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Development of Garbage Collection Lake Bin and Water Quality Checker with Blynk Application

Norallisya Sazlin Irwan[1], Dalila Misman[1*]

[1]Department of Electronic Engineering Technology, Faculty of Engineering Technology,Universiti Tun Hussein Onn Malaysia, 86400 Pagoh, Johor, Malaysia

*Corresponding Author Designation

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Abstract: The goal of this project is to develop a prototype that will clean up the lake without using the energy of the people. By using this product, it makes lake will clean without any garbage on the surface water. Both software and hardware are used in this product. This project also is to develop a robot that automatically can control the movement of the boat at same time it will scoop garbage on surface of a lake. Furthermore, Node MCU is used in this project to create a real time water quality in lakes with IoT application. The Wi-Fi microcontroller ESP 8266 was used. It acts as the main processing component for the project. It can only be operated by a smartphone and is remote-controllable from a certain range detection (1 meter). It will be using temperature and humidity sensor, turbidity sensor and TDS sensor to check the water quality. The project's IoT application will make monitoring water quality easier by allowing the water condition to be displayed remotely. This system will include smartphone as a platform to connect each other

Keywords: Node MCU, TDS sensor, Humidity sensor, IoT application, surface water.

1. Introduction

Water pollution is a severe issue in Malaysia, threatening the sustainability of water resources. Furthermore, the impact on plants and living organisms will be more important as well as people health and the country economy. It significantly affects the water availability since the expense of cleaning contaminated waters is too expensive nowadays, and in certain cases polluted waters are not treatable for consumption. Unfortunately, due to river pollution, the enormous amount of water resources available in the watershed does not provide adequate supply to all users [1]. The usage of this sort of water is widespread in agriculture. According to estimates, there is more than 50 nations from throughout the world and by covering an area of 20 million hectares are treated with filthy or partially treated contaminated water [2]. The main goal of this project is to develop and build a machine that is capable of automatically detect garbage on the water surface by a sensor.

*Corresponding author: mdalila@uthm.edu.my

2. Materials and Methods

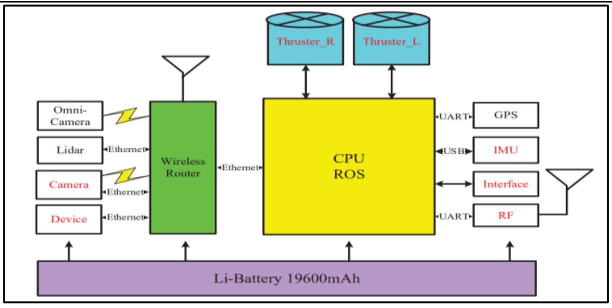
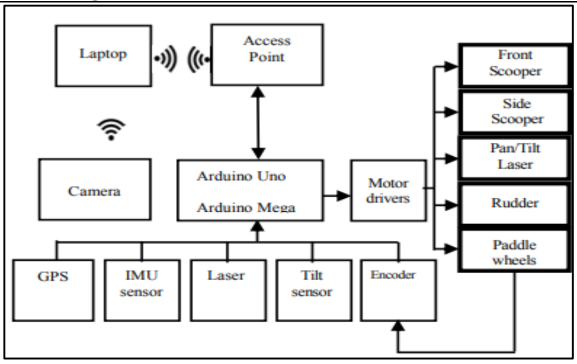
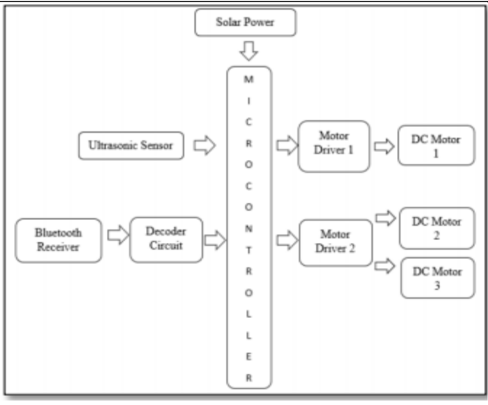
2.1 Literature Review

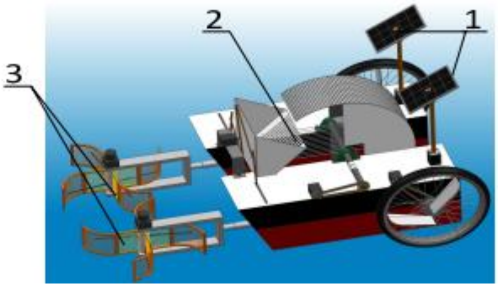
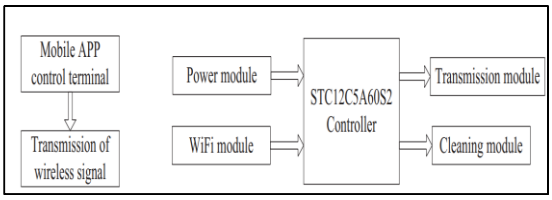
This part present about the controller and operating system of lake bin for cleaning surface water with mechanism of this part of the project presented in the previous works is discussed accordingly, along with some comparative analysis concerning the features of each work.

2.2 Controller and operating system.

Based on the Table 1 shows of the controller and operating system used from the previous project. From the table will have different title based on previous project. The table also shows diagram which are design system, physical appearance to show detail about controller and operating system used. There is different type of controlled used to collect the garbage. From the table the readers can compare a different theme.

Table 1: Comparison of controller unit from previous project

No	Title	Theme	Diagram
1.	Design of Low-cost Unmanned Surface Vessel for Water Surface Cleaning [3].	-CPU ROS -GPS -Inertial measurement unit (IMU) -RF	 Figure 2.23: Control structure of USV [3]
2.	A Floating Waste Scooper Robot On Water Surface [4].	-Arduino -Scooper	 Figure 2.24: Electronic system design [4]
3.	Design and Developmen t of River Cleaning Robot Using IoT Technology [5].	-Arduino -DC motor	 Figure 2.25: The proposed block diagram [5]

4.	The Seabin project [6].	-Bin -Water pump	 Figure 2.26: The Seabin [6].
5.	Amphibious clean-up robot [7].	-Rotary gather and collection system -Motor -Sun Automation Tracking system	 Figure 2.26: Main structure of the schematic diagram [7]. 1. Automatic tracking system. 2. The system of rotation aggregation system. 3. Rotary collection system.
6.	Miniature Water Surface Garbage Cleaning Robot [8].	-STC12C5A60S2	 Figure 2.27: System structure of the miniature water surface garbage cleaning robot [8]

2.2 Mechanism of the project

Based on Table 2 shows a sensor that are used from previous project. There are some previous projects used a sensor to detect an obstacle. They use a sensor to prove their project can attain objective and effectiveness.

Table 2: Comparison of the sensor from previous project

No.	Title	Sensor Used	Function
1.	A robust Obstacle Detection Method for Robotic Vacuum Cleaners [9].	- Ultrasonic Sensor - Infrared sensor	- Detecting obstacle. - Ultrasonic sensor has difficulty when measuring the accurate location of the obstacle, and an IR sensor has a narrow search range [9].
2.	Design and Hydrodynamic Modelling of a Lake Surface Cleaning Robot [10].	- Ultrasonic sensors - Sensors for visual	- Sensors for obstacle avoidance. - When tele operates the robots, it is necessary to view the surrounding environment of the robot.

			- A vision system is developed that helps operates to view the surrounding environment [10].
3.	Development of Water trash collector [11].	- Water level sensor - Ultrasonic sensor	- Will receive a instruction of water level data and will give a command to move the conveyor.
4.	River cleaning robot using IoT technology [12].	- Waterproof ultrasonic sensor - PH sensor	- Detecting obstacle. - Through a robot, the PH level of the water in the river will be monitored [12].
5.	IWSCR: An Intelligent Water Surface Cleaner Robot for Collecting Floating Garbage [13].	- Binocular vision sensor	- The robot glides over the water's surface in following a present course while utilising its vision module to find trash. [13].

2.2 Flowchart

A flowchart must be created to assist and direct the planned project in achieving its goal. This guarantees that the process or step used to create the system software is created in accordance with the specifications necessary for the system. Figure 1 and 2 below shows the diagram's overall flow.

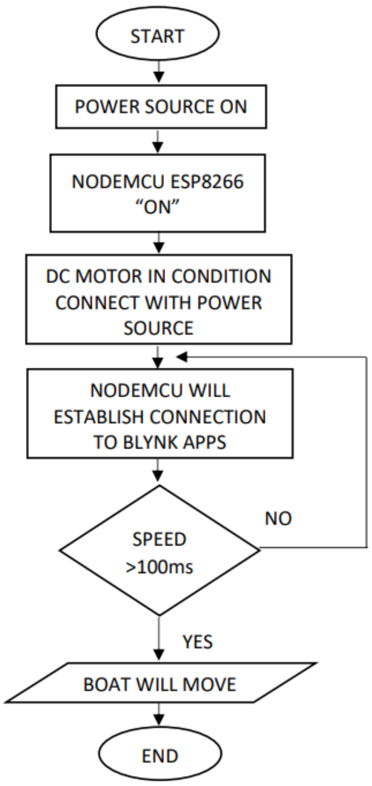


Figure 1: Flowchart for Lake bin project

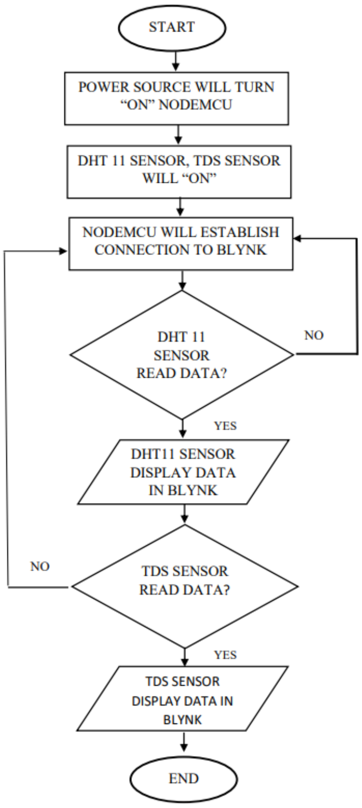


Figure 2: Flowchart of water quality system monitoring

2.3 Block diagram

This project presents and demonstrates the structure of the hardware used. A block diagram is used to visually represent the main components and functions of the system. The circuit design is shown in figures 3 and 4. The power source supplies power to the Arduino, which then sends signals to the DC motor and ultrasonic sensor to start collecting garbage on the surface water. The water quality monitoring system takes in water from lakes, and the control circuit, consisting of the Arduino and sensors, begins to operate. The actuators collect data from the control circuit and send it to the user via the Blynk application to indicate the water's quality. The water then flows out through the water outlet.

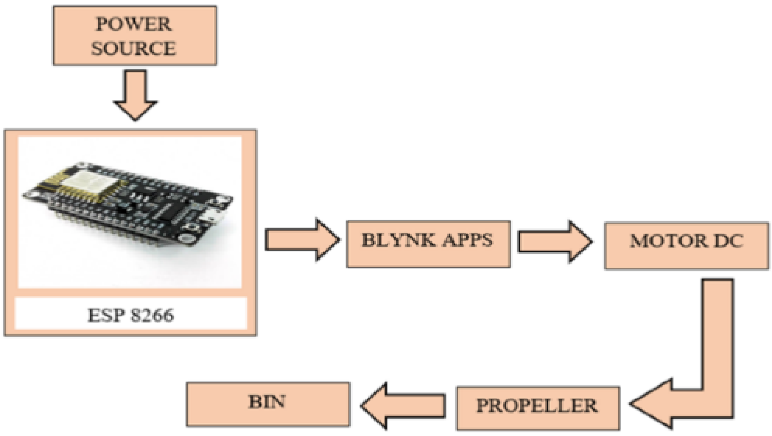


Figure 3: Block diagram Lake bin project

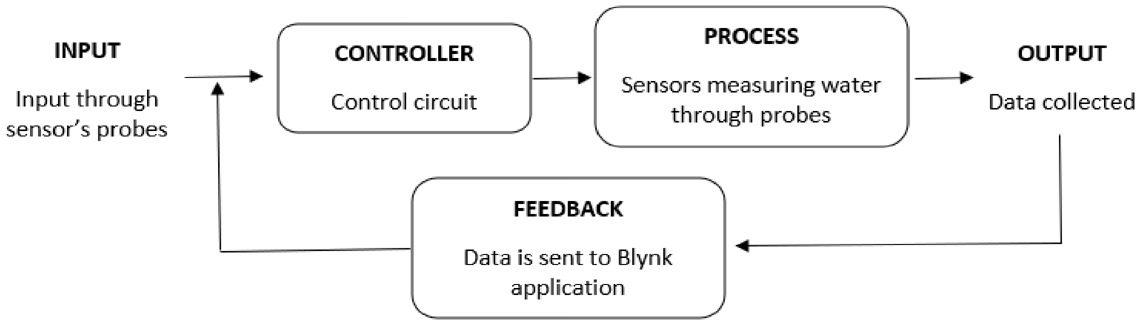


Figure 4: Block diagram of the water quality monitoring system

2.4 Circuit diagram for connection electronic circuit

Figure 5 and 6 shows the construction of the development of garbage collection lake bin and water quality checker with IoT application by using Proteus software. The nodeMCU ESP8266 is the brain of the system which is used as a circuit controller that controls other components. The components controlled by nodeMCU ESP8266 the are dc motor, motor drive (L298N). All connections between the component and the Arduino are complete.

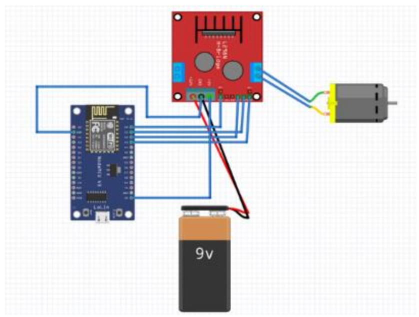


Figure 5: Circuit diagram for garbage collection Bin

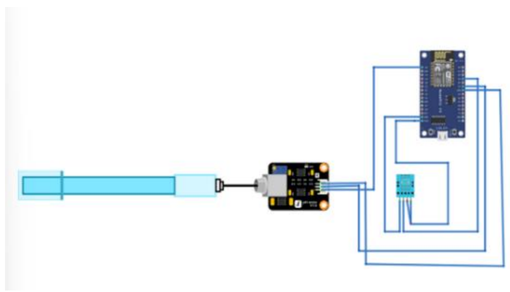


Figure 6: Circuit diagram for water quality checker

3. Results and Discussion

Based on figure 7 show the prototype for this project which is Development of Garbage Collection Lake Bin and Water Quality Checker with Blynk Application. All of the component were placed inside the box on top of the Lake Bin. Polystyrene also is placed for this prototype to make sure this boat will float on the water. A bin is placed under the box of component to scope the garbage are floating on water. TDS sensor and Humidity sensor are placed on the boat. TDS sensor was placed at the bin to check the water quality of lake and Humidity sensor are placed beside the box of the component.

Figure 7: The specific design for this project

3.1 Result

3.1.1 Blynk application for controller boat

In this phase, the controller boat system using Internet of Things such as Blynk apps was developed. It will use the ESP 8266 as the Wi-Fi module that connected to the DC motor. The Blynk application is interfaced with nodeMCU esp8266 to monitor the controller for the boat to pick up garbage based on the motor and propeller. The connection between of the ESP 8266, motor drive and DC motor are shows in Figure 8.

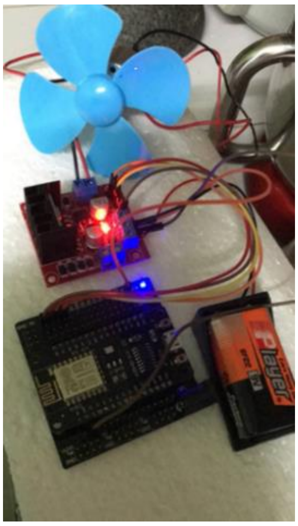


Figure 8: The connection between of the ESP 8266, motor drive and DC motor

3.1.2 Blynk application for water quality checker

During this stage, a monitoring system for monitoring the quality of the water was developed utilizing the Internet of Things and apps like Blynk. The TDS sensor is connected to the ESP 8266 Wi-Fi module using a DHT11 sensor. The water quality monitoring system is checked via an interface between the Blynk application and the nodeMCU esp8266. Before we can use the electronic component, there are a number of actions to take. Figure 9 shows the connection between the ESP 8266, TDS sensor, and DHT11 sensor.

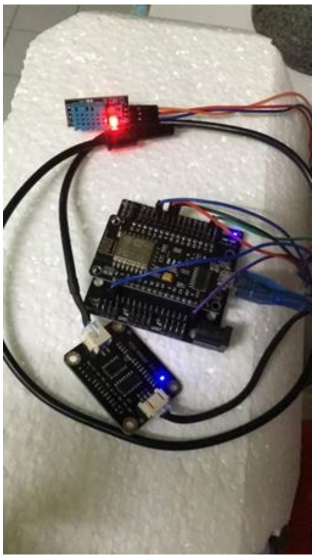


Figure 9: The connection between ESP8266 with TDS sensor and DHT11 sensor

3.1.3 Temperature (°C), humidity (%) and time (min).

Thirteen minutes of indoor environment temperature and humidity. The sensor is then tested for the following thirteen minutes around the Edu Hub Pagoh Lake. Based on table 3, the temperature and humidity are recorded for each trial in the room and lake environments. The sensor was used to measure the temperature and humidity. Temperature was expressed in degrees Celsius (°C), while humidity was expressed as a percentage (%). Thirteen minutes were devoted to measuring the temperature and humidity.

Table 3: Temperature, humidity and time

ENVIRONMENT	ROOM		LAKE	
TIME (MIN)	Temp. (°C)	Humidity (%).	Temp. (°C)	Humidity (%).
1	25	67	28	75
2	25	67	28	76
3	26	68	27	75
4	25	66	29	81
5	26	68	28	77
6	27	69	28	76
7	27	69	28	76
8	27	70	29	78
9	26	68	28	78
10	26	68	28	79
11	25	66	29	81
12	27	68	29	83
13	27	70	29	83

Based on the result that have been recorded in table 3, it meets the specification based on National Lake Water Quality Criteria and Standards (NLWQS) information is comparable to that found in the international literature on lake water quality standards. Additionally, the data in (NLWQS) is pertinent to the situation current in Malaysia based on the surrounding humidity and temperature(10).

The temperature vs time graph for room and a lake surrounding are shown in Figure 10. As determined by the analysis, the temperature in the room environment is reasonable given that it is typically around 26-27°C. Due to the sensor's exposure to the outdoors while in the lake area, the temperature is rather high. The specific source of this situation is that the sensor is exposed to the sun in a lake environment, which may be what increased the temperature.

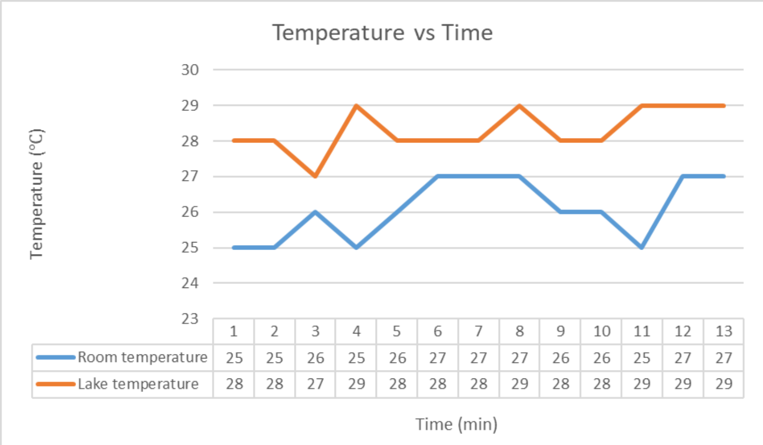


Figure 10: Temperature vs Time

The humidity vs time graph for room and a lake surrounding are shown in Figure 11. According to the analysis, a room's humidity level is lower than a lake. This is because the lake condensation of water vapors made the atmosphere more humid.

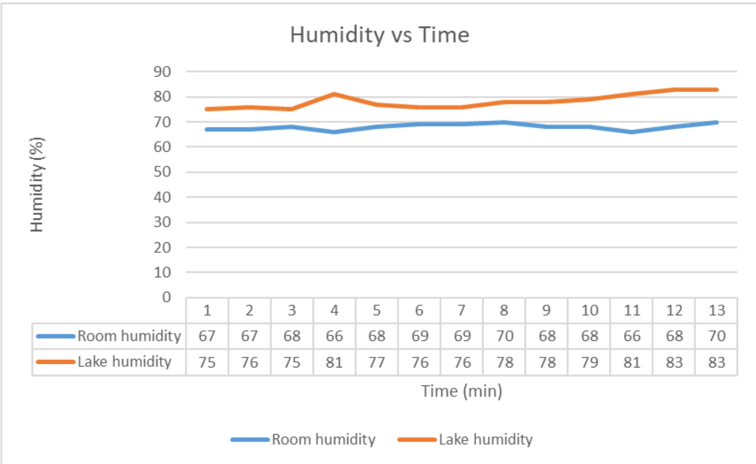


Figure 11: Humidity vs Time

3.1.4 TDS value (ppm) and EC (mS)

TDS stands for Total Dissolved Solids which are both organic and inorganic compounds suspended in water. It is typically stated as mg/L or ppm. TDS is closely related to water quality, with purer water having lower TDS values. Tap water can range from 20-300 TDS while reverse osmosis cleaned water has TDS between 0-10. Table 2 shows TDS and EC values for different liquid samples from Edu Hub Pagoh Lake, mineral water, water pipes and milk. Table 2: TDS value (ppm) and EC value (mS) based on liquid sample.

Table 2: TDS value (ppm) and EC value (mS) based on liquid sample

Sample of liquid	TDS value (ppm)	EC value (mS)
Edu Hub Pagoh lake	30	1.00
Mineral Water	30	0.14
Water pipes	30	0.21
Milk	30	0.70

Based on table 2 the TDS value are taken when the sensor measured the value. Every sample have a same value but different EC value which is pure water itself is a bad conductor, which is why an EC meter will read 0.0 in rainwater, reverse osmosis water or de-mineralized water. In contrast, salty seawater is a much better conductor.

3.15 Garbage collection efficiency

The efficiency of this boat shown in Figure 12 which is collecting garbage before and after of condition on surface water is particularly high due to its ability to gather garbage that is floating on the surface of the water, as well as its capability to clean the area surrounding the lake. The design of this boat enables it to effectively target floating garbage while also a cleaner environment in the lake ecosystem. The combination of these capabilities makes this boat a powerful tool in maintaining a clean and healthy lake. Maximum load it able to carry for garbage is limit for 2 kilograms.

Figure 12: Efficiency of collecting garbage by the boat

Additionally, this boat also equipped with a microprocessor which is NodeMCU esp8266 and technologies of motor DC it can control the boat by using smartphone. It will easier the boat can go to the that enables it to clean and maintain the surrounding area of the lake.

3.16 The speed of the boat and time (seconds) to reach target point.

The speed of the boat is controlled by a motor drive that can be set to a range of 0-255 RPM in a Blynk application. The DC motor that powers the boat's movement is regulated by this motor drive. The data analysis will measure the travel time to a target point based on the speed set by the motor drive. The goal is to understand the effect of the boat's speed on its travel time to a specific destination. Table 4.3 shows the boat speed and time taken to reach the target point, as shown in Figure 13.

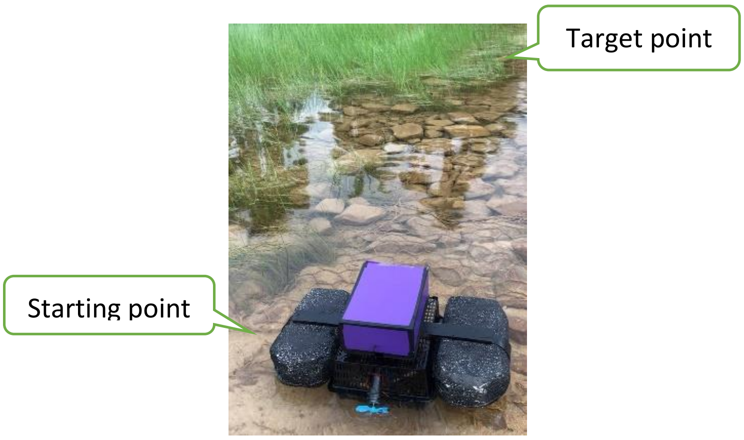


Figure 13: Starting point with target point

Table 4.3: The speed of the boat and time (seconds) to reach target point

Speed of the boat (rpm)	Time (sec)
100	176 seconds
110	167 seconds
120	155 seconds
130	146 seconds
140	133 seconds
150	124 seconds
160	111 seconds
170	102 seconds
180	91 seconds
190	79 seconds

The graph in Figure 14 shows the relationship between speed and time for a boat. As the speed increases, the time it takes to travel a certain distance decrease, as seen on the graph. This supports the conclusion that as the speed gets higher, the time decreases. The graph shows that as speed increases from 100 to 190, time decreases consistently. This can be explained by the mathematical relationship between speed, distance, and time.

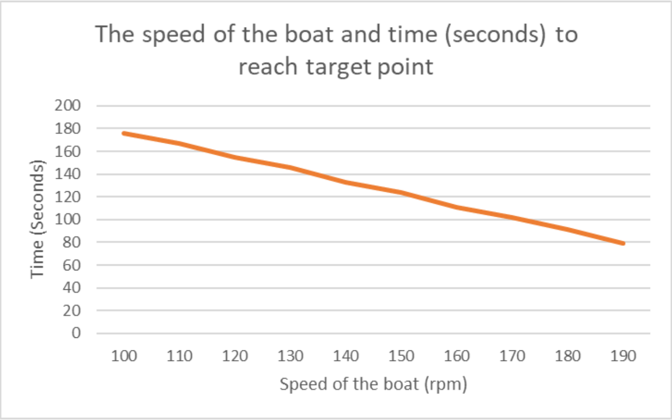


Figure 14: The speed of the boat and time (seconds) to reach target point.

4.0 Conclusion

This project has achieved its current objectives. Based on the experiment, Lakebin able to scope any floating garbage on the water surface. The DC motor could be have controlled by Blynk apps. Besides that, the real time water quality monitoring with IOT application has been developed. The system was driven by using the nodeMCU ESP 8266 programmed by Arduino IDE C language. The system consists of two main sensors which are TDS sensor and DHT11 sensor. In conclusion, with this project, development of garbage collection lake bin and water quality checker with Blynk application can be control the boat by suing Blynk application and water quality monitoring is made easy as now user can check through their own mobile phone using the Blynk application.

Acknowledgement

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