



UNIVERSITY OF BOHOL

Tagbilaran City, Bohol, Philippines

COLLEGE OF ENGINEERING, TECHNOLOGIES,
ARCHITECTURE AND FINE ARTS

COMPUTER ENGINEERING
DRAFTING AND DESIGN
CPEP223A

SUMOBOT | HOCKEYBOT

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Introduction

The **Sumobot / Hockeybot** project aims to design and develop an autonomous robot capable of participating in competitive scenarios such as sumo wrestling matches or robotic hockey games. The robot utilizes sensors, actuators, and control algorithms to interact with its environment, detect opponents or objects, and execute strategies to achieve its objectives.

Objectives

- **Design and Construction:** Build a robust and compact robot chassis suitable for competitive environments.
- **Autonomous Navigation:** Implement sensor-based navigation to detect boundaries, obstacles, and opponents.
- **Wireless Communication:** Integrate Bluetooth modules for remote control and debugging.
- **Power Management:** Utilize DC-DC boost converters to ensure stable voltage supply to all components.
- **Modularity:** Design the system to allow easy upgrades and maintenance.

Scope and Limitation

Scope

- The robot operates autonomously within a defined arena.
- Equipped with IR sensors for line and edge detection.
- Utilizes Bluetooth communication for remote control and data monitoring.
- Powered by rechargeable batteries with voltage regulation.

Limitations

- Performance may vary based on surface conditions and lighting.
- Limited processing power due to the use of Arduino Nano.
- Battery life constraints may limit operation time.
- Not designed for outdoor or uneven terrains.

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Purpose

The primary purpose of this project is to apply principles of electronics, programming, and mechanical design to create a functional autonomous robot. The project serves as a practical application of theoretical knowledge, fostering skills in system integration, problem-solving, and innovation.

Overall Description

The robot is designed to detect and respond to its environment using a combination of sensors and actuators controlled by an Arduino Nano microcontroller. Depending on the mode (Sumobot or Hockeybot), the robot either seeks to push an opponent out of the arena or control a puck towards a goal. The integration of a Bluetooth module allows for remote operation and real-time data monitoring.

Features of the Project

- Autonomous Operation: Sensor-based navigation and decision-making.
- Edge Detection: IR sensors prevent the robot from exiting the arena.
- Opponent/Object Detection: Ability to detect and respond to opponents or pucks.
- Wireless Communication: Bluetooth module for remote control and debugging.
- Power Regulation: DC-DC boost converter ensures stable voltage supply.

COMPONENTS USED

Microcontroller:

- Arduino Nano: Serves as the central processing unit, handling sensor inputs and controlling actuators.

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Sensors

- IR Sensors: Detect lines and edges to prevent the robot from leaving the arena.
- Ultrasonic Sensor (Optional): Measures distance to detect opponents or obstacles.

Actuators

- DC Motors with Wheels: Provide movement capabilities.
- Motor Driver (L298N): Controls the direction and speed of the DC motors

Power Supply

- Rechargeable Battery Pack: Provides the primary power source.
- DC-DC Boost Converter: Steps up the battery voltage to the required level for components.
- Boost Converter Cover: Protects the boost converter from physical damage and short circuits.

Communication

- Bluetooth Module (HC-05/HC-06): Enables wireless communication for control and debugging.

Chassis and Mechanical Components

- Robot Chassis: Houses all components and provides structural integrity.

Miscellaneous

- Switches: Control power supply to the robot.
- Wiring and Connectors: Establish electrical connections between components.

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- 1k Ω Resistor – Used in the switch configuration to enable mode selection between Sumobot and Hockeybot. It acts as a pull-down resistor to prevent floating input when the switch is open.

Design

The design phase included the following:

- Sketching chassis layout (for compactness and sensor placement)
- Prototyping circuits on breadboard

Software Package and Description

Development Environment

- Arduino IDE: Used for writing, compiling, and uploading code to the Arduino Nano.

Programming Language

- C/C++: Implements control algorithms and sensor data processing.

Software Modules

- Sensor Reading: Functions to read data from IR and ultrasonic sensors.
- Motor Control: Functions to control motor speed and direction based on sensor inputs.
- Bluetooth Communication: Functions to handle data transmission and reception via the Bluetooth module.
- Decision-Making Algorithms: Logic to determine robot actions based on sensor data.



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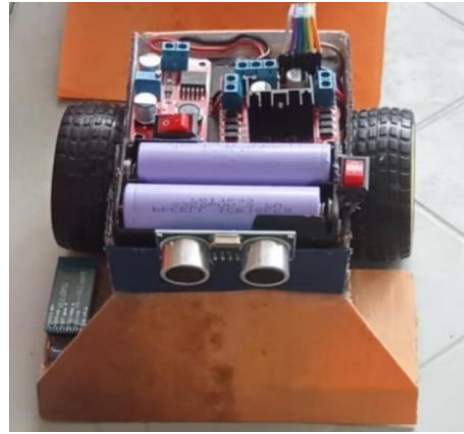
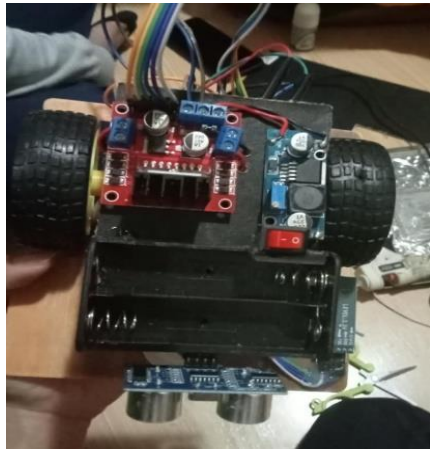
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Documentation



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Future Development

- Enhanced Sensors: Integrate additional sensors for improved environment perception.
- Advanced Algorithms: Implement machine learning techniques for adaptive behavior.
- Improved Power Management: Develop more efficient power systems for extended operation.
- Modular Attachments: Design interchangeable modules for different competition modes.
- User Interface: Create a mobile application for more intuitive control and monitoring.

Project Cost

Component	Quantity	Total Price
Arduino Nano	1	₱187
L298N Motor Driver	1	₱75
DC Motors with Wheels	2	₱130
IR Sensors	2	₱50
Bluetooth Module	1	₱199
DC-DC Boost Converter	2	₱110
Ultrasonic Sensor	1	₱49
Rechargeable Battery Pack	1	₱370
Miscellaneous Components	-	₱500
Total		₱1,670

Glossary

- **Arduino Nano:** A compact microcontroller board based on the ATmega328P, used for controlling the robot's operations.
- **IR Sensor:** Infrared sensor used to detect lines or edges by measuring reflected infrared light.
- **Ultrasonic Sensor:** Measures distance by emitting ultrasonic waves and measuring the time it takes for the echo to return.
- **L298N Motor Driver:** A dual H-bridge motor driver that allows control of the speed and direction of two DC motors.
- **DC-DC Boost Converter:** Increases (boosts) the voltage from the battery to the required level for the robot's components.
- **Bluetooth Module (HC-05/HC-06):** Enables wireless communication between the robot and other devices.
- **Chassis:** The structural framework of the robot that houses all components.
- **1k Ω Resistor** – Used in the switch configuration to enable mode selection between Sumobot and Hockeybot. It acts as a pull-down resistor to prevent floating input when the switch is open.

Bibliography

- Class lectures and Arduino workshops
- Arduino Official Documentation
- Electronics tutorials: www.circuitdigest.com
- DIY Robotics YouTube Channels
- Sumobot Rules and Arena Layout: local competition guidelines