Robot Mower Charging Station

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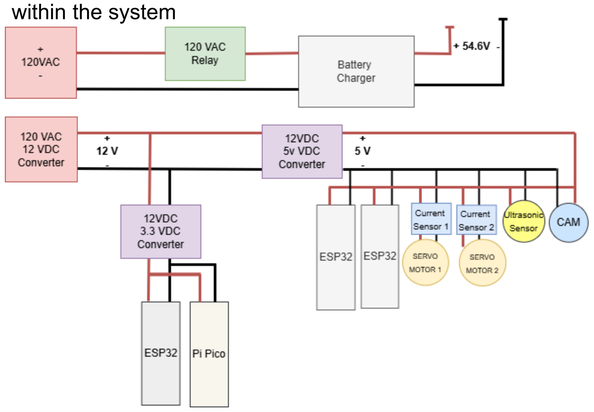
Introduction

The goal of the project is to build a hands-free, automated charging station for a robot mower. The system will include safety features to prevent electrical faults and ensure reliable operation. It will provide a way for users to view the mower as it moves, enhancing monitoring and control. Additionally, the system will notify users of any potential collisions detected by the mower, improving safety and awareness. Real-time information, including collision alerts and weather conditions such as whether it is raining at the location of the mower and the charging station will be reported to a website for remote access. The system will also feature start and stop buttons that allow users to control the mower directly.

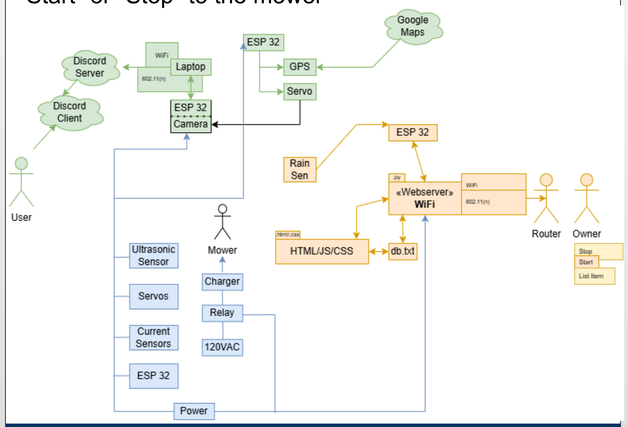
Wiring Diagram

This power control diagram illustrates the electrical system of an automated charging station for a robot mower. The setup begins with a 120VAC input, which powers a relay that controls the battery charger outputting 54.6V to charge the mower. A 120VAC to 12VDC converter supplies power to two voltage regulators: one converting 12VDC to 5VDC and another to 3.3VDC. The 5V line powers components such as two ESP32 microcontrollers, a camera, two servo motors (each with its own current sensor), and an ultrasonic sensor used for proximity detection. Meanwhile, the 3.3VDC output powers an additional ESP32 and a Raspberry Pi Pico microcontroller for control logic and communications. This distributed architecture ensures stable power delivery and reliable operation of all sensors, actuators, and controllers within the system

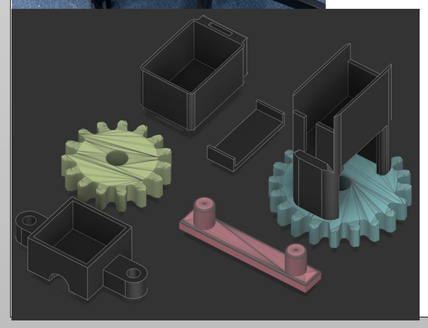


Overall Design

This block diagram illustrates a robotic mower system with interconnected components for power, monitoring, and control. The blue lines show the power flow to charge the battery and power all devices. Green lines represent the monitoring system, where an ESP32 with a camera sends visuals to a laptop via WiFi, which then forwards them to a Discord server for the user, while another ESP32 handles GPS, servos, and a rain sensor, integrating with Google Maps for navigation. Orange lines show the control system, where an ESP32 hosts a web server, accessible via a router, allowing the owner to interact through a webpage and send commands like "Start" or "Stop" to the mower



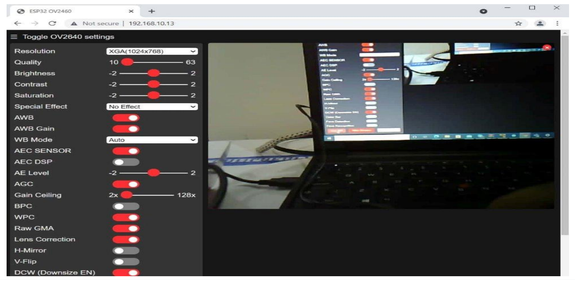
Design



Surveillance System

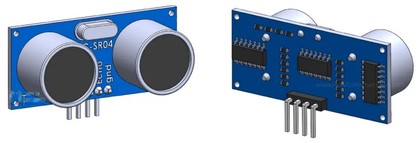
The Charging Station offers and Camera tracking system allowing the user to remotely view the mower. The camera tracks by collecting the GPS coordinate of the station and the mower and moving by the bearing angle between them. This solution offers the user a hands-free system to view the mower while away from home.

Should the mower encounter anything a signal is sent to the station to upload onto the website. The user is then notified via Discord. If two signals are encountered less than 10 feet away from one another the signal is ignored and not sent to the user.



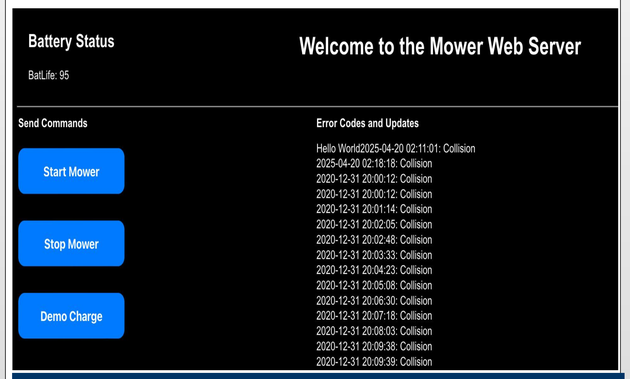
Ultrasonic Sensor

The ultrasonic sensor is used to detect when the robot mower is within 6 inches of the charging station. It continuously measures the distance between the mower and the base. When the mower comes within 6 inches, the system triggers the charging process. This allows for automatic, hands free docking and alignment



Website

The Charging Station hosts a webserver allowing the user to interact with the mower, view some of the status codes coming in from the mower and view the battery life of the mower. This simple interface can be accessed by almost any device near the charging station just using the web browser. This is all bring ran off of a Raspberry Pi and an ESP32. The Raspberry Pi is the microcontroller in charge of running the webserver. It connects to a local router and opens a socket for a client to connect to and then serve the client a custom webpage. The ESP32 is the microcontroller in charge of communicating with various other devices, including the mower, organizing that data, and then sending it out to the Raspberry Pi.



Future Considerations

Some possible considerations should the project continue may include:

-Procuring a more accurate GPS module

-Find a more permanent solution than using copper tape on the charging arms

-Improve reliability of the website

-Offer more ways for the surveillance camera to start its position than only beginning from North.

-improve overall design of the station structure