team 2EZ

ITERATION MANUAL

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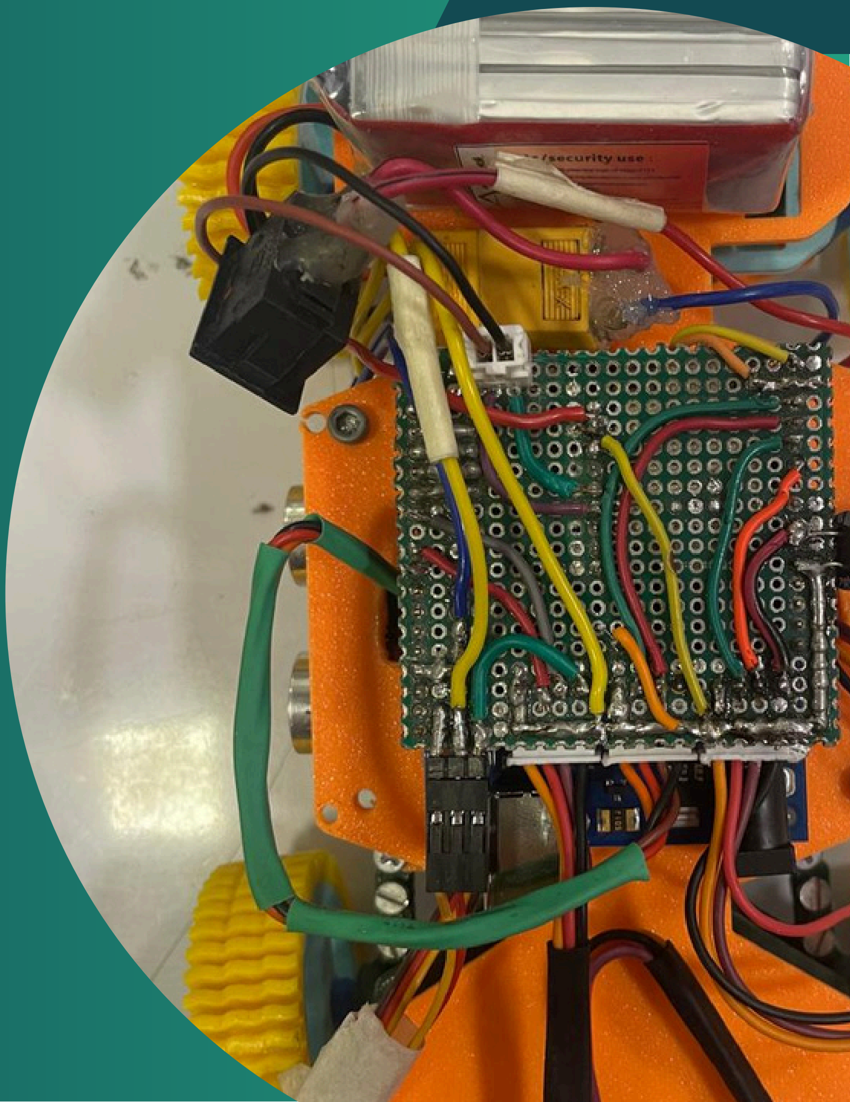

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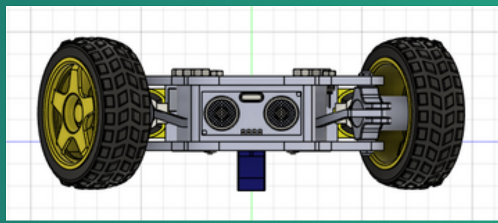
ITERATION : 01

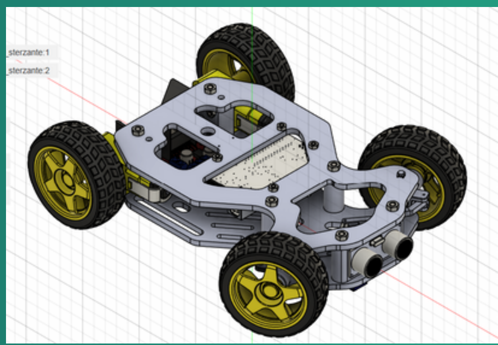
1. First Iteration: The Base Bot

1.1 Overview

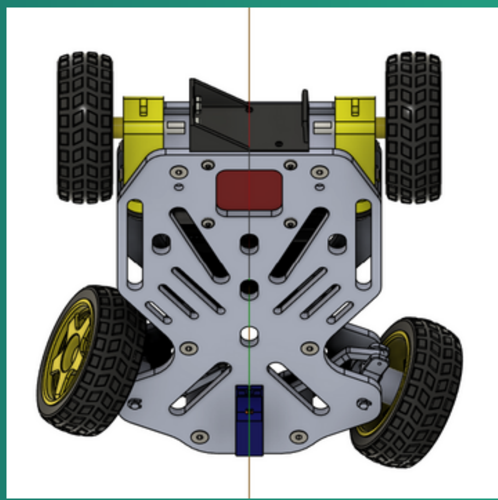
The first iteration was a simple prototype designed to test the basic functionality of movement and sensing. However, it was limited in terms of both hardware and software, which made it difficult to code and operate.



1.2 Key Features

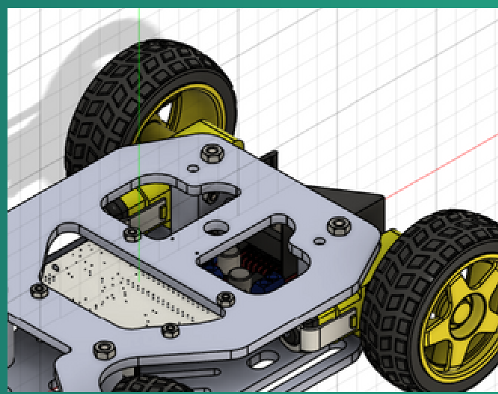


Hardware: The bot had two DC motors, one for each rear wheel.
Movement: The two motors controlled each rear wheel independently, making the system harder to control.
Design Challenges: The dual-motor setup was against the rules of the competition, which mandated the use of a single motor for propulsion. There was also low torque because of using the SG90 servo motor for steering mechanism. Also, often the gears were seen being damaged due to the plastic gearbox.



1.3 Challenges

Coding Complexity: Managing two motors independently increased the complexity of the code. It required intricate motor control to maintain balance and avoid drifting.
Size and Layout: The bot was bulky, and the large size made it less nimble on the track.
Competition Compliance: The use of two motors violated competition rules, necessitating a redesign.



ITERATION : 02

2. Second Iteration: Structural Change and Motor Update

2.1 Overview

In the second iteration, the bot was significantly redesigned to address the shortcomings of the first version. The primary goals were to improve steering torque, make the bot easier to modify, and switch to a single motor system.

2.2 Key Changes

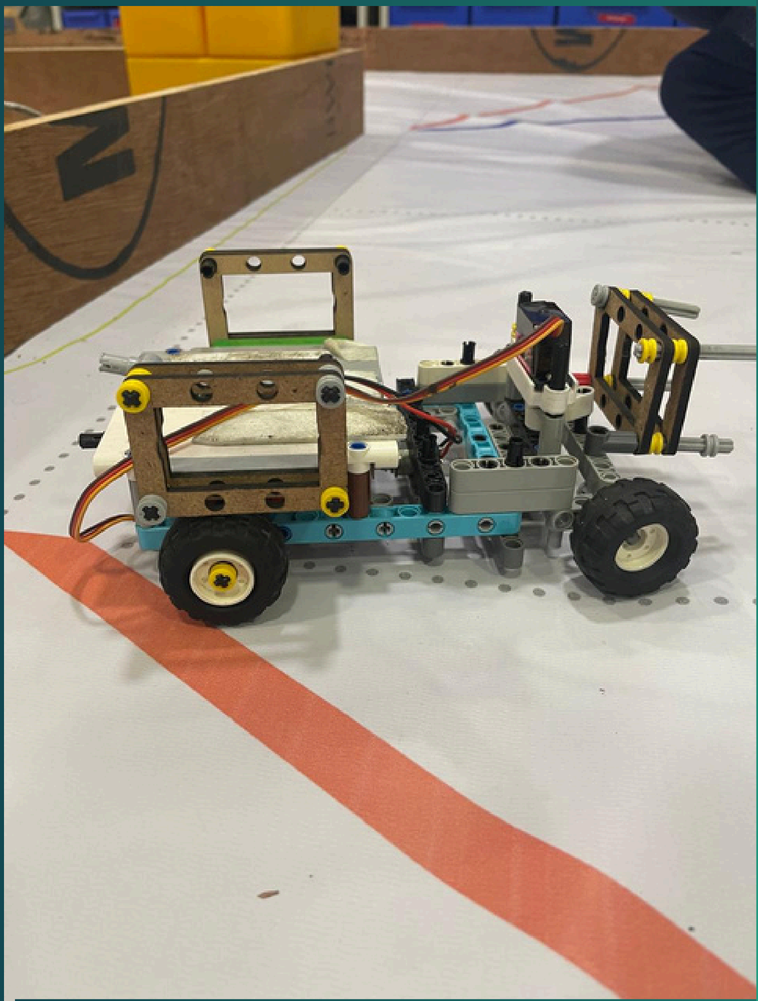
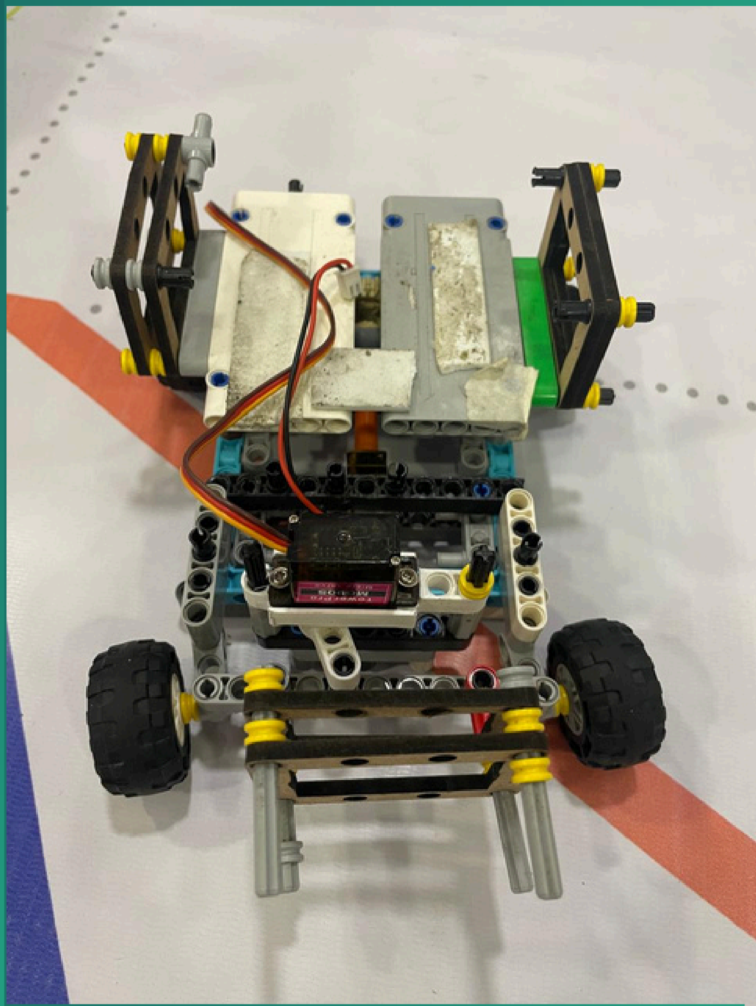
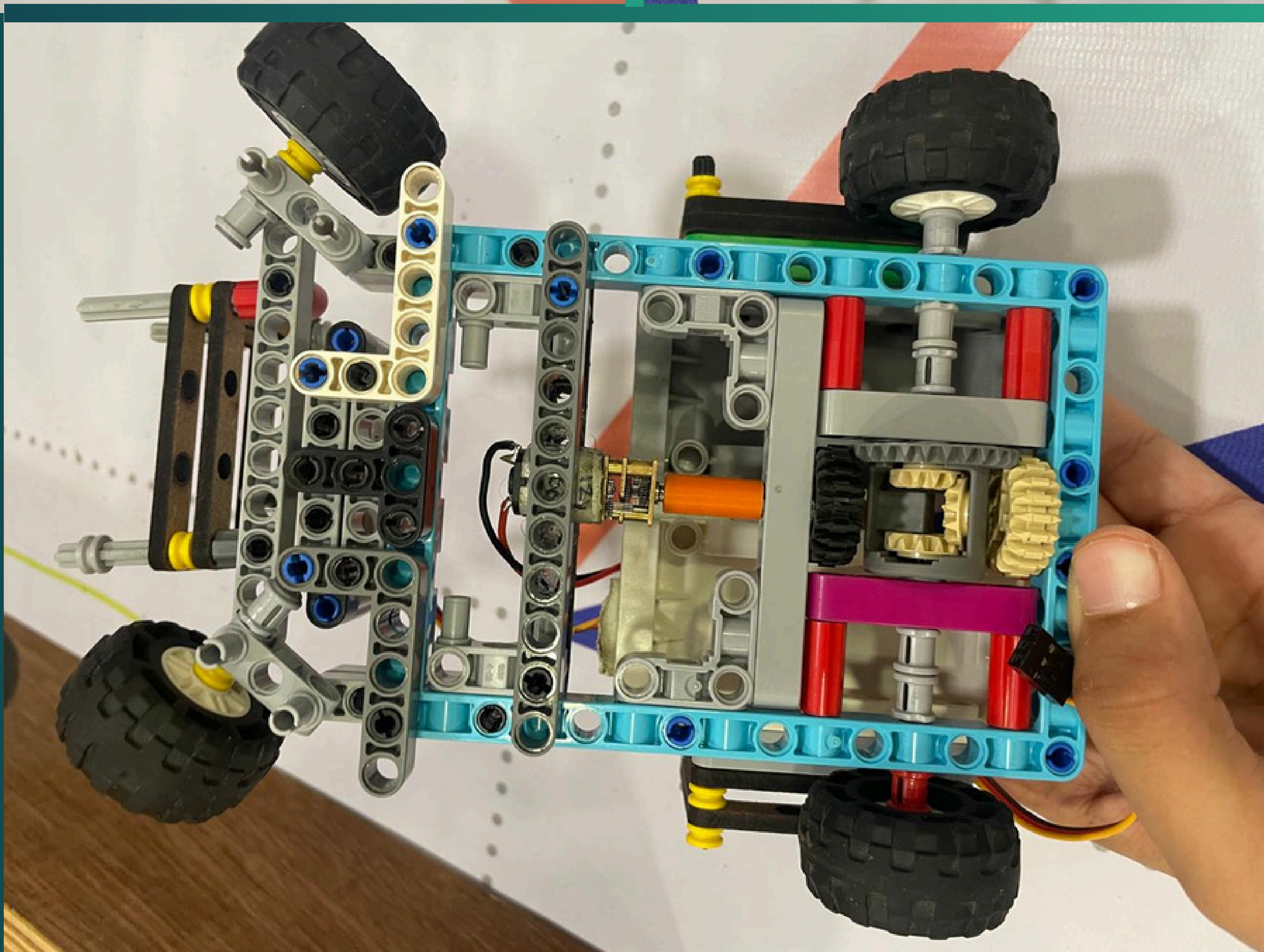
Servo Upgrade: The steering system was upgraded with an MG90S microservo, which provided greater torque and improved control over the front wheels. This allowed the bot to make more precise and forceful turns.
Structural Change to LEGO: The frame of the bot was redesigned using LEGO pieces to make the structure more modular, allowing easy adjustments and modifications without rebuilding the entire chassis.
Single Motor with Differential System: The bot transitioned to using a single N20 DC motor to power both rear wheels via a differential system, simplifying the drivetrain while allowing for more compliant competition rules.

2.3 Improvements

Improved Steering: The MG90S servo, with its higher torque, allowed for smoother, more powerful turns compared to the previous system.
Easier Modifications: The LEGO structure enabled quick edits to the design, which speed up the prototyping process. Adjustments could be made easily without having to fully disassemble the bot.
Simplified Drive: The use of the single N20 motor with a differential made the drive system compliant with competition rules, as only one motor was now used for both rear wheels.

2.4 Challenges

Weak Structural Links: While LEGO provided flexibility, it also resulted in weak connection points. The bot frequently fell apart, especially at high speeds or during turns.
Instability at High Speeds: Due to the weak links in the LEGO construction, the bot struggled to handle higher speeds, as parts would become loose or detached, reducing its performance on the track.
Limited Durability: The bot was fragile, meaning that any impacts or sudden turns would cause it to lose its form or control.

ITERATION : 03

This iteration marks the completion of the bot's development, transitioning from a LEGO-based design to a fully 3D-printed structure using PLA filament. The goal of this final iteration was to create a sturdy and reliable bot that no longer requires structural edits or adjustments.

Key Features

Full 3D-Printed Structure: The entire chassis and key components are now 3D-printed in PLA filament, providing a sturdy, well-integrated design.
MG90S Servo Motor: The MG90S microservo remains in use to control the front wheels for steering, offering precise and reliable turns.
N20 DC Motor with 1:1 Gear Ratio: The bot uses a N20 DC motor connected to both rear wheels via two 1:1 ratio gears mounted on a 3D-printed axle. This ensures consistent power distribution and smooth propulsion.

Improvements and Pros of the 3D-Printed Design

1. Structural Sturdiness

The most significant upgrade in this iteration is the transition to a fully 3D-printed chassis made from PLA filament. Unlike the LEGO-based structure in previous iterations, this version is far more durable and resistant to the stresses of high-speed movement, turns, and impacts. The use of 3D printing allowed for:
Increased Strength: PLA is a rigid material, making the bot less prone to falling apart or experiencing weak points during operation.
Customization: The design could be tailored specifically to fit all components perfectly, minimizing the space wasted and improving overall balance.

2. Improved Steering with the MG90S Servo

The MG90S servo motor remains the same as in previous iterations but is now better integrated into the 3D-printed structure, ensuring tighter connections and smoother operation. This ensures:
More Reliable Turns: The precise fit of the servo into the 3D-printed frame

ensures better alignment of the front wheels, reducing wobble or inaccurate turns.

Increased Torque Efficiency: The servo now operates without any issues of loose or flexible mounts, ensuring full utilization of its torque for accurate control.

3. Consistent Propulsion with the N20 DC Motor and 1:1 Gear Ratio

The drivetrain consists of an N20 DC motor connected to the rear wheels through 1:1 ratio gears mounted on a 3D-printed axle. The integration of the motor and axle into the 3D-printed frame enhances performance by:
Stable Power Delivery: The direct connection of the motor to the 3D-printed gears and axle ensures minimal slippage or mechanical losses, allowing for smoother acceleration and deceleration.
Precise Gear Alignment: The 1:1 gear ratio ensures equal force is applied to both wheels, providing balanced and controlled movement, especially during straight runs.

4. Finalized Design

As this is the final iteration, the focus was on making the design as sturdy and refined as possible. The decision to use 3D printing was driven by the fact that:
No Further Edits Needed: With all design challenges and structural weaknesses resolved, the bot no longer requires further modifications or changes.
Durability for Competition: The sturdy, final design can withstand the rigors of competition without the need for continuous tweaks, unlike the earlier LEGO-based designs that were fragile and prone to falling apart.