WORLD ROBOT OLYMPIAD 2024

Future Engineer

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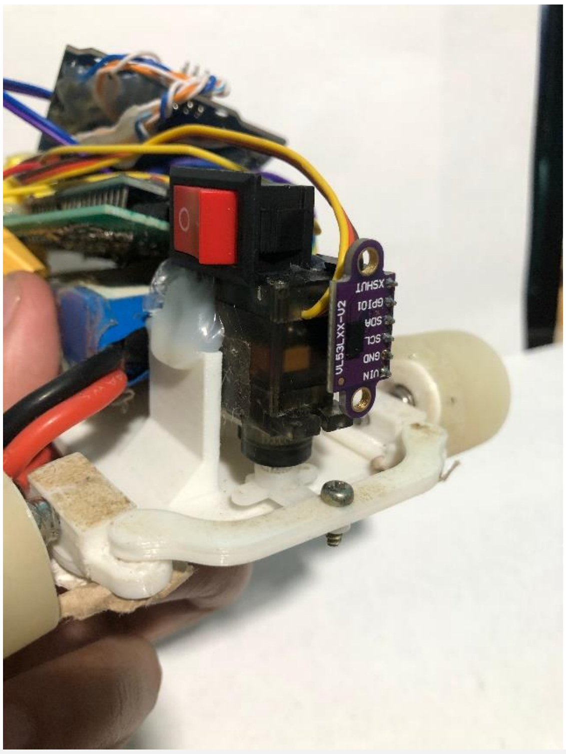
Country: Argentina

Mobility Management

In alignment with the competition regulations, our robot is designed with precision, utilizing one DC motor and a single servo motor. To optimize the steering system, we have ingeniously incorporated a custom 3D-printed component that facilitates the turning of both front wheels, enabling smooth transitions from left to right. This steering mechanism, while straightforward in its design, proves to be highly effective and reliable for the robot's maneuverability.

The DC motor is strategically mounted to ensure maximum efficiency. We've directly attached two wheels to it, achieving a streamlined and compact build. This not only minimizes the robot's overall size but also enhances its agility and responsiveness. The DC motor is critical in providing the essential forward and backward movements, making the robot versatile and well-suited for various challenges posed by the competition.



Power and Sense Management

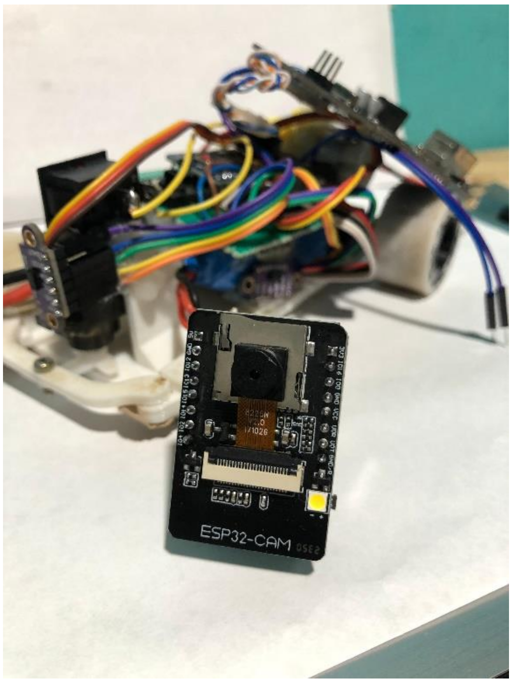
We power our robot using a 7V 2000mAh Li-Po battery, which efficiently drives both the logic components and the DC motors. Li-Po (Lithium-Polymer) batteries are particularly well-suited for robotics due to their lightweight design and high energy density, offering an excellent balance between power and portability. This allows the robot to maintain peak performance without adding unnecessary weight, which is crucial in competitive environments where every gram counts.

In terms of sensor technology, our robot is equipped with three CJVL53L0XV2 sensors, which play a critical role in ensuring precise and rapid wall distance detection. These sensors are capable of measuring distances up to 2 meters with millimeter-level accuracy, providing reliable data that allows our robot to navigate its environment with exceptional precision.

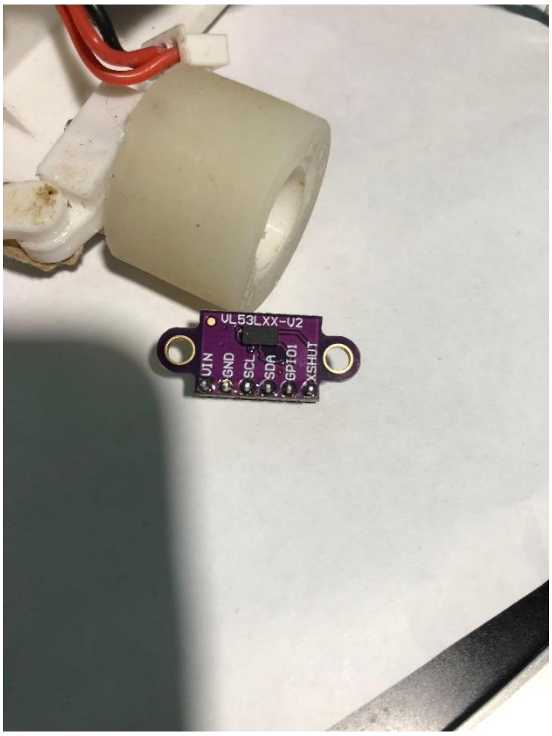
The high resolution of these sensors ensures that even the smallest deviations from the intended path are detected and corrected in real-time, enhancing the robot's ability to respond to dynamic conditions and maintain optimal performance throughout the competition.

Obstacle Management

To detect colors and obstacles, we utilize an ESP32 camera, a versatile board that excels not only in capturing images but also in processing them using artificial intelligence (AI). This capability makes the ESP32 camera particularly effective for real-time obstacle avoidance, as it enables the robot to make instantaneous decisions based on its environment. The onboard processing power of the ESP32 allows it to handle complex computations directly on the device, thereby eliminating the latency associated with sending data to an external server. This local processing capability ensures faster and more efficient responses, which is critical in dynamic and fast-paced competition settings where every millisecond counts.

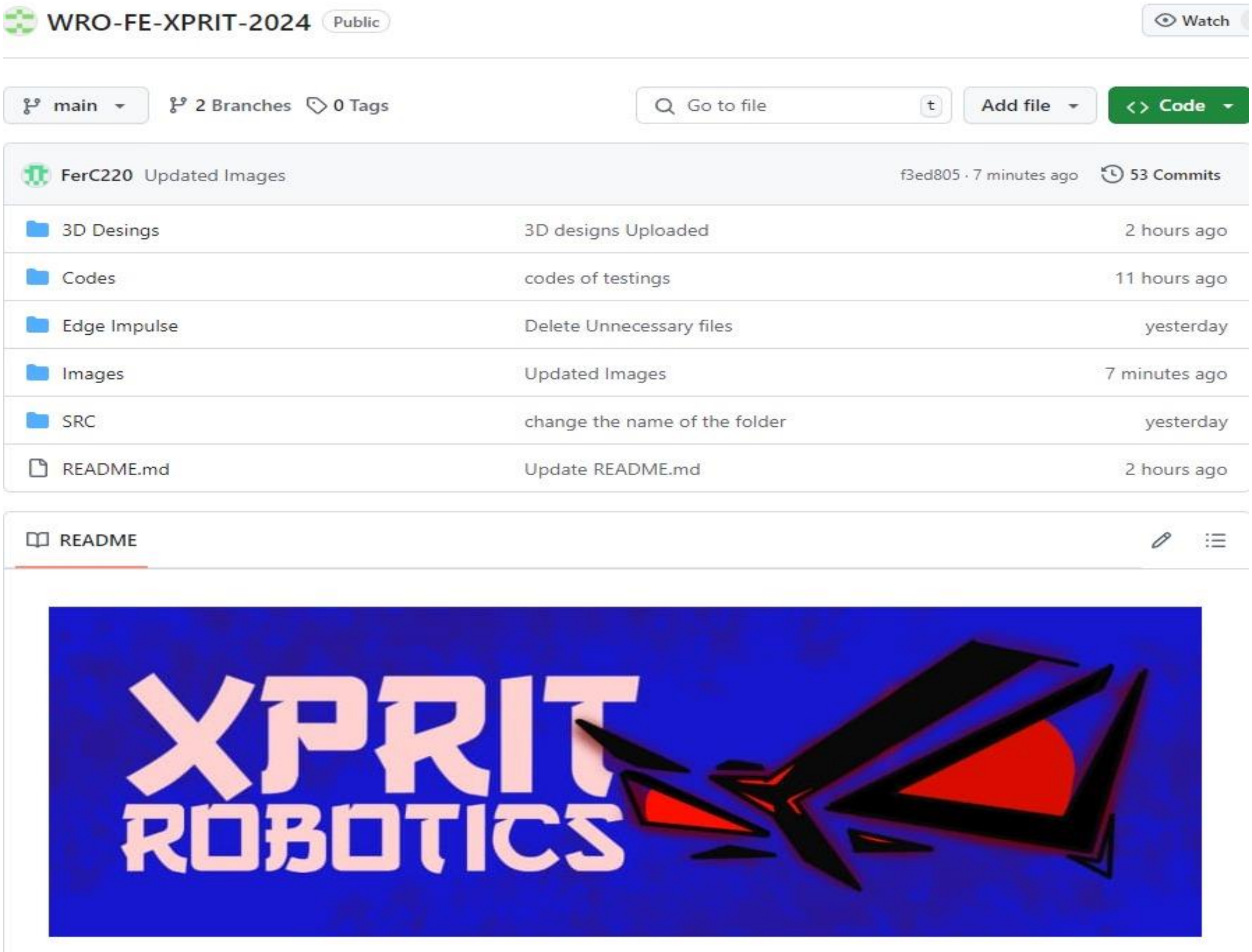


In order to optimize the performance of the ESP32 camera, we train its system using Edge Impulse, a cutting-edge platform that streamlines the creation and training of custom machine learning models. Edge Impulse allows us to develop models tailored to our specific needs, enabling the camera to recognize and differentiate between a wide range of colors and objects with high accuracy. By leveraging this platform, we significantly enhance the robot's ability to identify and avoid obstacles in real-time, ensuring that it can navigate complex environments with precision and reliability. This integration of advanced AI and machine learning techniques into our robot's sensory system represents a significant advantage, providing it with the intelligence necessary to adapt to changing conditions and make informed decisions on the fly.



GitHub

We use GitHub as our version control system, which allows us to efficiently manage and track changes in our code. Additionally, we use it for file sharing among team members and to keep our project documentation up to date, ensuring everyone has access to the latest information and resources.



Engineering Factor

The robot's chassis and all of its mechanisms were designed and 3D-printed by us. The steering system was designed using the Ackerman method. The control board and its circuit were also designed, soldered, and engineered by us.

We use two ESP32-C3 Super Mini controllers: one as the master, which reads sensors and performs calculations to control the robot, and a second as the slave, which receives movement commands. This second controller manages the DC motor and the servo motor based on the information sent by the master.

Additionally, we use CJVL53L0XV2 sensors to provide the robot with spatial awareness, allowing it to detect its surroundings and complete the challenge.