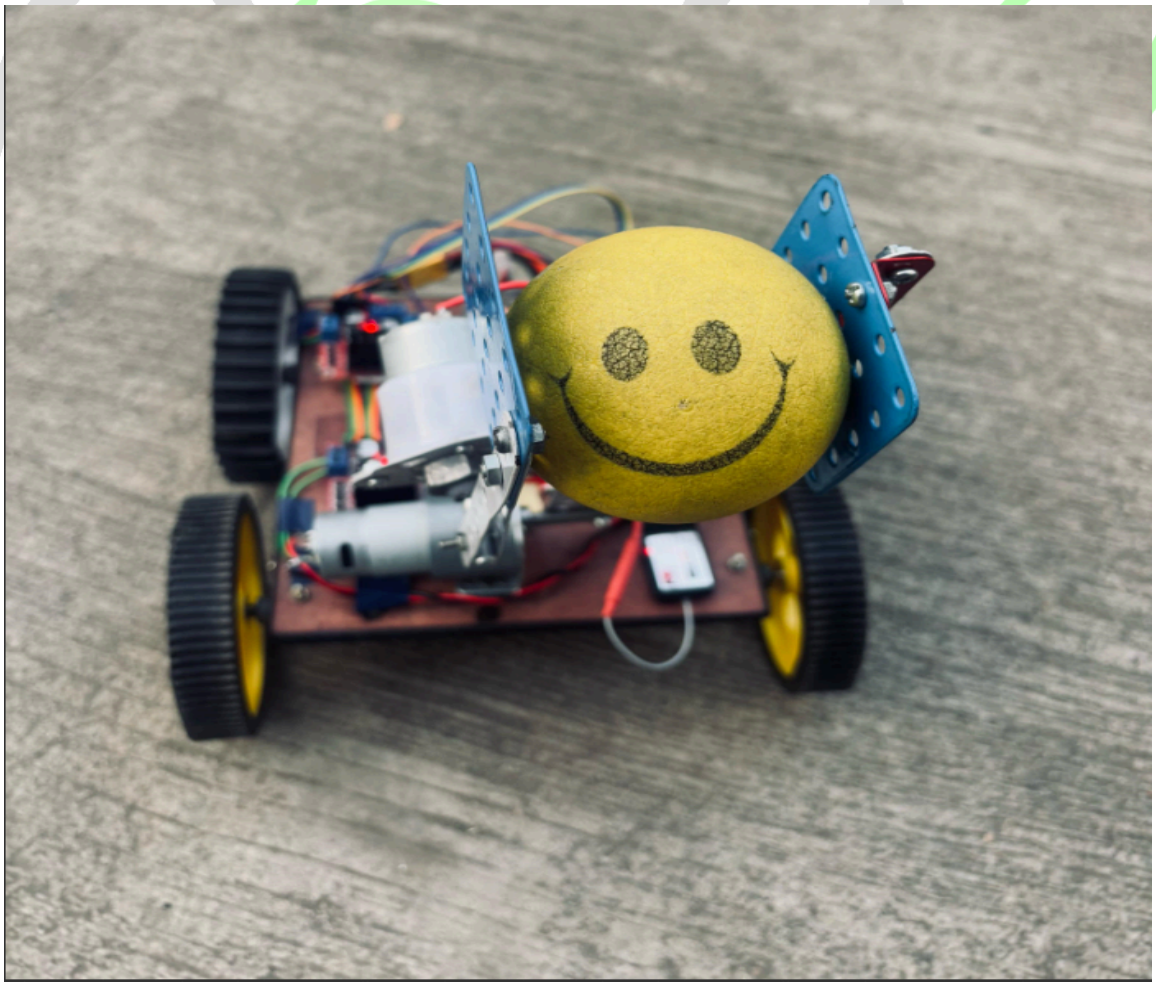
Axis VNIT 2K25
Manual Robotics

To make a bot capable of driving on various terrains and bridges, clearing different obstacles, and grabbing stuff with its claw while being manually operated by a team member.



1. Team Intro

1.1. Team Zomato (RAC RBU)

1.2. Date: 28/3/2025

1.3. Team Members:

- Dhariya Wegad
- Sanchay Dubey
- Revanshu Pusadkar
- Saksham Goyal

1.4. Advisor/Supervisor:

- Dhariya Wegad

2. Executive Summary / Abstract

The Manual Robotics project was developed to participate in the **Manual Robotics Competition at Axis VNIT**. The primary objective was to build a bot capable of navigating obstacles and reaching the finish line while performing tasks such as grabbing objects. The project provided valuable experience in hardware and software integration, motor control, and mechanical design. The bot was successfully tested, refined, and optimized to perform efficiently in the competition environment.

3. Table of Contents

4. Introduction

4.1 Background

Manual Robotics competitions require a bot to navigate terrains, overcome obstacles, and interact with objects. This project was initiated to **build a robust, manually controlled bot** to compete at Axis VNIT. The competition required precise maneuverability, strong structural integrity, and an effective object-handling mechanism.

4.2 Problem Statement

The challenge was to design a **sturdy, maneuverable, and efficient robotic vehicle** that could navigate challenging terrains, pick up objects, and successfully complete the competition course.

4.3 Objectives & Scope

Primary Objectives:

- Develop a remote-controlled bot capable of moving in all directions.
- Integrate a functional claw mechanism for grabbing objects.
- Ensure durability and reliability to withstand collisions and falls.

Scope:

- Includes mechanical structure, motor control, and wireless remote operation.
- Excludes AI-based automation or advanced sensor-based navigation.

4.4 Significance

This project enhanced the team's **practical skills in robotics, electronics, and programming**. It provided hands-on experience with components like **Arduino Nano, motor drivers, and controllers** while fostering teamwork and problem-solving abilities.

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5. Components & Materials

Sr. No.	Component Name	Quantity	Use Case
1	Johnson Motor	6	4 for wheels, 2 for claw
2	Battery (12V)	1	Power supply
3	Arduino Nano	1	Control hardware & integrate code
4	Wheels	4	Bot movement
5	L298N Motor Drivers	3	Provide current & control movement
6	Flysky Controller	1	Wireless control of the bot
7	Claw (Mechanix parts)	As needed	Object gripping
8	Chassis	1	Mount components

Sourcing Details

Most components were sourced from The club room, and some of them were ordered from the **local electronics stores and online marketplaces**.

6. Design & Methodology

Mechanical/Structural Design

- The bot's **chassis was built using sturdy materials** to ensure durability.
- **Wheels were mounted using Johnson motors** for effective mobility.
- The claw mechanism was designed using **Mechanix parts**, with two motors enabling movement **up/down and in/out** for gripping objects.

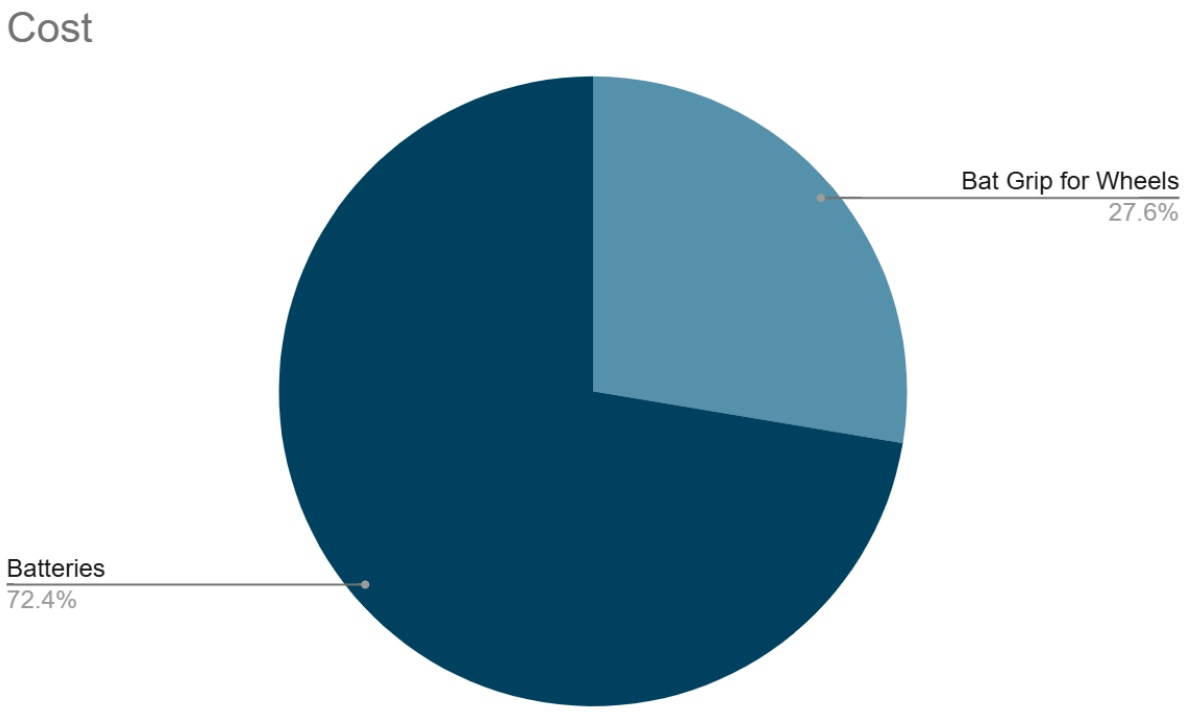
Electronics & Circuitry

- Two **functional motor drivers** were used to control the four wheel motors.
- **Non-functional motor drivers** were utilized for interfacing additional motors.
- The control system was built around **Arduino Nano**, programmed using **Arduino IDE**.
- **Wireless control was achieved using the Flysky controller**.

Integration Approach

- Right and left wheels were **paired for synchronized movement**.
- The claw was designed to move **vertically and horizontally** for object grabbing.
- **Manual control ensured precision movements** during competition.

7. Cost Analysis



Cost vs. Benefit Analysis

- We have got the other requiring parts from the club.
- The **bot was built within budget constraints**, and its **performance exceeded expectations** regarding durability and maneuverability. Future improvements can focus on **higher-quality motors and batteries** to enhance climbing ability.

8.Testing & Evaluation

Test Setup

The bot was tested on various terrains and obstacle courses **similar to the competition setup**.

Test Procedures

1. **Movement Test:** Forward, backward, left, and right movement.
2. **Claw Functionality Test:** Grabbing and lifting different objects.
3. **Durability Test:** Collision and fall resistance.

Results & Analysis

- Initially, **one wheel had incorrect control pins**, causing confusion in navigation. This was fixed.
- The **claw successfully gripped objects tightly** after adjustments.

The **bot's durability was exceptional**, remaining intact despite falls and collisions.

9. Safety, Compliance, & Environmental Consideration

Safety Guidelines

- Care was taken while soldering and assembling electronics.
- Operators were trained to handle the bot safely during testing.

Regulatory Compliance

The project adheres to standard **electronic and mechanical safety protocols**.

Environmental Impact

- Components are **reusable** for future projects.
- Consideration for **energy-efficient components** in future iterations.

10. Conclusion & Future Work

Summary of Findings

- The bot was successfully built and tested for **manual control, movement, and object handling**.
- The **durability exceeded expectations**, making it competition-ready.

Implications

- This project **enhanced the team's engineering and problem-solving skills**.
- The design principles learned can be applied to **future robotics projects**.

Future Enhancements

- **Improved motors and power supply** for better ramp climbing.
- Potential AI integration for **semi-autonomous movement**.

Closing Remarks

This project was a **great learning experience**, refining our **robotics, programming, and teamwork** skills. We are excited about further improvements in future competitions.

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11. References

- **GitHub Repository:** [Cozmo Clench 2K25]