UNIVERSITY OF BOHOL
College of Engineering, Technology, Architecture, and Fine Arts
DR. CECILIO PUTONG ST., TAGBILARAN CITY

Second Semester

SUMOBOT & HACKYBOT

In Partial Fulfillment of the Requirements for CPEP 327 course

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BSCpE-3

May 2025

TABLE OF CONTENTS

FINALS

INTRODUCTION

In the modern era, where technology is progressing at an extraordinary rate, robotics has become a fundamental part of our daily lives. Robotics appears in many forms, from industrial machines to medical robots, and it has gained significant popularity in sports as well. A notable example is Sumobot, a small robot created to compete in a sumo-style arena, which is not only an entertaining and thrilling activity but also offers many advantages. It promotes the development of critical thinking, problem-solving, technical abilities, and teamwork. Participants must design and construct robots, encouraging creativity and cooperation. Furthermore, Sumobot serves as a fantastic introduction to robotics in an enjoyable and captivating manner, potentially motivating individuals to explore careers in this rapidly expanding field.

This SumoBot and HackyBot project is designed to enable learners to explore possibilities in the robotics field. With this, a microcontroller has been used to able to make the robot more powerful in problem-decision making and to compete with other robots as well. Designed as an autonomous an remotely controlled robot, the SumoBot is engineered to participate in Roboseum competition, attempt to push other out of a defined area. With the use of type of microcontroller, it is serve as a central processing unit provides the platform with a robust combination of computational power, connectivity, and versatility, making it reliable for both SumoBot and HackyBot category.

In summary, the SumoBot/HackyBot powered by the ESP32 microcontroller exemplifies the convergence of affordability, accessibility, and technological sophistication in modern robotics. By leveraging the ESP32’s advanced features, this platform provides an effective and engaging means for students and enthusiasts to acquire practical skills in robotics, programming, and systems integration, while also serving as a testbed for innovation in autonomous and interactive robotic systems

SUMOBOT & HACKYBOT

PROBLEM REQUIREMENTS

- **Reliable Sensor Integration**
  The system must incorporate and effectively integrate essential sensors such as IR sensors and ultrasonic sensors to detect the opponent robot's position and the boundaries of the sumo ring accurately.
- **Efficient Motor Control**
  The robot must have precise and responsive motor control using a suitable motor driver, enabling quick and accurate maneuvers to push the opponent out of the arena while maintaining stability.
- **Stable Power Supply and Voltage Management**
  The design must ensure a stable power supply with appropriate voltage regulation, including step-up voltage modules if necessary, to maintain consistent performance of the ESP32 and motors throughout the match.
- **Real-Time Processing and Decision Making**
  The ESP32 microcontroller must process sensor inputs and execute control algorithms in real time to enable autonomous or remote-controlled navigation and opponent engagement.
- **Robust Communication and Control Interface**
  The system should support reliable communication protocols, such as Bluetooth or Wi-Fi, to allow remote control or telemetry, possibly integrating libraries like Bluepad32 for controller input.
- **Compact and Durable Mechanical Design**
  The robot must have a compact, lightweight, and durable chassis to optimize speed and torque while withstanding impacts during sumo battles.

SCOPE AND LIMITATIONS

The robot is designed for remote control via Bluetooth or Wi-Fi, allowing real-time operation while incorporating basic sensor-assisted navigation to improve effectiveness. Nonetheless, the project is constrained by the ESP32's hardware limitations, which prevent full autonomy and prioritize remote control with

limited sensor functionality. Wireless communication may experience occasional delays or connection issues, and the robot's runtime is limited by its onboard battery life. Furthermore, factors such as lighting variations and uneven surfaces can impact sensor performance. Budgetary and design restrictions also limit the inclusion of advanced components, emphasizing affordable and competition-compliant design choices.

ANALYSIS

The SumoBot/HackyBot operates by receiving inputs from infrared and ultrasonic sensors that detect the boundaries of the sumo ring and the position of the opponent robot, respectively. These sensor signals, along with wireless commands sent via Bluetooth or Wi-Fi from a remote controller, are processed by the ESP32 microcontroller to make real-time decisions. The processed data is then converted into motor control signals that drive the robot's wheels, enabling precise movements such as advancing, retreating, or maneuvering to push the opponent out of the arena. The system also transmits feedback to the operator to enhance control accuracy. This integration of sensor data, wireless communication, and motor actuation allows the robot to effectively navigate the competition environment and respond dynamically during matches.

DESIGN AND IMPLEMENTATION

Figure 1.1: Actual SumoBot

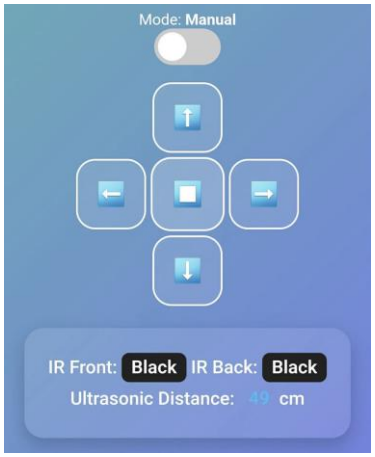

Figure 1.2: HTML of HackyBot

TESTING AND DEBUGGING

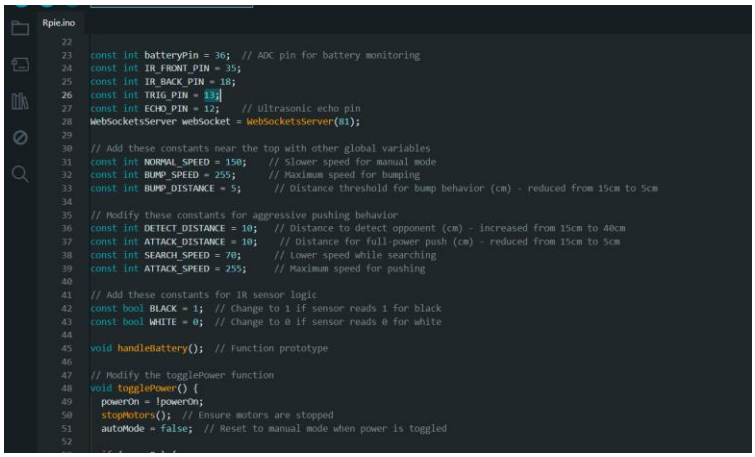

Figure 1.3: Arduino code error list

FUTURE DEVELOPMENT

Future developments for Sumobot could include integrating AI and machine learning to enable smarter, adaptive strategies during matches, along with improved sensors for better awareness of the environment. Simplifying programming and adding virtual simulation tools would make design and testing easier and more accessible. Enhanced connectivity through technologies like 5G could improve real-time performance, while stronger safety features would ensure safer interaction. These advancements would not only boost competition but also expand Sumobot's role in education and inspire interest in robotics careers.

STUDENT INFORMATION

CURRICULUM VITAE

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https://bit.ly/4kq6Efq

"If it is to be, it is up to me."

PROFILE

Date of Birth	:	May 15, 2002
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EDUCATIONAL BACKGROUND:

Primary	:	Immaculata High School Baclayon, Bohol 2017 - 2018
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PROJECTS:

Final Project	:	SumoBot & HackyBot
Project Link	:	**https://bit.ly/3SjMdoM**