International Journal of Synergy in Engineering and Technology Vol.5 No.2 (2024) 53-61

International Journal of Synergy in Engineering and Technology IJSET

Journal homepage: https://tatiuc.edu.my/ijset/index.php/ijset/ e-ISSN: 2735-0622

Wireless Control Buoy Boat for Water Rescue Operation

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KEYWORDS

Wireless control buoy boat
WCB
Rescue
Water rescue technology
Boat
Buoy

ABSTRACT

Water rescue operations are essential for saving lives during emergencies, but they often pose significant risks to rescue personnel. To enhance the efficiency and safety of such operations, this research proposes the development of a Wireless Control Buoy boat (WCB) system. The WCB is an autonomous watercraft designed to perform water rescue missions with remote control capabilities. The proposed Wireless Control Buoy boat system shows promise in improving the effectiveness and safety of water rescue operations. By integrating cutting-edge technologies, it has the potential to save lives while reducing the risks faced by rescue personnel. Further development and testing will be required to optimize the WCB's performance, but the research provides a foundation for advancing the State-of-the art in water rescue technology.

Received 27 June 2024; Revised 06 August 2024; Accepted 12 September 2024; Published 01 October 2024.
DOI: https://doi.xxxxx.xx

1.0 INTRODUCTION

Water rescue operations are critical for saving lives during emergencies such as floods, drowning incidents, and maritime accidents. However, these missions often involve perilous conditions and put rescue personnel at risk. To address these challenges and improve the effectiveness of water rescue operations, the concept of a Wireless Control Buoy boat (WCB) system has been developed[1]–[5].

In 2015, as per a report by the World Wellbeing Organization, around three hundred and sixty thousand people misplaced their lives due to suffocating, stamping it as a noteworthy open wellbeing concern all-inclusive[6], [7]. Suffocating stands as the third driving cause of inadvertent damage passing around the world, with moo and middle-income nations confronting increased dangers; in this manner, putting India within the high-risk category for suffocating occurrences. In this way, tending to this societal issue holds most extreme significance. The essential scenarios where drownings commonly happen incorporate: (a) shorelines with tall occurrences of suffocating; (b) open ocean ranges, characterized by perilous conditions complicating protect operations; and (c) flooding circumstances, where getting to people gets to be challenging, frequently inside limited spaces[8], [9].

A standardized convention for reacting to suffocating occurrences is the All-inclusive Suffocating Chain of Survival, comprising five pivotal joins: Avoidance of suffocating, Acknowledgment of trouble signals, Arrangement of buoyancy gadgets, Evacuation from water, and Arrangement of essential care as required[10]. Within the space of Look and Protect mechanical autonomy, 'Search' relates to exercises pointed at finding survivors, whereas 'Rescue' includes removing them. Water-based look and protect operations include scenarios such as protecting surge casualties or people caught in quick water streams, or reacting to mischances where vehicles have submerged in water bodies [11]–[13]. For surface water operations, unmanned surface vehicles rise as ideal arrangements owing to their get to Worldwide Situating Framework (GPS) and other localization procedures, strong communication capabilities, considerable payload capacity, and capacity to utilize vitality collecting for delayed missions [14], [15]. Common water protect hardware incorporates protect tubes, protect sheets, Shepherd's crook, ring buoy, life jackets. Lifebuoys or ring buoys, which are torus-shaped, can be situated around a victim's abdomen or beneath their armpits to encourage buoyancy. Ordinarily developed from Tall Thickness Polyethylene (HDPE) shells filled with thick froth and brightly colored orange for upgraded deceivability, they serve as individual buoyancy gadgets conveyed by lifeguard administrations amid water protect operations.

The project aims to design and implement an autonomous watercraft that can carry out water rescue missions with remote control capabilities. The WCB will be equipped with high-speed motor, wireless remote control, and gyro sensor to ensure efficient operation in diverse and hazardous water environments.

The Wireless Control Buoy boat (WCB) aims to improve water rescue operations by introducing an autonomous system that enhances efficiency while prioritizing the safety of both victims and rescue personnel. With the successful implementation of this project, water rescue missions can become more effective, saving more lives and reducing the risks involved in such critical operations.

2.0 METHODOLOGY

2.1 Project Block Diagram

The block diagram is diagram that have three elements that is input, process and output. The contain of block diagram is the material that are using from the project. The project of remote-control buoy boat will connect to the 24V DC high speed motor and connect to the ESP 8266. Then, the high-speed motor will produce energy to control the buoy boat. Figure 2 is block diagram for buoy boat.

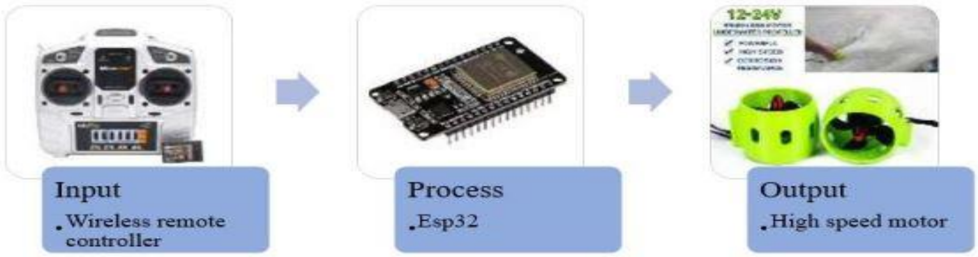


Figure 2: Block diagram of wireless control buoy boat

2.2 Project Design

This project Figure 3 is development for Wireless Remote Control Buoy Boat for Water Rescue Operation. Refer to figure below, The U-shaped design provides exceptional stability on the water, distributing weight evenly and ensuring steady performance even in varying water conditions. This stability is particularly crucial for buoy boats engaged in tasks like data collection or monitoring. The increased buoyancy of the U-shaped hull allows for the efficient carrying of heavier loads, beneficial for deploying or servicing buoys with substantial weight or equipment.

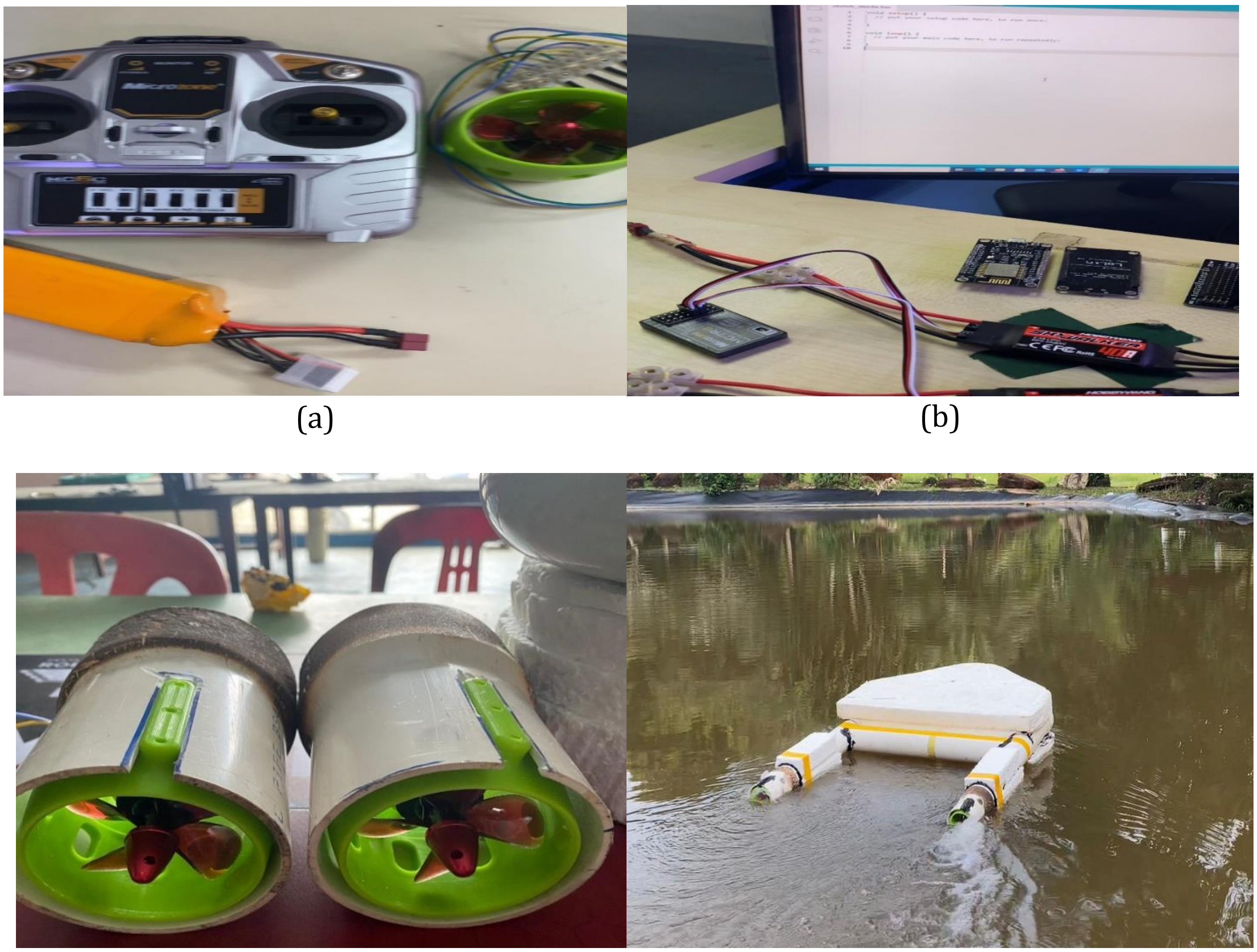
(c)

Figure 3: (a) Design the U shape (b) Design Styrofoam to make a support of the buoy boat (c) The final design of the project

2.3 Project Setup

In the initial step, it is imperative to configure the remote-control system in order to effectively regulate and adjust the speed of the throttle. This involves the meticulous process of establishing the necessary parameters and settings on the remote control. Program the ESP8266 and gyro sensor using the Arduino IDE software, begin by initiating the Arduino IDE on computer. Upload the compiled code onto the ESP8266, facilitating the integration and functional communication between the ESP8266 and the gyro sensor in the intended application. Cut the pipe at the marked point using a suitable tool, ensuring precision. This allows for the seamless insertion of the high-speed motor, facilitating its installation securely.

Attach and arrange all components inside the pipe to prevent contact with water. Ensure that the placement is secure and organized to avoid any potential damage or malfunction. This process is to protect the components from water exposure. Test the buoy boat on water to determine whether it sinks or floats. Place the boat in the water and observe its buoyancy to assess its performance. This test is essential for evaluating the boat's ability to stay afloat and ensuring it aligns with the intended design and functionality. Figure 4 show the project setup for buoy boat.



(a) (b) (c) (d)

Figure 4: (a) Remote Control & Brushless Motor (b) ESP Program & Gyro (c) High-Speed Motor (d) The Buoy Boat Testing

2.4 Project Flow Chart

This flowchart Figure 5 describing the operation of a remote-controlled buoy boat designed to manage a 24V DC High-Speed Motor. Initially, the motor is powered by a 22.2V Li-Po Battery, while the remote control receives wireless signals for regulating the motor's forward, right, and left movements. Subsequently, a gyro sensor assesses data stability and transmits the collected data to Thinger IO.

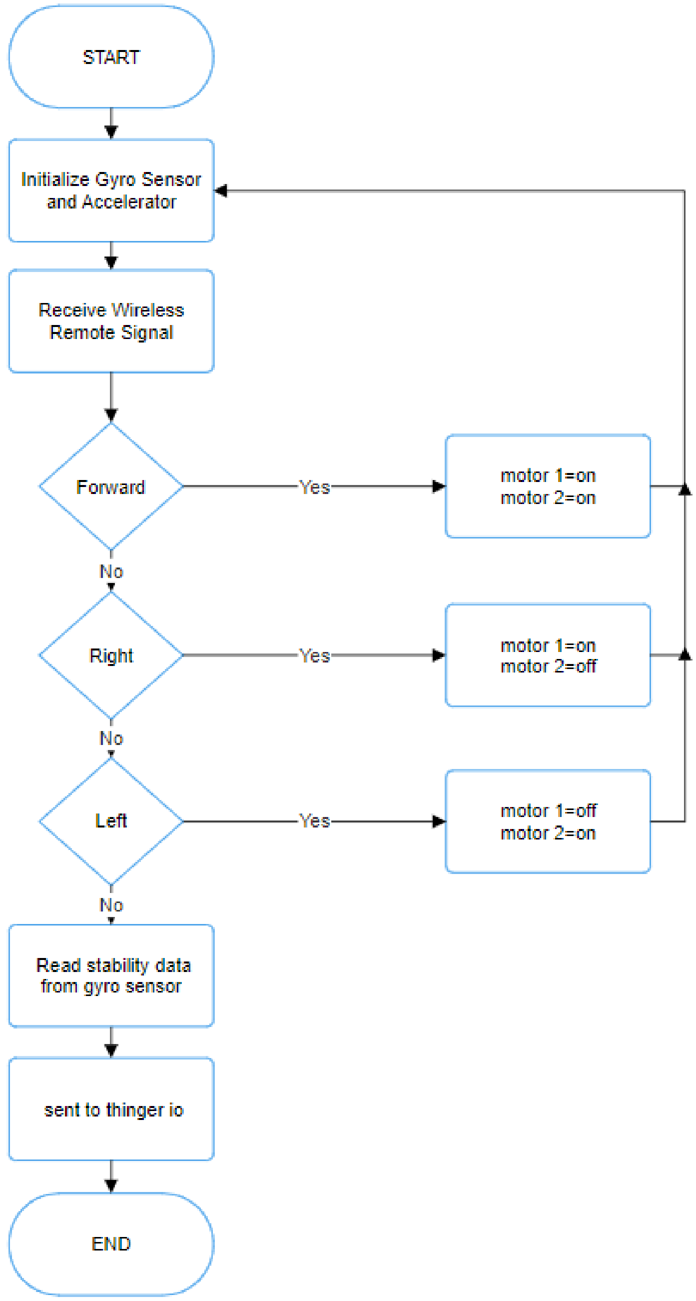


Figure 5: Flow Chart

3.0 RESULTS AND DISCUSSION

3.1 IoT Platform Development for Wireless Control Buoy Boat

Thinger.io provides an easy to use and extremely scalable virtual storage system, that allows to store long term device data from device output resources. This information can be used to be plotted in dashboards, or can be exported in different formats for offline processing or third-party Data Analysis process. Figure 6 show the interface of Thinger.io platform of IoT

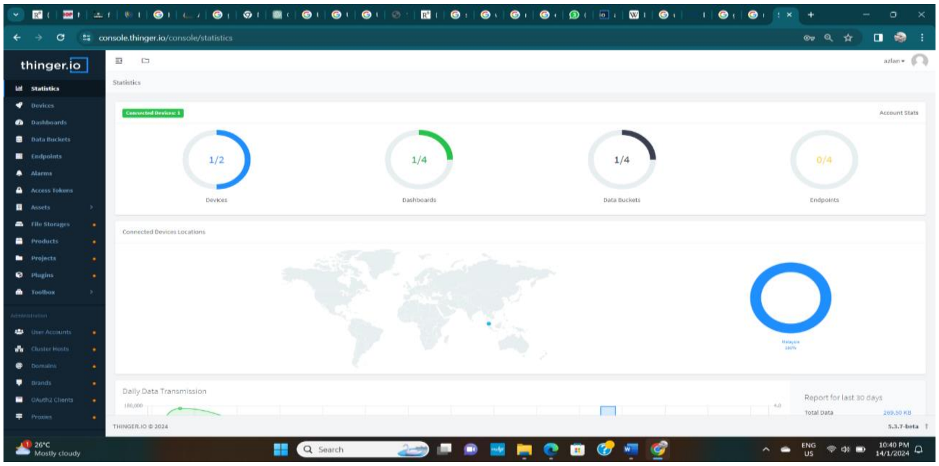


Figure 6: Interface Thinger IO Platform

Figure 7 below shows the connection status between the control box (ESP 8266 Wi-Fi Module) and the Thinger.io control. When the status is connected between the ESP 8266 WiFi Module and Thinger.io by using any Wi-Fi connection with, it will show green, while if not connected it will show red.

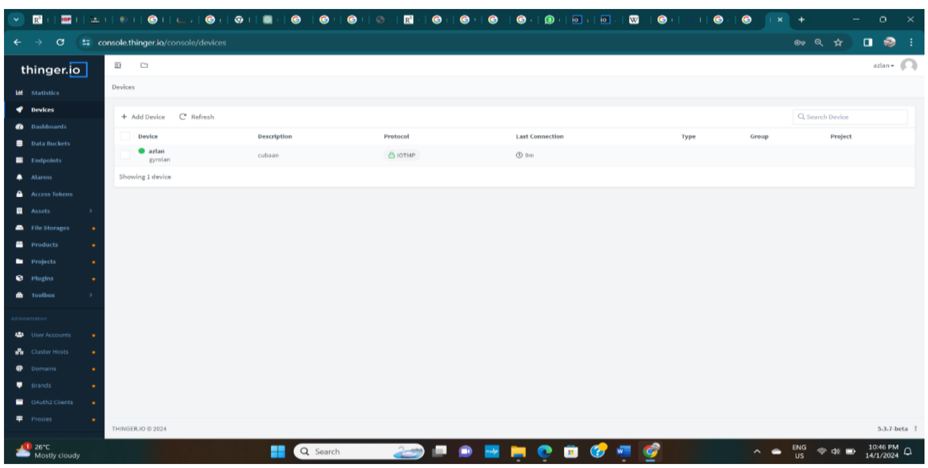


Figure 7: Status Thinger IO Platform

Figure 8 below shows the IoT display data and graph of accelerator and gyro when the buoy boat moves. The X-axis typically represents the horizontal axis, the Y-axis is the vertical axis and the Z-axis is the axis pointing out of the sensor, perpendicular to both the X and Y axes.

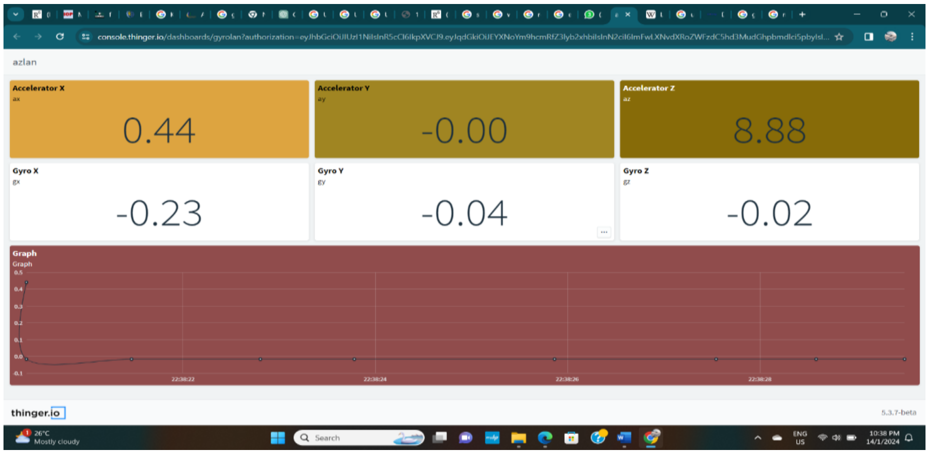


Figure 8: Data Display of Gyro & Accelerator of buoy boat

3.2 Data Collection

The Table 1 shows the relationship between weight and duration appears to follow a pattern. As the weight increases, the corresponding duration also tends to increase. Specifically, when a weight of 2kg is applied, the result is a duration of 32 seconds. With an increase in weight to 4kg, the duration extends to 36 seconds. Subsequent increments in weight, such as 6kg, 8kg, and 10kg, are associated with increasing durations of 38s, 40s, and 42s, respectively. The pattern continues with a weight of 14kg resulting in 47 seconds, and a weight of 18kg resulting in 51 seconds. This suggests a positive correlation between the applied weight and the time taken, indicating that as the weight increases, so does the time require for some process or measurement.

Table 1: The Table of Weight (kg) Versus Time (sec)

No	Distance	Weight (Kg)	Time (sec)
1	7 meter	2	32
2	7 meter	4	36
3	7 meter	6	28
4	7 meter	8	40
5	7 meter	10	42
6	7 meter	14	47
7	7 meter	18	51

4.0 CONCLUSIONS

This project aimed to analyse and collect the data about maximum distance towards victim, the capabilities of Buoy boat rescue based on the victim's weight and the speed of rescue operation based on signal frequency time response. Theoretically, this project is successfully developed and can be very useful in order to save victims compared to conventional buoy boat. Furthermore, the buoy boat is able to cope with the victim's weight and reach towards them with high-speed buoy boat in a maximum distance.

Author Contribution

Muhammad Ameen B Wahab and Muhamad Azlan Bin Azman: Conceptualization, methodology, investigation, visualisation, writing and editing. Kharudin Ali: Investigation, supervision, writing, IoT and editing. Nazry Abd Rahman: Hardware development and data analysis

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

In preparation of my final year project, I had to take the help and guidance of some respected persons, who deserve my deepest gratitude. As the completion of this assignment gave me much pleasure, I would like to show my gratitude Ts. Dr Kharudin bin Ali, supervisor at University College TATI for giving me good guidelines to all those who have directly and indirectly guided me in writing this report. in addition, a thank you to En. Nazry bin Abdul Rahman, who introduced me to the methodology of work. I also thank the University College TATI for consent to include copyrighted pictured as part of my research.

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