | 35-36.1 | 36.18℃ | 70-120 | 72 Bpm | 95-100 | 100% |
| **26 – 40** | 33.3-36.4 | 36.3℃ | 60-100 | 89 Bpm | 95-100 | 100% |
| **41 Above** | 36 | 36.01℃ | 60-100 | 90 Bpm | 95-100 | 100% |

According to Lauren Castiello, MS, AGNP-C blood oxygen levels in healthy people range between 75 and 100 millimeters of mercury (mm Hg). The medical profession deems it low when arterial blood gas (ABG) test results reveal an oxygen level below 60 mm Trusted Source. People who have these results may require oxygen supplementation in some situations. Hypoxemia is characterized by a blood oxygen level that is too low when compared to the typical level of a healthy person. This happens when the body has problems getting oxygen to all of its cells, tissues, and organs. Oxygen saturation refers to the amount of oxygen in a person's blood. A pulse oximeter is a device that doctors regularly use for a quick diagnostics or long-term monitoring [26].

MAX30102 uses a method called photoplethysmography to measure the heart rate of the user as well as the blood oxygen level (Spo2). The proponents test the accuracy of the sensor sensitivity by varying the ages of the user. With this method, the proponents can assure the efficiency of the sensor by comparing the values of the result in the standard parameters value of a healthy person.

**Secondary Testing.** The table below shows the comparison graph of the proposed device to a health monitoring device in the market as a wearable device. This will identify the accuracy of the whole device in measuring a given parameter.

Edward R. Laskowski, M.D. stated that a resting heart rate of 60 to 100 beats per minute is recommended for adults. A lower resting heart rate, in general, suggests improved cardiac function and cardiovascular fitness. A well-trained athlete's resting heart rate, for example, would be closer to 40 beats per minute. Although there is a wide range of normal, a heart rate that is excessively high or low could suggest a problem. If your resting heart rate is consistently greater than 100 beats per minute (tachycardia), or if you're not a trained athlete and your resting heart rate is less than 60 beats per minute (bradycardia), see your doctor, especially if you have other signs or symptoms like fainting, dizziness, or shortness of breath [27].

In line with Mayo Clinic Staff the average body temperature is 98.6 degrees Fahrenheit (37 C). Normal body temperature, on the other hand, can range from 97 F (36.1C) to 99 F (37.2 C) or higher. Fever is indicated by the following thermometer readings: Temperatures of 100.4 (38 C) or greater in the rectal, ear, or temporal arteries Oral temperature of 100 degrees Fahrenheit (37.8 degrees Celsius) or higher Armpit temperature of 99 degrees Fahrenheit (37.2 degrees Celsius) or greater [28].

**Table 7 Device Comparison Graph**

| | **Proponent's Device** | | | **Lefun Health Smart Watch (Market Smart Watch)** | | |
|---|---|---|---|---|---|---|
| | Temperature | Heart Rate | Spo2 | Temperature | Heart Rate | Spo2 |
| Test 1 | 36.12℃ | 86Bpm | 100% | 36.14℃ | 85Bpm | 100% |
| Test 2 | 36.15℃ | 77Bpm | 99% | 36.16℃ | 77Bpm | 99% |
| Test 3 | 36.20℃ | 101Bpm | 99% | 36.19℃ | 100Bpm | 98% |

This will show the comparison result of the measured parameters in two different devices. It will help the developers to identify if the sensor is calibrated equally and right for determining the accuracy and efficiency of the proposed device. Based on the result the proposed design shows the result with almost the same with the market smartwatch.

**Table 8 Functionality of Features Testing**

| Feature | Test Case | | | | |
|---|---|---|---|---|---|
| | Trial 1 | Trial 2 | Trial 3 | Trial 4 | Trial 5 |
| Temperature Sensor | Failed | Success | Success | Success | Success |
| Pulse Sensor | Failed | Success | Success | Success | Success |
| Spo2 Level | Failed | Success | Success | Success | Success |
| Blynk IoT to Blynk Cloud Connection | Success | Success | Success | Success | Success |
| Wi-Fi Module Connectivity | Failed to Connect | Failed to Conne ct | Success | Success | Success |
| Check Location | Failed | Failed | Failed | Success | Success |
| Notifier | Failed | Failed | Success | Success | Success |
| Battery Configuration | Failed | Success | Success | Success | Success |

The table above shows the features testing table varies by its functionalities. The first trial is conducted on April 2, 2022. The first trial on the features temperature, heart rate, and Spo2 sensor failed because the MAX30100 was busted. After coding and uploading the module didn't correspond and show multiple error and bugs saying the Module was not found on the console. This concludes the change of the module sensor to MAX30102. Wi-Fi module connectivity, checking of location, Notifier, and Battery Configuration testing also fails because of the shortage of modules. On second trial which is conducted on April 9, 2022, the Wi-Fi Connectivity, checking of location, and Notifier Testing fails because of the Blynk App update and patch. The developers struggled on finding the new authentication token which is needed connect the Wemos D1 Mini Wi-Fi module to Blynk Cloud and Blynk App. Third trial was conducted on April 10, 2022. Checking of location failed due to the lack of libraries needed to run the GPS mapping. This is why the developers decided to avail the Blynk Clou Map Widget, in order to access the real-time GPS mapping using the internet of things. Trial number 4 was conducted on May 15, 2022, this time the prototype is working properly. The calibration of the device was also conducted here. The developers use the Arduino IDE as one of the parameters use to calibrate the sensors by applying different values on the variables in order to test the IR sensitivity which is a very versatile component of the MAX30102 sensor. Trial number 5 was conducted on May 20, 2022, this concludes the unit testing, calibration, and testing of all the features of the prototype. All of the features were tested successfully.

**User's Evaluation.** A survey of target 4 users was conducted to assess the system's functionality, including the ability to measure the user's body temperature, heart rate, and blood oxygen level. This user is defined with different ages. This also evaluate the tracking and notifying system of the device.

## Chapter 5

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter covers the summary of findings, conclusions, and recommendations of the study. This includes the summary of the results obtained, the answer for the problems that needed to be solved and to the treatment of the limitations needed to be improved through the use of recommendations. This chapter tells the essential part of the research and project design process. This chapter answers the objectives of the study which serves as proof in the accomplishment and success of the project study. Lastly, it also includes recommendations for further improvement and development of the device.

### SUMMARY OF FINDINGS

A Wearable Device for Smart Healthcare Monitoring and Tracking System is a device that can help monitor and track the user's location if a user's body temperature, heart rate, or pulse rate is unusual.

1. The user's relative can detect where the user is by using the Blynk App's real-time GPS functionality. When its parameters are unusual, a device that can track the user's location is incredibly valuable in determining the whereabouts of the wearer. If their settings are odd, there's a significant

chance of acquiring access to them using the Blynk App's tracking tool, which may track the user's position.

2. Through the use of internet of things-based components such as WeMos D1 Mini, which is interconnected to the sensors, MAX30102, and Blynk application of the health monitoring and tracking system, real-time health monitoring was designed. With the use of the Blynk application for the push notification, real-time monitoring was implemented to monitor the temperature, heart rate, and blood oxygen level of the user.
3. Using the evaluation and unit testing process. The proponents achieved a successful outcome. The sensor's functions were precise and effective. The device also has a success feature. The Sensing System, Notification System, and Tracking System are all part of this.

**CONCLUSIONS**

Based on the findings of the study, the researchers reached the following conclusions:

1. The researchers succeeded in developing a tracking device. The Blynk App allows for additional flexibility over tracking the position of the device's user. It improves the user's ability to track their whereabouts.
2. Using advanced sensor technologies, the temperature, heartbeat, and

blood oxygen level of the wearer were all measured. The user's relative will be notified through push notification if the gathered parameters are odd.

3. Through trial and error, the researchers were able to obtain precise results. The researchers used trial and error to identify irregularities and deficiencies that needed to be addressed. Furthermore, the researchers examine the project for functionality, usability, reliability, efficiency, compatibility, maintainability, and portability before deploying it.

**RECOMMENDATIONS**

Based on the findings and conclusions, the researchers highly recommend the following:

1. The Blynk application is quite useful for tracking the user's whereabouts. The researchers recommend adding a new feature to the tracking system: individual user data.
2. The researchers recommend adding a GSM module with a small dimension to give SMS notice, as well as Real-Time and Date functions, to make it more relevant. Measurable indicators like blood pressure and blood sugar levels should also be included.
3. The unit testing and evaluation went successfully. There are numerous

factors that can be used to assess the device's performance, accuracy, and efficiency. The proponents recommend comparing the proposed device to other devices on the market. By comparing the data from all of the devices will be a huge assistance in testing the device accuracy and efficiency. The sensors should then be adjusted or recalibrated to achieve the desired accuracy and efficiency.

Additionally, the proponents pass on these suggestions to future developers, making the design more appealing and fashionable. Water Proofing is another property that maintains its water-resistant or prevents water infiltration in specific scenarios. Additional components, such as an OLed (LCD), are more expensive, but they produce better picture quality and use less power.

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## APPENDICES

Appendices contain supplemental information that is not required reading for the text but may be useful in gaining a better understanding of the study problem. The following are the contents of the appendices:

| | |
|---|---|
| APPENDIX A: | Materials Used in A Wearable Device For Smart Healthcare Monitoring and Tracking System |
| APPENDIX B: | Estimated Cost |
| APPENDIX C: | Certificate of Grammarian |
| APPENDIX D: | Program Source Code |
| APPENDIX E: | Survey Questionnaire |
| APPENDIX F: | User’s Evaluation for the Health Monitoring and Tracking Device |
| APPENDIX G: | Actual Device |
| APPENDIX H: | Device Manual |
| APPENDIX I: | Pictures |
| APPENDIX J: | Testing Pictures |
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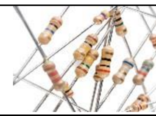
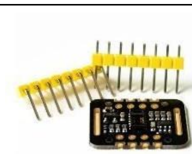
## APPENDIX A

Materials Used in A Wearable Device for Smart Healthcare Monitoring and Tracking System

| | |
|---|---|
| Voltage Sensor |  |
| Slide Switch |  |
| Heart/Pulse Rate Sensor/Temperature Sensor (MAX30102) |  |
| Microcontroller (WeMos D1 mini) |  |
| Power Supply (Lipo Battery) |  |
| Charging Module (TP4056) |  |
| Connecting Wires |  |

## APPENDIX B

Estimated Cost

| HARDWARE | PRICE |
|---|---|
| Voltage Sensor | 20.00 |
| Slide Switch | 10.00 |
| Heart/Pulse Rate Sensor/Temperature Sensor (MAX30102) | 277.00 |
| Microcontroller (WeMos D1 mini) | 218.00 |
| Power Supply (Lipo Battery) | 200.00 |
| Charging Module for 3.7V batteries Li Ion Li Po with MicroUSB Charger(TP4056) | 159.00 |
| Connecting Wires | 10.00 |
| **OTHER COSTING** | |
| 3D Print | 200.00 |
| Blynk App | 355.00 |
| Strap | 250.00 |
| **Total** | **1,699.00** |

## APPENDIX C

Certificate of Grammarian

TANAUAN CITY COLLEGE
BARANGAY TRAPICHE 1, TANAUAN CITY BATANGAS
BACHELOR OF SCIENCE IN COMPUTER ENGINEERING
E-mail: tanauancitycollege@gmail.com
Tel. No.: (043) 702-6979; (043) 706–6961; (043) 706-3934

*Certificate of Grammarian*

This is to certify that this Thesis/Dissertation entitled **"A Wearable Device for Smart Healthcare Monitoring and Tracking System"** of Milena Lyn Dolar, Jayson Garcia, Harish Gonzales, Edzel Manaog, and Monalisa Mendoza in partial fulfillment of the requirements for the degree of Bachelor of Science in Computer Engineering has been reviewed and edited by the undersigned based on the minutes of the Final Defense.

It now follows the standard format of the College and conventions of research writing.

FhelJoy C. Leones, LPT
Grammar Editor

Date Signed: June 21, 2022

## APPENDIX D

Program Source Code

```
#include <ESP8266HTTPClient.h>
#include <SimpleTimer.h> #include
<Blynk.h>
#include <Wire.h> #include
"MAX30105.h"
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>
#include "heartRate.h"
MAX30105 particleSensor;
#define BLYNK_TEMPLATE_ID
"TMPLWcXSCwem"
#define BLYNK_DEVICE_NAME
"DIoTSHCMTS"
#define BLYNK_AUTH_TOKEN
"cF1
1FIx7TQvlqY0Oq8EyCRzFB5B
N4F"
#define BLYNK_PRINT Serial
const byte RATE_SIZE = 4;
//Increase this for more averaging. 4
is good.
byte rates[RATE_SIZE]; //Array of
heart rates
byte rateSpot = 0;
long lastBeat = 0; //Time at which the
last beat occurred
float beatsPerMinute; int beatAvg;
long samplesTaken = 0; //Counter
for calculating the Hz or read rate
long unblockedValue; //Average IR
at power up
long startTime;
 //Used to calculate
measurement rate
```

```
int perCent;
int degOffset = 2.5; //calibrated Farenheit degrees
int irOffset = 650; int irOffset2 = 1000; int count;
int noFinger;
//auto calibrate int avgIr;
int avgTemp;
char auth[] = BLYNK_AUTH_TOKEN; char ssid[] = "ASHE-BALTY";
char pass[] = "aBlessed2021!"; int analogInput = 0;
float vout = 0.0; float vin = 0.0;
float R1 = 100000.0; // resistance of R1 (100K) -see text!
float R2 = 10000.0; // resistance of R2 (10K) - see text!
int value = 0;
WidgetMap myMap(V5); BlynkTimer timer;
void hrate()//Function for heart rate, tempearture, Spo2
beatAvg += rates[x]; beatAvg /= RATE_SIZE;
}
}

{
long irValue = particleSensor.getIR();
if (checkForBeat(irValue) == true)
{
//We sensed a beat!
long delta = millis() - lastBeat; lastBeat = millis();
beatsPerMinute = 60 / (delta / 1000.0);
```

```
if (beatsPerMinute < 255 && beatsPerMinute > 20)
{
rates[rateSpot++] = (byte)beatsPerMinute; //Store this reading in the array
rateSpot %= RATE_SIZE; //Wrap variable
//Take average of readings beatAvg = 0;
for (byte x = 0 ; x < RATE_SIZE ; x++)
int bpm = irValue / irOffset2;
if (bpm >= 130)&& (bpm <= 60)&&(temp >= 41) && (temp <= 35) && (perCent <= 95){
Blynk.logEvent("hrate", "The User of this device is in Critical Rate!");
}
Serial.print(" IR="); Serial.print(irValue); Serial.print(", BPM="); Serial.print(bpm); Serial.print(", Avg BPM="); Serial.print(beatAvg);
Serial.print(" ");
perCent = irValue / irOffset;
Serial.print("Oxygen=");
Serial.print(perCent);
Serial.print("%");
//Serial.print((float)samplesTaken / ((millis() - startTime) / 1000.0), 2);
float temperature = particleSensor.readTemperature();
//Because I am a bad global citizen
float temp = temperature - degOffset;
```

```
Serial.print("                Temp(C)=");
Serial.print(temp,                     2);
Serial.print("°");
Serial.print("                       IR=");
Serial.print(irValue);
if (irValue < 50000) { Serial.print("
No      finger?");      noFinger      =
noFinger+1;
} else {
//only count and grab the reading if
there's something there.
count = count+1;
avgIr = avgIr + irValue;
avgTemp      =      avgTemp      +
temperature; Serial.print(" ... ");
}
//Get an average IR value over 100
loops if (count == 100) {
avgIr = avgIr / count; avgTemp =
avgTemp / count;
Serial.print("                   avgO=");
Serial.print(avgIr);       Serial.print("
avgF="); Serial.print(avgTemp);
Serial.print("                 count=");
Serial.print(count);
//reset for the next 100 count = 0;
avgIr = 0;
avgTemp = 0;
}
Serial.println();
Blynk.virtualWrite(V0,temp);
Blynk.virtualWrite(V1,bpm);
Blynk.virtualWrite(V3,perCent);
}
void voltage() //Function for Battery
and Voltage Level
{
value = analogRead(analogInput);
vout = (value * 5.0) / 1024.0; // see
text vin = vout / (R2/(R1+R2));
```

```
int battery = map(vin, 0, 5.69, 0,
100);
//int battery = vin;
//battery = map(battery, 0, 1023, 0,
100);
//analogWrite(9, battery);
Serial.print(" Voltage = ");
Serial.println("MAX30105
        was
        not found. Please check
wiring/power. ");
while (1);
Serial.print(vin);          Serial.print("
Battery = "); Serial.print(battery);
Serial.print("%");
Blynk.virtualWrite(V2,vin); if (vin >=
12){
Blynk.logEvent("voltage",
        "Voltage reached it
maximum value!");
}
Blynk.virtualWrite(V4,battery);
}
void setup()
{
Serial.begin(115200);
Blynk.begin(auth,
        ssid,
        pass,
"blynk.cloud", 80);
timer.setInterval(1, hrate); //timer
will run every sec
timer.setInterval(1,
        voltage);
        //timer will run every sec
Serial.println("Initializing...");
// Initialize sensor
if
        (!particleSensor.begin(Wire
```

, I2C_SPEED_FAST)) //Use default I2C port, 400kHz speed

{

}

Serial.println("Place your index finger on the sensor with steady pressure.");

//The LEDs are very low power and won't affect the temp reading much but

//you may want to turn off the LEDs to avoid any local heating

particleSensor.setup(0);

//Configure sensor. Turn off LEDs

particleSensor.enableDIETEMPRDY();

//Enable the temp ready interrupt. This is required.

//Setup to sense up to 18 inches, max LED brightness

byte ledBrightness = 25; //Options: 0=Off to 255=50mA=0xFF hexadecimal. 100=0x64; 50=0x32 25=0x19

byte sampleAverage = 4; //Options: 1, 2,

4, 8, 16, 32

byte ledMode = 2; //Options: 1 = Red only, 2 = Red + IR, 3 = Red + IR + Green

int sampleRate = 400; //Options: 50,

100, 200, 400, 800, 1000, 1600, 3200

int pulseWidth = 411; //Options: 69, 118, 215, 411

int adcRange = 2048; //Options: 2048,

4096, 8192, 16384

particleSensor.setup(ledBrightness, sampleAverage, ledMode, sampleRate,

pulseWidth,

adcRange);

//Configure sensor with these settings

particleSensor.setPulseAmplitudeRed(0x 0A); //Turn Red LED to low to indicate sensor is running

particleSensor.setPulseAmplitudeGreen( 0); //Turn off Green LED

particleSensor.enableDIETEMPRDY();

//Enable the temp ready interrupt. This is required.

int index = 1;

float lat = 51.5074; float lon = 0.1278;

myMap.location(index,

lat,

lon, "value");

}

void loop()

{

Blynk.run();

// run Blynk magic

timer.run();// run timer every second

**APPENDIX E**

Survey Questionnaire

CHO INTERVIEW QUESTIONNAIRE

Name:

Age:

How long have you been working?

1. What factors do you consider when there is an unexpected event, specifically in incidents of driving?

2. What can you say about the hospital's response whenever there is an emergency happening here in Tanauan City?

3. If your relative has a health problem but still need to work or go outside, what consider measures is needed to ensure his/her condition?

4. How long, and in what way have you been told that one of your relatives or acquaintance was in accident?

5. How do you ask for help when one of your relatives is feeling unwell or is in an emergency?

6. For you, what are the possible outcomes of unsafe driving?

7. Do you consider yourself a healthy individual?

8. How do you consider yourself as a healthy individual?

9. How do you consider your health 10 years from now?

10. How it is important to monitor your health while driving or when you go somewhere?

11. Consider yourself as a healthy individual. How do you take care of your health to maintain a strong physique?

12. Based on the incidents that occurred here in Tanauan City, provide three (3) barangays that you can say have the highest number of deaths from last January to the present.

13. Based on the incidents that occurred here in Tanauan City, provide three (3) barangays that you can say have the lowest number of deaths from last January to the present.

CHO Doc Dems Interview Questionnaire

1. What parameters are needed for monitoring a patient who has been diagnosed as positive for Covid19?
2. Is it possible for a wearable health monitoring and tracking device to assist a positive patient?
3. What assurances are there that the patient's relatives are aware of his or her condition if the patient is isolated?
4. Can a wearable device that has already been used by a covid positive patient be reused?
5. In what ways do you think a wearable device that can monitor an isolated covid patient will benefit the covid patient, the patient's relatives, and you?
6. If the patient who wears the device enter in critical stage do you think the wearable device will be helpful?

Respondents from Brgy. Balele and Boot Survey Questionnaire

**A Wearable Device For Smart Health Care Monitoring and Tracking System**
(Survey Questionnaire)

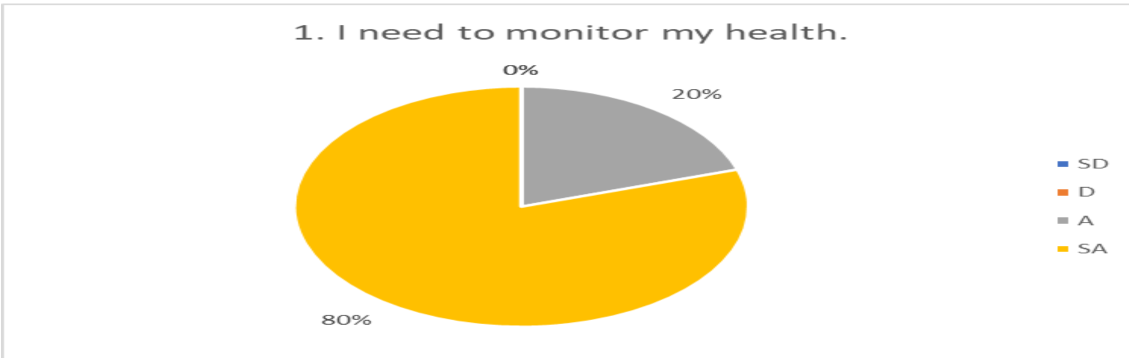
| | |
|---|---|
| Name: | Age: |
| Address: | |
| Occupation: | Sex: |

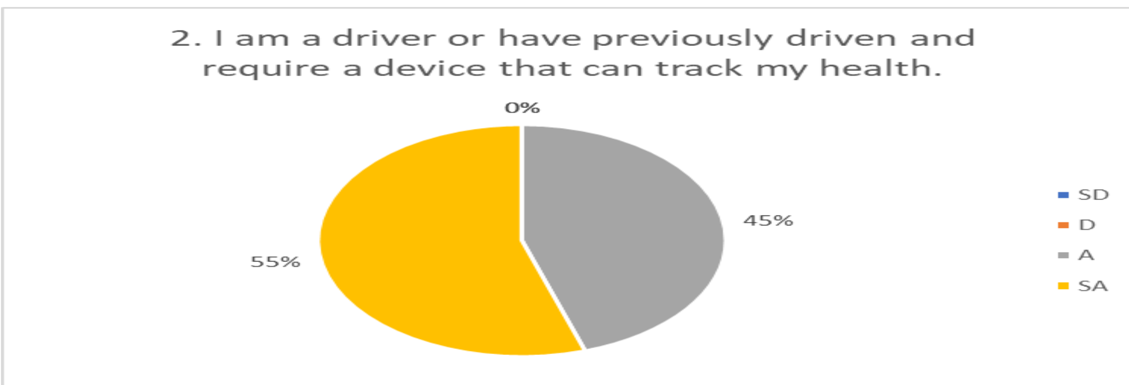
**Direction:** Put a check on the box provided for each of the following statement. Use the scale below to indicate your answer.
**SD - Strongly Disagree D - Disagree**
**SA - Strongly Agree**
**A – Agree**

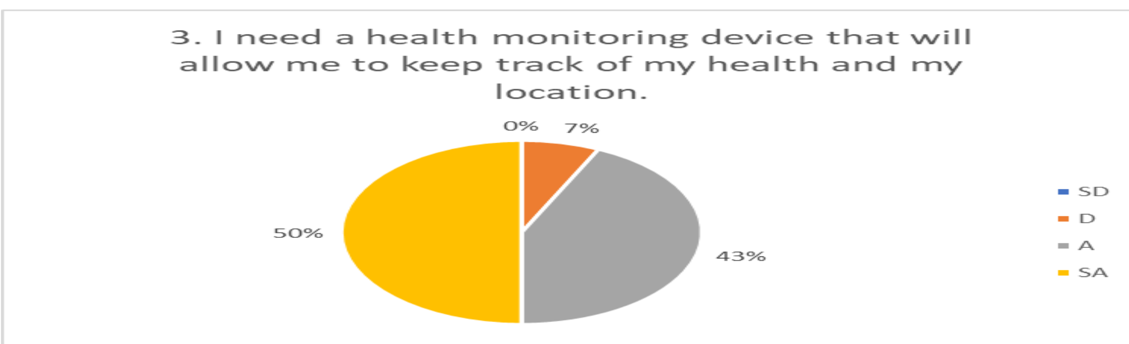
| | SD | D | SA | A |
|---|---|---|---|---|
| 1. I need to monitor my health. | | | | |
| 2. I am a driver or have previously driven and require a device that can track my health. | | | | |
| 3. I need a health monitoring device that will allow me to keep track of my health and my location. | | | | |
| 4. I want a device that will alert my family in the case of emergency. | | | | |
| 5. I want a light-weight health monitoring device. | | | | |
| 6. I want a health monitoring device that is reliable. | | | | |
| 7. I need a health monitoring device that is simple to use. | | | | |
| 8. I want a health monitoring device that will assist me in reducing my hospital visits. | | | | |

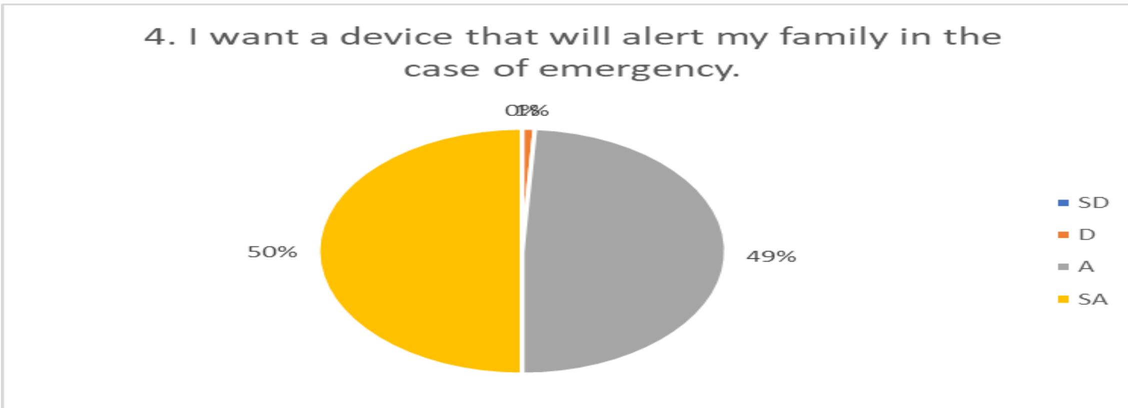
| | | | | |
|---|---|---|---|---|
| 9. I need a health monitoring device that can also help me improve my health. | | | | |
| 10. I need a health monitoring device that gives me the best chance of receiving the appropriate treatment swiftly and without complications. | | | | |

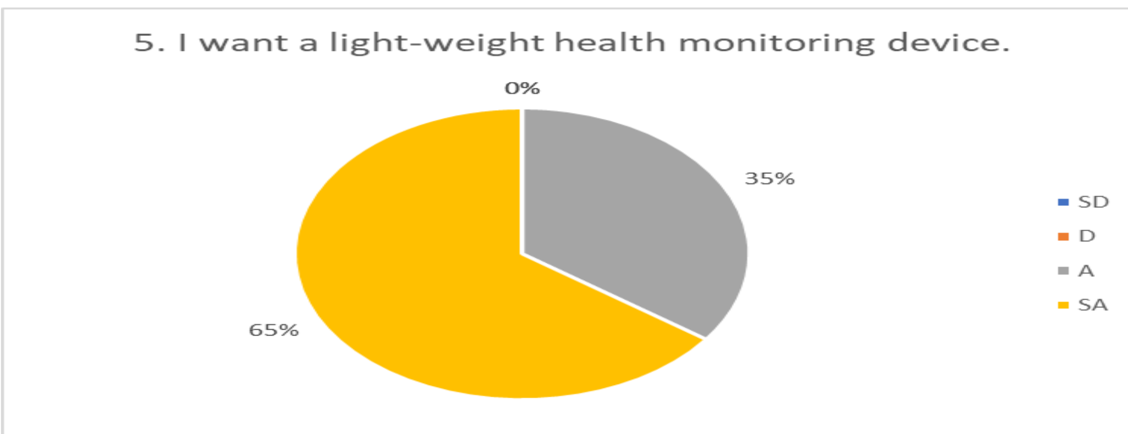
Survey results (Respondents from Brgy. Balele and Boot Survey Questionnaire)

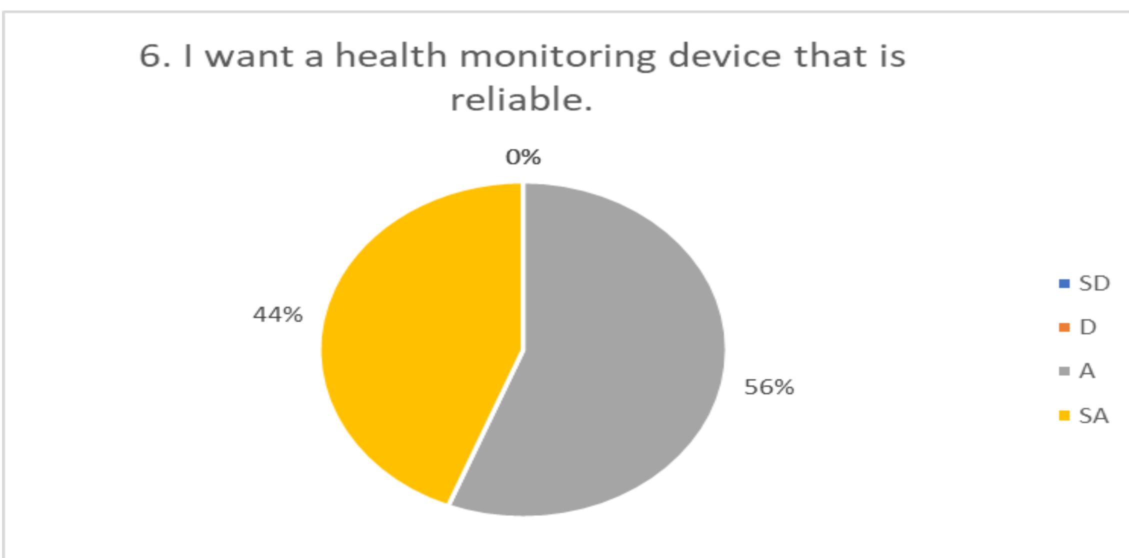


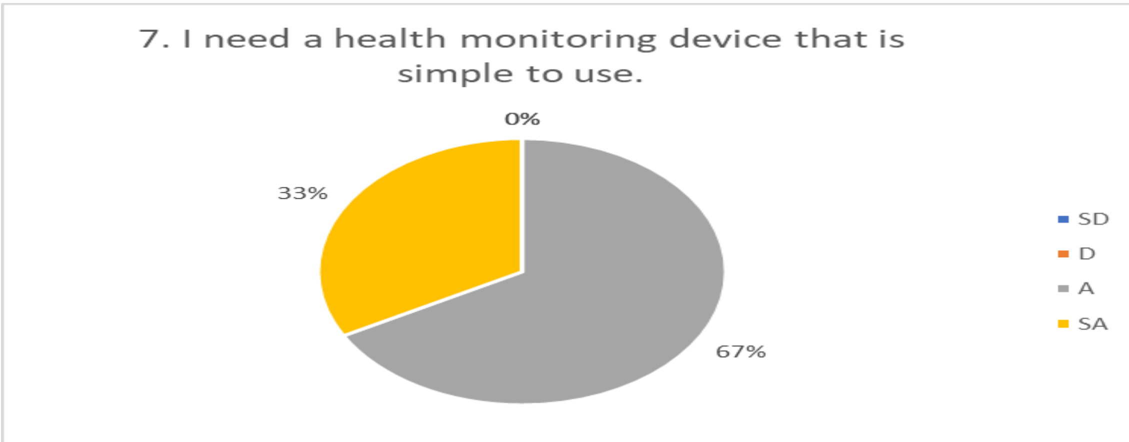



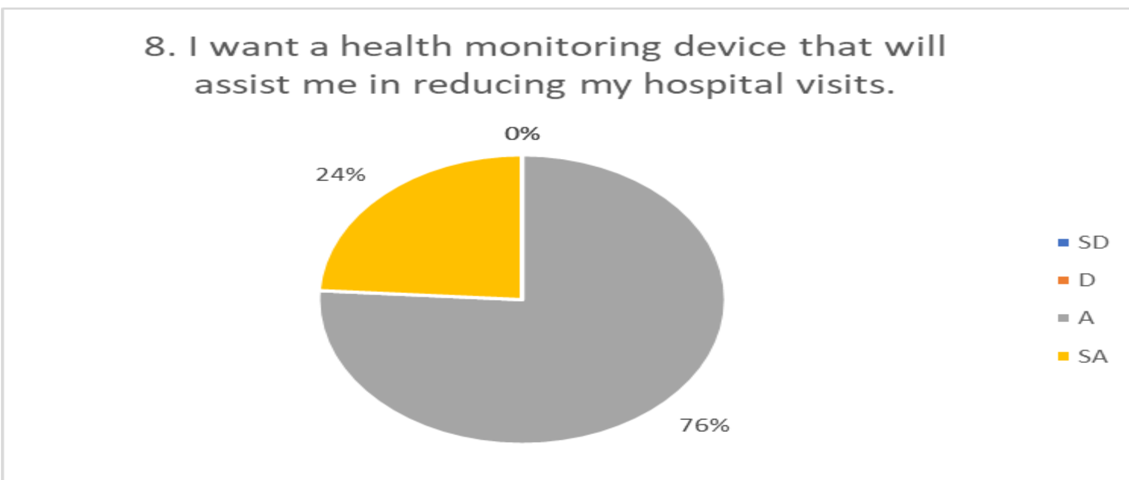



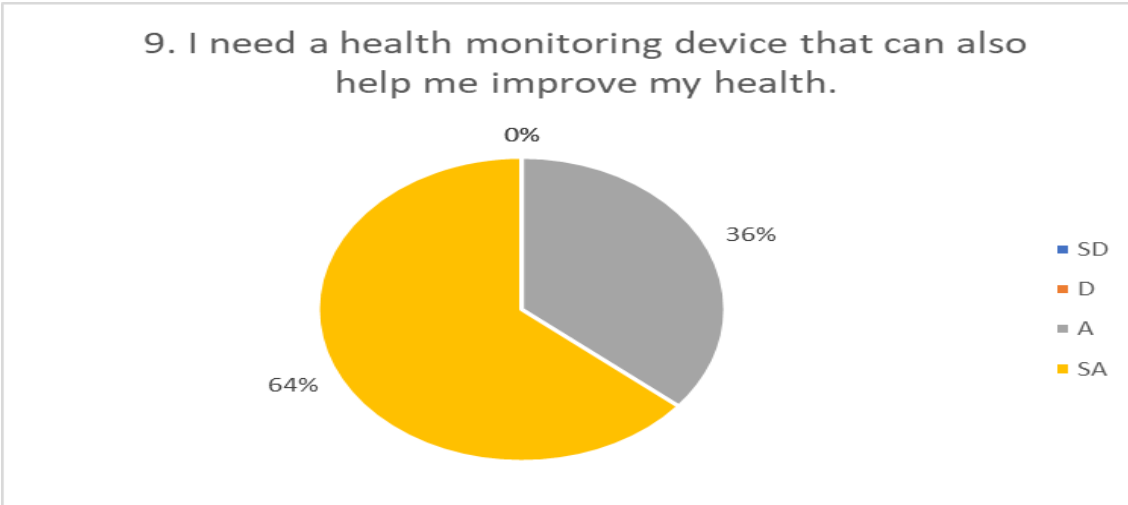

4. I want a device that will alert my family in the case of emergency.
0%
1%
49%
50%
SD
D
A
SA

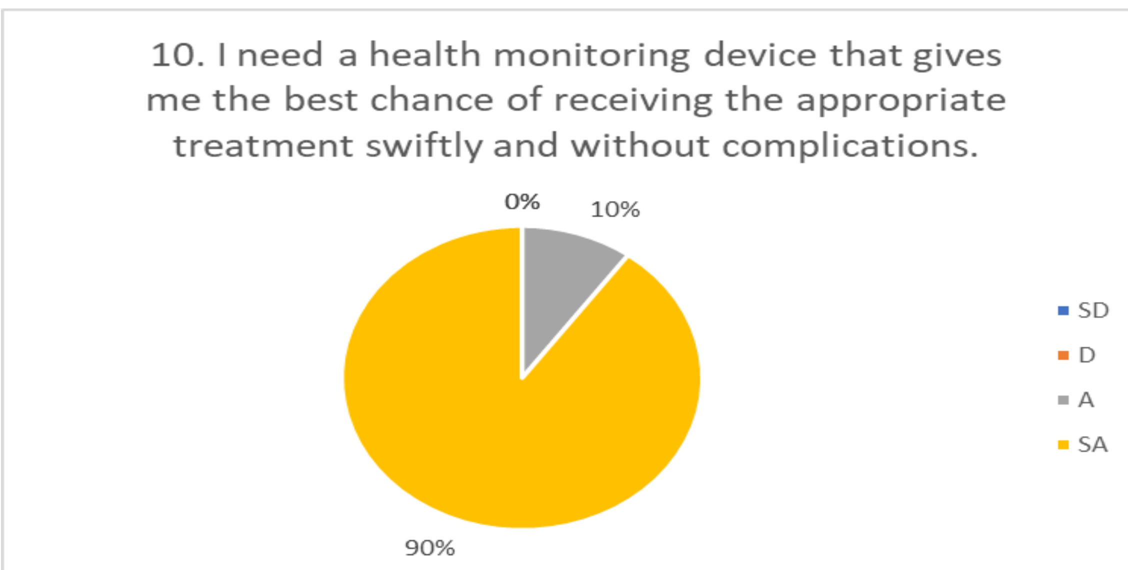

5. I want a light-weight health monitoring device.
0%
35%
65%
SD
D
A
SA


6. I want a health monitoring device that is reliable.
0%
44%
56%
SD
D
A
SA


7. I need a health monitoring device that is simple to use.
0%
33%
67%
SD
D
A
SA


8. I want a health monitoring device that will assist me in reducing my hospital visits.
0%
24%
76%
SD
D
A
SA


9. I need a health monitoring device that can also help me improve my health.
0%
36%
64%
SD
D
A
SA


10. I need a health monitoring device that gives me the best chance of receiving the appropriate treatment swiftly and without complications.
0%
10%
90%
SD
D
A
SA

**APPENDIX F**

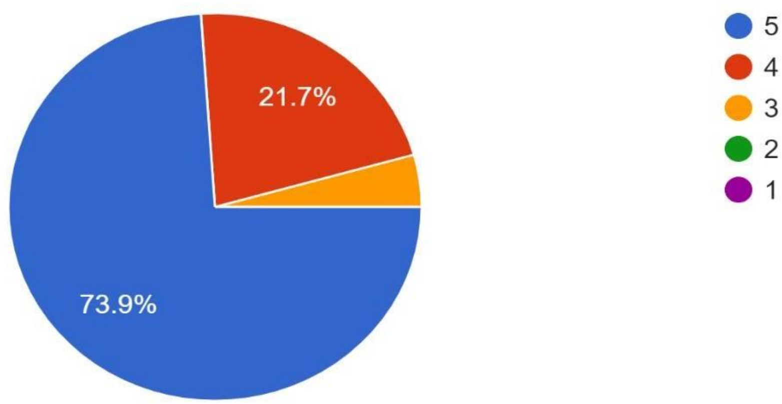
User's Evaluation for the Health Monitoring and Tracking Device

1. The device performed reliably.
2. The temperature feature on this device function as intended.
3. The heart rate feature on the device is substantial.
4. The device tracking feature is accurate.
5. The device fit my hand and comfortable.
6. Is it aesthetically pleasing to the eyes.
7. Lightness of the device.
8. The price of device is affordable.
9. Device Durability
10. The device overall function is trusted.

Result for User's Evaluation for the Health Monitoring and Tracking Device

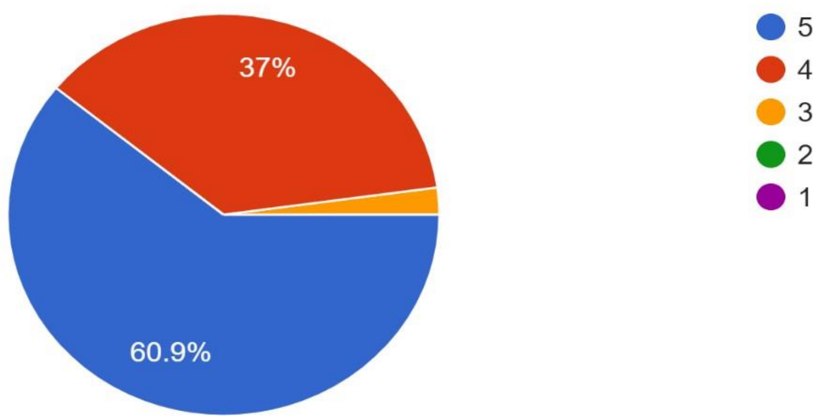
1. The device performed reliably ?

46 responses



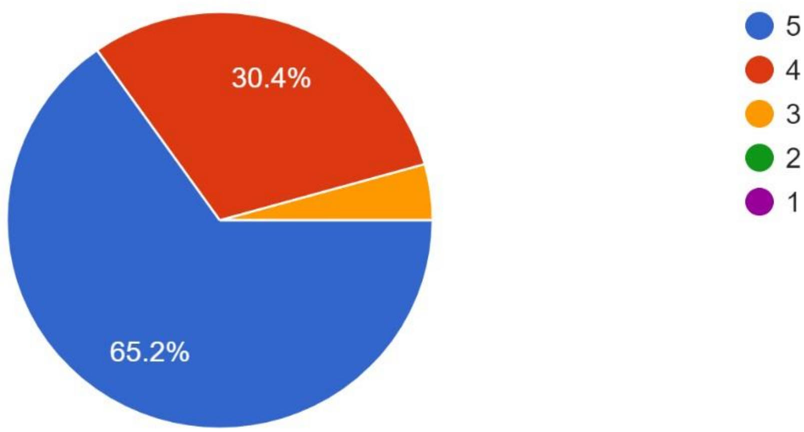

2. The temperature feature on this device function as intended.

46 responses



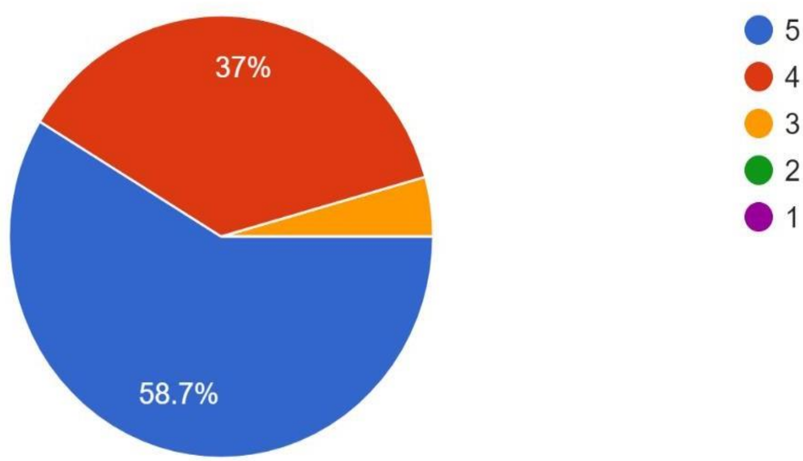
3. The heart rate feature on the device is substential.

46 responses



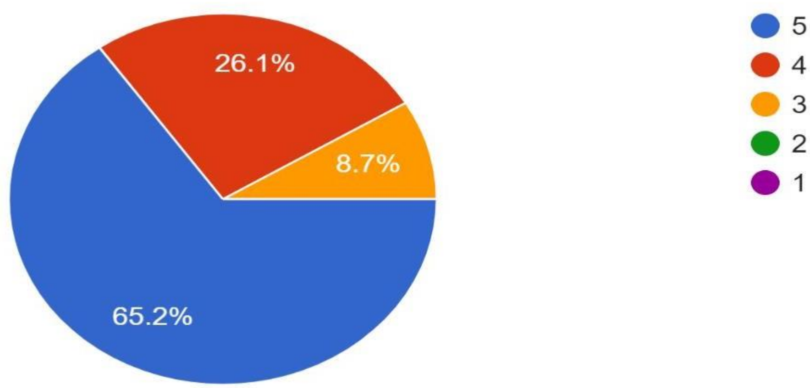

4. The device tracking feature is accurate.

46 responses



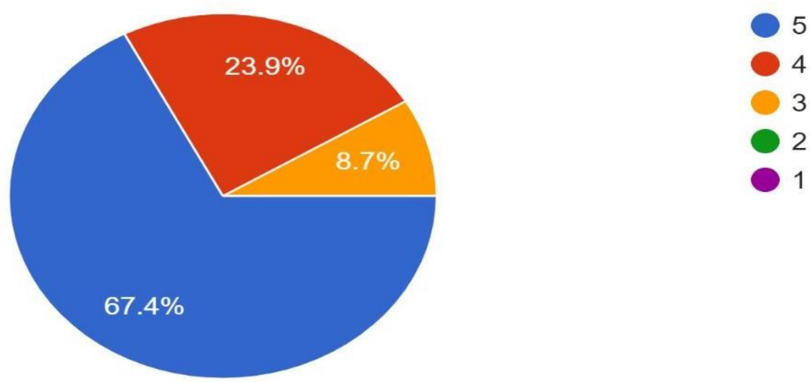
5. The device fit my hand and comfortable.

46 responses

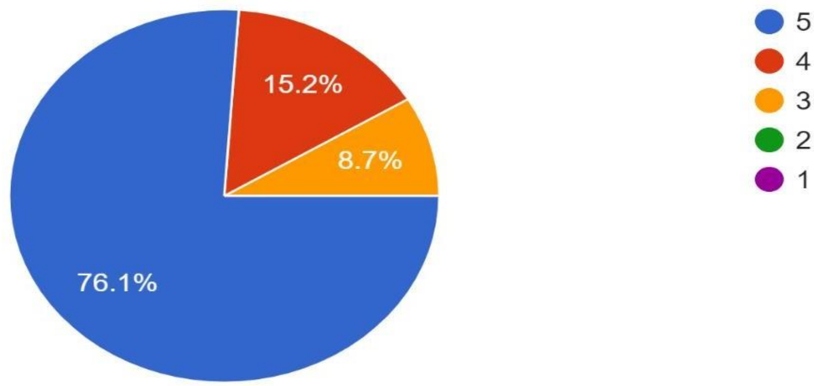



6. Is it aesthetically pleasing to the eyes.

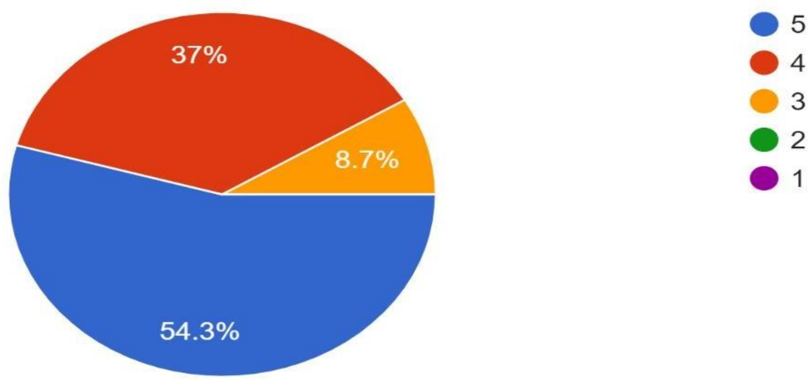
46 responses



7. Lightness of the device.
46 responses

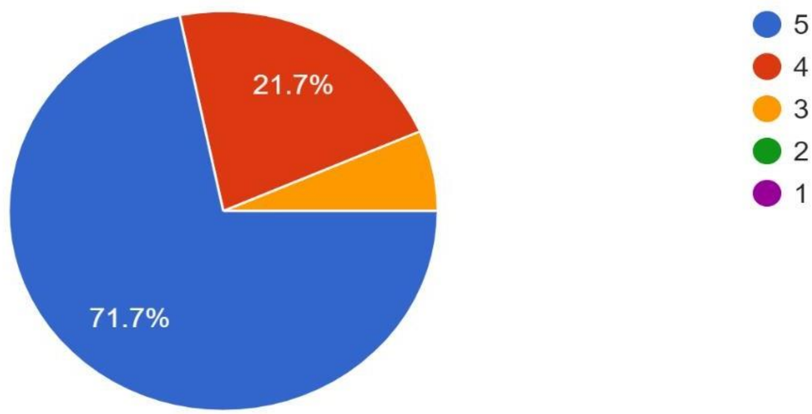



8. The price of device is affordable.
46 responses



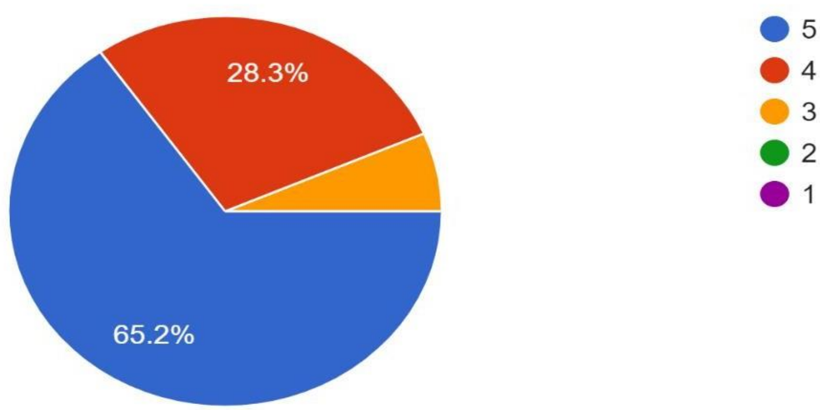
9. Device Durability

46 responses




10. The device overall function is trusted.

46 responses



**APPENDIX G**

Actual Device

## APPENDIX H

Device Manual

Operation:

**ADMIN**

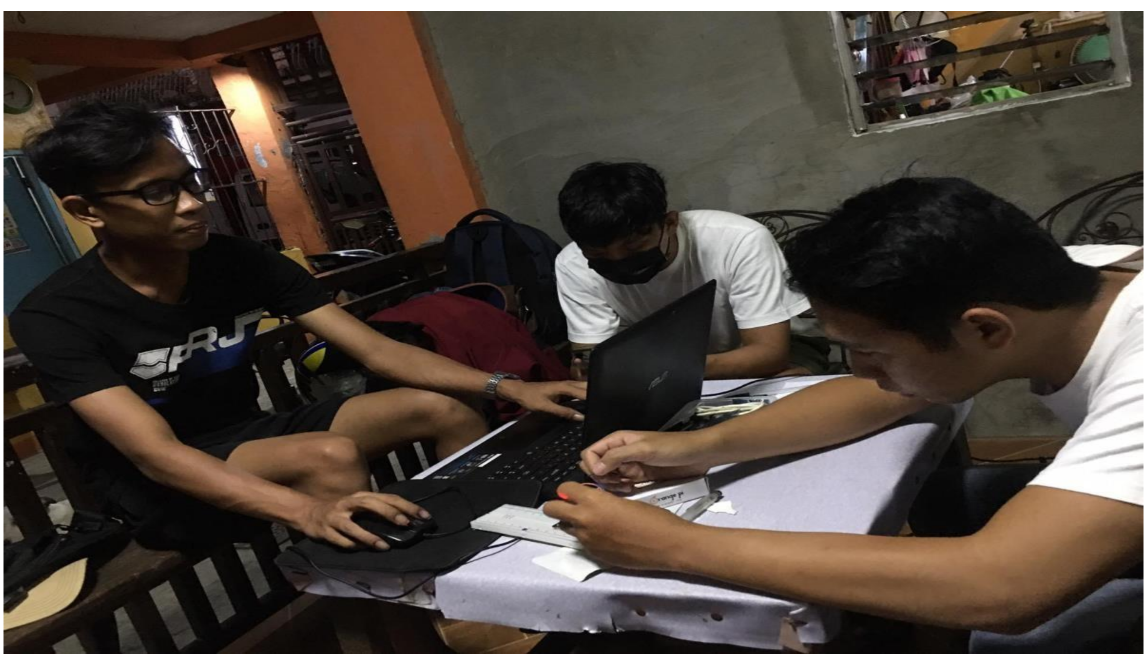
1. In the laptop or PC, open the Blynk.Cloud (Blynk server).
2. Login to your account, which will be used as the admin account.
3. Choose the device you want to monitor
4. The administrator has complete control over the device's upgrades and maintenance.

**USER**

1. Install the Blynk Iot App on your smartphone.
2. Login your account.
3. Open the device for health monitoring.
4. Select the device name to be taken to the dashboard.
5. By selecting the main tab or the location tab in the user interface, the user can check the parameters (body temperature, heart/pulse rate, oxygen level) or the location.
6. If the device detects an irregularity, the user will receive a push notification via the Blynk App.

**APPENDIX I**

Pictures



**APPENDIX J**

Testing Pictures

Initial Testing

**Initial Testing (Age 7-12 years old)**

**Initial Testing (Age 13-25 years old)**

**Initial Testing (Age 26-40 years old)**

**Initial Testing (Age 41 and above)**

Secondary Testing

Test 1

Test 2

Test 3

# APPENDIX K

Curriculum Vitae

## TANAUAN CITY COLLEGE

**School of Engineering**

### MILENA LYN DOLAR

Brgy. San Jose Tanauan City Batangas

(+63) 909- 465 -3547

enferando949@gmail.com

### OBJECTIVES

To secure a responsible career opportunity to fully utilize my training and skills, while making a significant contribution to the success of the company.

### SKILLS

- Knowledgeable in MS Applications
- Mechatronics Servicing Skills
- Basic knowledge about HTML CSS, VISUAL BASIC, VISUAL STUDIO, JAVASSCRIPT, PHP, C and C++ Language.
- Can work with less supervision
- Can work under pressure
- Good Communication Skills
- Dedicate, hardworking and flexible, and willing to assume responsibility

## ACTIVITIES/SEMINARS ATTENDED/WORKSHOPs

Introduction to Arduino: Hardware, Software and Sensor Integration
November 9-10 2018
Tanauan City College
Trapiche 1, Tanauan City, Batangas

Research Conference on Digital Systems And it's Applications (RCoDSA) 2019
May 18, 2019
HRMDO Old Tanauan City Hall
Barangay 2, Tanauan City, Batangas

Getting Started with Cloud Essentials
March 7, 2020
Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City Batangas

Mobile Development Made Easy With Microsoft Power Apps
March 7, 2020
Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City,Batangas

"Discovering Big Data and Analytics"
March 7, 2020
Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City, Batangas

Ethical Hacking: A Webinar on Information Security
November 3, 2020
Tanauan City College
Barangay Trapiche 1, Tanauan City Batangas

HKNL 2021 (Cyber security Conference) | February 20-21, 2021
Sophie's Information Technology Services

Cloud Computing | April 17, 2021
Webinar, Tanauan City College

Cybercrime Law in PH | May 25, 2021
Webinar, Tanauan City College

CPE: Career Paths in Esports | August 08, 2021
Webinar, Tanauan City College

## EDUCATIONAL ATTAINMENT

**Tertiary**

**Bachelor of Science in Computer Engineering**
Tanauan City College
Brgy. Trapiche 1, Tanauan City, Batangas
2018-Present

**Secondary**

**Senior High School**
**Tanauan City College**
Brgy. Trapiche 1, Tanauan City, Batangas
S.Y 2017-2018

**Junior High School**
**Luyos National High School**
Brgy. Luyos, Tanauan City, Batangas
S.Y 2015-2016

**Primary** **San Jose Elementary School**
Brgy. San Jose, Tanauan City, Batangas
S.Y 2011-2012

## PERSONAL INFORMATION

| | |
|---|---|
| **Date of Birth** | : January 09, 2000 |
| **Place of Birth** | : Mataas na Kahoy, Batangas |
| **Age** | : 22 yrs. Old |
| **Sex** | : Female |
| **Civil Status** | : Single |
| **Religion** | : Roman Catholic |

## ACHIEVEMENTS

- National Certificate II in Mechatronics Servicing
- Institute of Computer Engineers of the Philippines, Inc. Student Edition (ICpEP.se)

## CHARACTER REFERENCES

**Hon. Dory T. Cruz**

Barangay Captain

Brgy. San Jose, Tanauan City, Batangas

0945-512-7815

**TANAUAN CITY COLLEGE**

**School of Engineering**

**Hon. Generose M. Austria**

Sangguniang Kabataan Chairman

Brgy. San Jose, Tanauan City, Batangas

0906-431-7508

*I hereby certify that the above information is true and correct to the best of my knowledge and belief.*

**MILENA LYN DOLAR**

# TANAUAN CITY COLLEGE

**School of Engineering**

## JAYSON S. GARCIA

Brgy. Natatas Tanauan City Batangas

(+63) 9502790505

gjayson777@gmail.com

### OBJECTIVES

Looking for a challenging position in a reputable organization where I can put my technical, database, and management skills to good use while also learning about new and emerging trends in the computer industry.

### SKILLS

- Knowledgeable in MS Applications
- Basic knowledge about HTML CSS, VISUAL BASIC, VISUAL STUDIO, JAVASSCRIPT, PHP, C and C++ Language.

### ACTIVITIES/SEMINARS ATTENDED/WORKSHOPs

| | |
|---|---|
| Introduction to Arduino: Hardware, Software and Sensor Integration | November 9-10 2018<br>Tanauan City College<br>Trapiche 1, Tanauan City, Batangas |
| Research Conference on Digital Systems And it's Applications (RCoDSA) 2019 | May 18, 2019<br>HRMDO Old Tanauan City Hall |

Barangay 2, Tanauan City, Batangas

| | | |
|---|---|---|
| Getting Started with Cloud Essentials | | March 7, 2020 |
| | Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City Batangas | |
| Mobile Development Made Easy With Microsoft Power Apps | | March 7, 2020 |
| | Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City,Batangas | |
| "Discovering Big Data and Analytics" | | March 7, 2020 |
| | Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City, Batangas | |
| Ethical Hacking: A Webinar on Information Security | | November 3, 2020 |
| | Tanauan City College Barangay Trapiche 1, Tanauan City Batangas | |
| HKNL 2021 (Cyber security Conference) | | February 20-21, 2021 |
| | Sophie's Information Technology Services | |
| Cloud Computing | | April 17, 2021 |
| | Webinar, Tanauan City College | |
| Cybercrime Law in PH | | May 25, 2021 |
| | Webinar, Tanauan City College | |

# TANAUAN CITY COLLEGE

**School of Engineering**

CPE: Career Paths in Esports

August 08, 2021

Webinar, Tanauan City College

## EDUCATIONAL ATTAINMENT

**Tertiary**

**Bachelor of Science in Computer Engineering**
Tanauan City College
Brgy. Trapiche 1, Tanauan City, Batangas
2018-Present

**Secondary**

**Talisay High School**
Brgy. Ppoblacion 4, Talisay Batangas

S.Y 2011-2012

**Primary**

**Venancio Trenidad Sr. Momorial School** Brgy. Poblacion 3, Talisay Batangas, Batangas

S.Y 2007-2008

## PERSONAL INFORMATION

| | |
|---|---|
| **Date of Birth** | : April 07, 1996 |
| **Place of Birth** | : Talisay, Batangas |
| **Age** | : 26 yrs. Old |
| **Sex** | : Male |
| **Civil Status** | : Single |
| **Religion** | : Roman Catholic |

## ACHIEVEMENTS

- National Certificate II
- Institute of Computer Engineers of the Philippines, Inc. Student Edition (ICpEP.se)

## CHARACTER REFERENCES

**Reigna Rizza Ocampo, Lpt**

Teacher

Brgy. Natatas, Tanauan City, Batangas

Contact No. will be update soon.

**Hon. Generose M. Austria**

Sangguniang Kabataan Chairman

Brgy. San Jose, Tanauan City, Batangas

0906-431-7508

*I hereby certify that the above information is true and correct to the best of my knowledge and belief.*

**JAYSON S. GARCIA**

# TANAUAN CITY COLLEGE

**School of Engineering**


## HARISH A. GONZALES

Brgy. Bagumbayan Tanauan City Batangas

(+63) 965- 374 -0088

harishgonzales10@gmail.com


### OBJECTIVES

Seeking an entry-level position to begin my career in a high-level professional environment.

### SKILLS

- Encoder
- Basic knowledge about HTML CSS, VISUAL BASIC, VISUAL STUDIO, JAVASSCRIPT, PHP, C and C++ Language.
- Knowledgeable in Microsoft applications
- Good Communication skills
- Can work under pressure
- Dedicate, hardworking and flexible, and willing to assume responsibility
- Fast learner

### ACTIVITIES/SEMINARS ATTENDED/WORKSHOPs

| | |
|---|---|
| Introduction to Arduino: | November 9-10 2018 |
| Hardware, Software and | Tanauan City College |
| Sensor Integration | Trapiche 1, Tanauan City, Batangas |

| | |
|---|---|
| Research Conference on Digital Systems And it's Applications (RCoDSA) 2019 | May 18, 2019<br>HRMDO Old Tanauan City Hall<br>Barangay 2, Tanauan City, Batangas |
| Getting Started with Cloud Essentials | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City Batangas |
| Mobile Development Made Easy With Microsoft Power Apps | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City,Batangas |
| "Discovering Big Data and Analytics" | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City, Batangas |
| Ethical Hacking: A Webinar on Information Security | November 3, 2020<br>Tanauan City College<br>Barangay Trapiche 1, Tanauan City Batangas |
| HKNL 2021 (Cyber security Conference) | February 20-21, 2021<br>Sophie's Information Technology Services |
| Cloud Computing | April 17, 2021<br>Webinar, Tanauan City College |

Cybercrime Law in PH
May 25, 2021
Webinar, Tanauan City College

CPE: Career Paths in Esports
August 08, 2021
Webinar, Tanauan City College

## EDUCATIONAL ATTAINMENT

**Tertiary**

**Bachelor of Science in Computer Engineering**
Tanauan City College
Brgy. Trapiche 1, Tanauan City, Batangas
2018-Present

**Secondary**

**Senior High School**
Christian College of Tanauan
J.V Pagaspas St. Tanauan City, Batangas
S.Y 2017-2018

**Junior High School**
Tinurik National High School
Tinurik, Tanauan City, Batangas
S.Y 2015-2016

**Primary**

**Bagumbayan Elementary School**
Bagumbayan, Tanauan City, Batangas
S.Y 2011-2012

## PERSONAL INFORMATION

**Date of Birth** : July 10, 2000

**Place of Birth** : Tanauan Batangas

| | |
|---|---|
| **Age** | : 21 yrs. Old |
| **Sex** | : Male |
| **Civil Status** | : Single |
| **Religion** | : Roman Catholic |

## ACHIEVEMENTS

- Institute of Computer Engineers of the Philippines, Inc. Student Edition (ICpEP.se)

## CHARACTER REFERENCES

**Engr. Rhena Faith Abdon**

09653740088

Food Engineer

*I hereby certify that the above information is true and correct to the best of my knowledge and belief.*

**HARISH A. GONZALES**

**TANAUAN CITY COLLEGE**

**School of Engineering**

## EDZEL V. MANAOG

Brgy. Ambulong Tanauan City Batangas

09072612787

edzelmanaog10@gmail.com

### OBJECTIVES

To probably have found a responsible job that allows me to put my training and skills to good use while also contributing to the company's success.

### SKILLS

- Knowledgeable in MS Applications
- Appliance repairs and Laptop minor software and hardware debugging
- Can work with less supervision
- Can work under pressure
- Dedicate, hardworking and flexible, and willing to assume responsibility

### ACTIVITIES/SEMINARS ATTENDED/WORKSHOPs

| | |
|---|---|
| Introduction to Arduino: | November 9-10 2018 |
| Hardware, Software and | Tanauan City College |
| Sensor Integration | Trapiche 1, Tanauan City, Batangas |

| | |
|---|---|
| Research Conference on Digital Systems And it's Applications (RCoDSA) 2019 | May 18, 2019<br>HRMDO Old Tanauan City Hall<br>Barangay 2, Tanauan City, Batangas |
| Getting Started with Cloud Essentials | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City Batangas |
| Mobile Development Made Easy With Microsoft Power Apps | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City,Batangas |
| "Discovering Big Data and Analytics" | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City, Batangas |
| Ethical Hacking: A Webinar on Information Security | November 3, 2020<br>Tanauan City College<br>Barangay Trapiche 1, Tanauan City Batangas |
| HKNL 2021 (Cyber security Conference) | February 20-21, 2021<br>Sophie's Information Technology Services |
| Cloud Computing | April 17, 2021<br>Webinar, Tanauan City College |

Cybercrime Law in PH May 25, 2021

Webinar, Tanauan City College

CPE: Career Paths in Esports August 08, 2021

Webinar, Tanauan City College

## EDUCATIONAL ATTAINMENT

**Tertiary** **Bachelor of Science in Computer Engineering**
Tanauan City College
Brgy. Trapiche 1, Tanauan City, Batangas
2018-Present

**Secondary** **Senior High School**
**Tanauan School of Fisheries**
Brgy. Ambulong, Tanauan City, Batangas
S.Y 2017-2018

**Junior High School**
**Tanauan School of Fisheries**
Brgy. Ambulong, Tanauan City, Batangas
S.Y 2015-2016

**Primary** **Guinayangan Elementary School**
S.Y 2011-2012

## PERSONAL INFORMATION

**Date of Birth** : November 10, 1999

**Place of Birth** : Guinayangan Quezon

**Age** : 22 yrs. Old

**Sex** : Male

**Civil Status** : Single

**Religion** : Roman Catholic

## ACHIEVEMENTS

- National Certificate II in Aquaculture
- Institute of Computer Engineers of the Philippines, Inc. Student Edition (ICpEP.se)
- 

## CHARACTER REFERENCES

**Loida Malabanan**

Barangay Councilor

Brgy. Ambulong, Tanauan City Batangas

Contact No. will be update soon.

*I hereby certify that the above information is true and correct to the best of my knowledge and belief.*

**EDZEL V. MANAOG**

# TANAUAN CITY COLLEGE

**School of Engineering**


## MONALISA C. MENDOZA

Brgy. 3 Tanauan City Batangas
(+63) 946- 447-3034
mendozamona072@gmail.com


## OBJECTIVES

To expand my knowledge and lead myself toward reaching corporate vision and fulfilment to perform well in work field, willing to undergo training to further hasten my skills, to professionalism and have a good working relationship.

## WORK EXPERIENCE

On-the-Job Training (Encoder) — Municipality of Malvar
April 2018

## SKILLS

- Interpersonal Skills (Listening and manners)
- Communication Skills (English and Tagalog)
- Computer Skills (Microsoft office application including word and PowerPoint)
- Basic knowledge about HTML CSS, VISUAL BASIC, VISUAL STUDIO, JAVASSCRIPT, PHP, C and C++ Language

## ACTIVITIES/SEMINARS ATTENDED/WORKSHOPs

Introduction to Arduino: — November 9-10 2018
Hardware, Software and — Tanauan City College

| | |
|---|---|
| Sensor Integration | Trapiche 1, Tanauan City, Batangas |
| Research Conference on Digital Systems And it's Applications (RCoDSA) 2019 | May 18, 2019<br>HRMDO Old Tanauan City Hall<br>Barangay 2, Tanauan City, Batangas |
| Getting Started with Cloud Essentials | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City Batangas |
| Mobile Development Made Easy With Microsoft Power Apps | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City,Batangas |
| "Discovering Big Data and Analytics" | March 7, 2020<br>Mayor's Theater Room, New Tanauan City Hall, Natatas, Tanauan City, Batangas |
| Ethical Hacking: A Webinar on Information Security | November 3, 2020<br>Tanauan City College<br>Barangay Trapiche 1, Tanauan City Batangas |
| HKNL 2021 (Cyber security Conference) | February 20-21, 2021<br>Sophie's Information Technology Services |
| Cloud Computing | April 17, 2021<br>Webinar, Tanauan City College |

Cybercrime Law in PH — May 25, 2021
Webinar, Tanauan City College

CPE: Career Paths in Esports — August 08, 2021
Webinar, Tanauan City College

## EDUCATIONAL ATTAINMENT

**Tertiary**

**Bachelor of Science in Computer Engineering**
Tanauan City College
Brgy. Trapiche 1, Tanauan City, Batangas
2018-Present

**Secondary**

**Senior High School**
**Christian College of Tanauan**
Brgy. Pagaspas, Tanauan City, Batangas
S.Y 2017-2018

**Junior High School**
**Bernardo Lirio Memorial National High School**
Brgy. Darasa, Tanauan City, Batangas
S.Y 2015-2016

**Primary**

**Tanauan South School**
Brgy. 1, Tanauan City, Batangas
S.Y 2011-2012

## PERSONAL INFORMATION

# TANAUAN CITY COLLEGE

**School of Engineering**

| | |
|---|---|
| **Date of Birth** | : October 29, 1999 |
| **Place of Birth** | : Tanauan City Batangas |
| **Age** | : 22 yrs. Old |
| **Sex** | : Female |
| **Civil Status** | : Single |

## ACHIEVEMENTS

- Institute of Computer Engineers of the Philippines, Inc. Student Edition (ICpEP.se)

## CHARACTER REFERENCES

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0947-569-9346

**Dennis F. Collano**
Government City of Tanauan
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0907-601-2191

*I hereby certify that the above information is true and correct to the best of my knowledge and belief.*

**MONALISA C. MENDOZA**