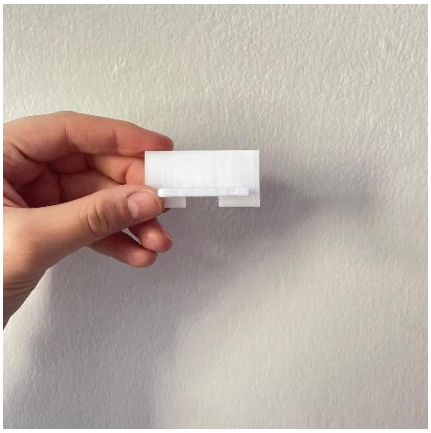
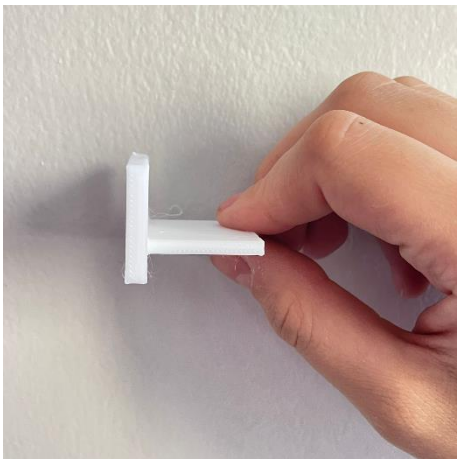
Problem: During robot operation, we noticed that the sensors were not stable enough, which led to inaccurate readings and negatively affected task performance.

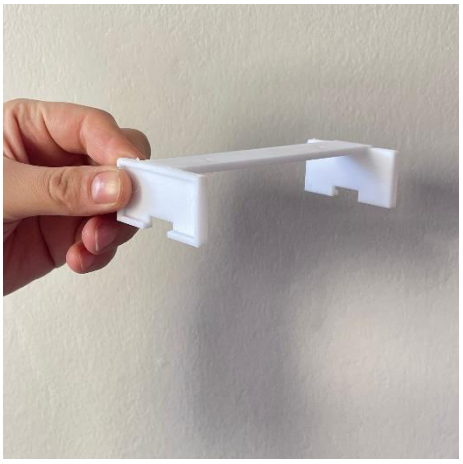
Solution: We designed and installed a custom sensor mount using 3D printing, ensuring precise and secure placement of the sensors.

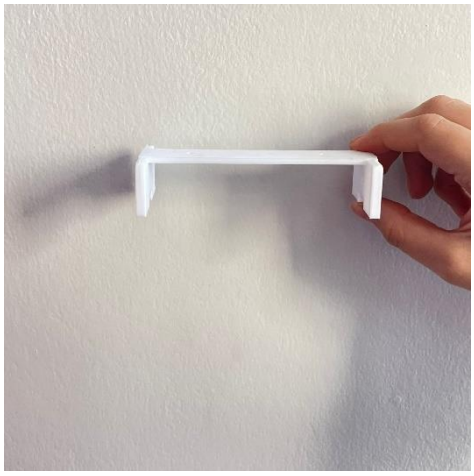
Benefits:

- Improved sensor accuracy.
- Reduced vibrations during robot movement.
- Enhanced structural and professional appearance of the robo









Problem: During robot testing, we noticed that the Control Device (SD0

was slow, causing delays in command execution and poor sensor responsiveness.

Solution: We replaced the unit with a new one featuring higher performance and faster processing speed, which significantly improved the robot's responsiveness and task accuracy

Benefits:

- Faster execution of programmed commands.
- Better interaction with sensors and motors.
- Reduced errors caused by time delays.

Old SD

New SD

Category	SD1 Old	SD 2 New
Model	SanDisk Ultra microSDXC	SanDiskUltra microSDXC A1
Capacity	64GB	64GB
Speed Class	Class 10	Class 10
UHS Standard	UHS-1	UHS-1
Application Performance Rating	None	A1 (Optimized for running applications
UHS Speed Rating	Not specified	U1(Minimum write speed 10MB/s
Performance with OS (e.g., Raspberry Pi)	Average	High performance optimized for system booting
Boot & App Loading Speed	Slower	Faster and more stable
Recommended Use	Basic file storage	Robotics OS running, Raspberry Pi, real-time tasks
Reason Not Selected	Can cause lag and slow loading	Chosen for stability, speed, and smooth robot performance

Problem:

While using the Raspberry Pi 4, we encountered several issues, including slow performance and unexpected system freezes. These problems affected the overall efficiency and reliability of our setup.

Solution:

To overcome these challenges, we upgraded our system to the Raspberry Pi 5, which offers improved processing power, better thermal management, and enhanced stability.

Benefits:

- Faster and more responsive performance
- Reduced system crashes and downtime
- Improved reliability and efficiency for continuous operation

Problem:

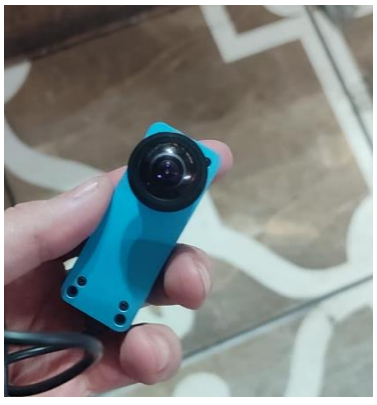
At the beginning, we used a camera because it provided good performance and accurate detection. However, after modifying the robot's engineering design and adding the 3D funnel, the camera no longer fit properly. Its position affected the field of view, which reduced its efficiency and response accuracy during movement.

Solution:

We decided to replace the camera with New Camera that better match the updated design and work effectively with the new 3D funnel structure. This allowed us to maintain reliable environmental sensing without compromising the robot's mechanical design or functionality.

Benefits:

With this change, the robot achieved better integration between the mechanical structure and the electronic components. The new Camera setup worked efficiently and provided a clear detection path, improving overall performance, stability, and reducing technical issues caused by unsuitable camera placement.



Old Camera

New Camera

Problem:

At the beginning of the project, we planned to use a color sensor to determine directions and guide the robot's movement. However, we faced difficulties with color detection due to lighting changes and surface reflections in the competition environment. This affected the sensor's accuracy and could cause the robot to make incorrect decisions.

Solution:

Instead of using the color sensor, we adopted a more reliable method by using the distance sensor. If the right sensor detects more than 160 cm, this means the robot should move counterclockwise. On the other hand, if the left sensor detects more than 160 cm, this means the robot should move clockwise. This approach allowed the robot to determine its direction accurately without relying on color detection.

Benefits:

This solution provided faster and more accurate direction control, making the robot less affected by lighting conditions or surface changes. It improved movement stability, enhanced performance, and increased reliability, helping the robot complete its path smoothly and efficiently.

Problem:

In the beginning, our robot relied only on the Ultrasonic sensor to determine its direction. However, we noticed that the robot sometimes drifted and did not stay perfectly on the intended path, especially when turning or moving for a long distance. This caused slight deviations that could affect its accuracy during the mission.

Solution:

To solve this issue, we added a gyroscope sensor alongside the distance sensor. The gyroscope helps the robot maintain a stable direction and corrects any drift by constantly monitoring the robot's rotation angle. By combining both sensors, the robot can detect direction accurately and stay aligned with the path

Benefits:

With the gyroscope added, the robot became more stable and precise in its movements. It no longer drifts easily, and its turns became smoother and more controlled. This upgrade improved the overall performance, reliability, and accuracy of the robot during the competition missions

Problem: After installing the camera on the robot, we noticed it wasn't securely fixed, which caused vibrations during movement and reduced image accuracy.

Solution: We designed a custom camera mount using 3D printing to ensure stable positioning and optimal viewing angle.

Benefits:

- Secure and stable camera installation.
- Improved image quality and visual processing.
- Easy adjustment of the camera angle when needed.

Problem:

We used to rely on time to make the robot complete three laps and return to the starting point. However, time-based control was not accurate, and small speed changes caused the robot to stop in the wrong location

Solution:

The robot sometimes missed the exact starting point because timing was not consistent. To solve this, we developed a new program that uses the distance sensor. When the sensor detects an obstacle or measures a distance greater than 160 cm, the robot counts one corner. After detecting 12 corners (3 laps), it stops precisely at the starting point

Benefits:

- More accurate return to the start point
- Stable and consistent performance
- Not affected by speed changes
- Higher precision and reliability