Rainbot: Automated Sprinkler

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GRAPIDS IRRIGATION

Use Case: The user installs the Rainbot on a standard American football field, connects it to water and AC power supply, powers it on, provides operational parameters via a .csv file, allows the Rainbot to calibrate and coordinate itself, and initiates autonomous operation. The Rainbot navigates the field, applies water uniformly, manages the hose and power cord, and finishes a run without human intervention.

Design Approach: The design approach integrates advanced navigation systems using IMU and GPS for precise positioning, durable brass nozzles for efficient water distribution, a full halo design and nylon-wrapped to prevent hose tangling, and a robust control system with a user-friendly interface.

Prototyping Phases

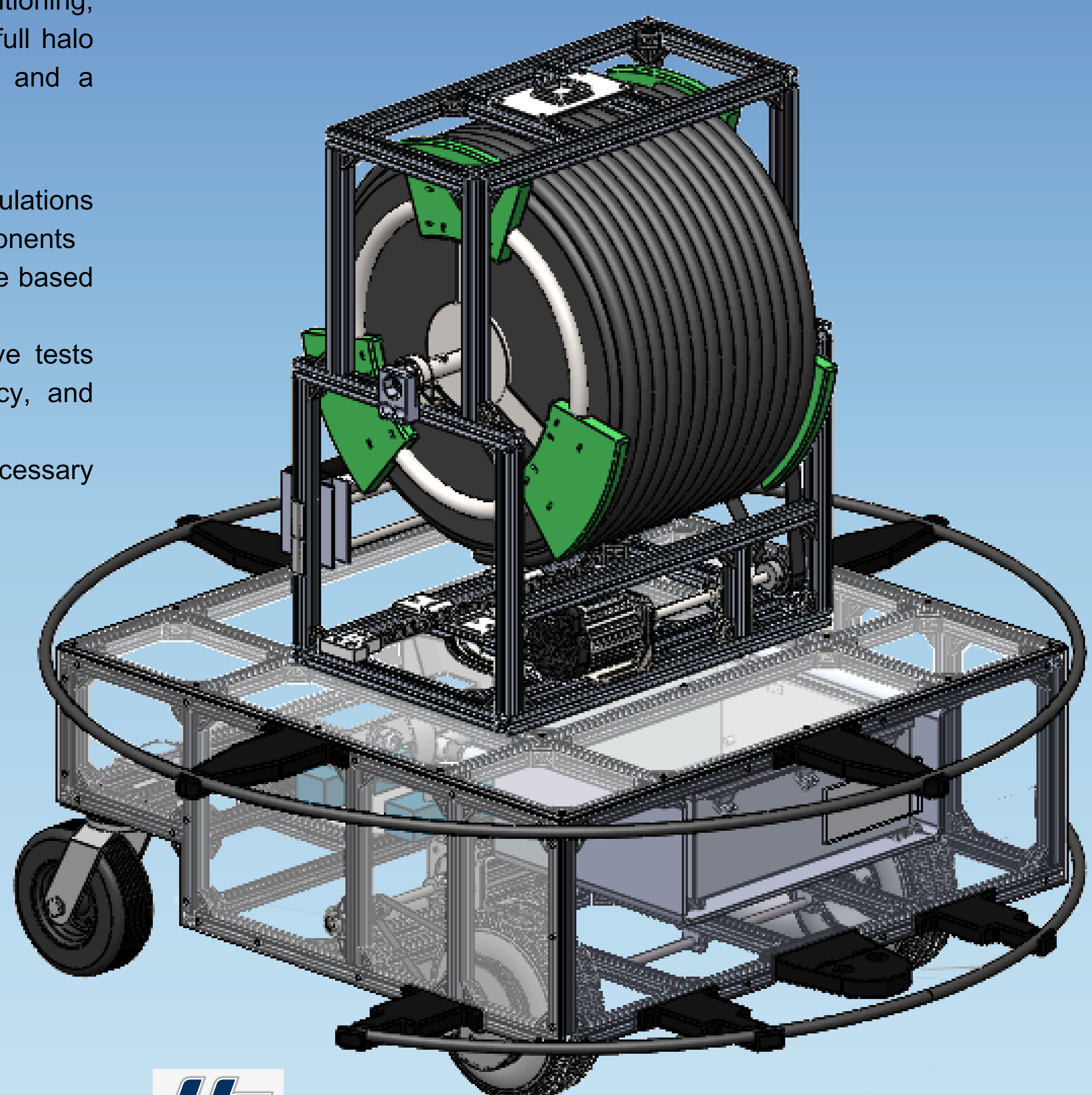
- **Initial Design:** Development of CAD models and simulations to refine the Rainbot's structural and functional components
- **Prototype Assembly:** Building a functional prototype based on the final design specifications
- **Testing and Validation:** Conducting comprehensive tests for navigation accuracy, water distribution efficiency, and overall performance
- **Iterative Refinement:** Using test data to make necessary adjustments and improvements to the prototype

Future Opportunities

- Utilize bulk thermoforming for the ABS plastic body construction
- Develop a reel specifically designed for the Rainbot's requirements
- Implement a single continuous hose with an extended nylon sleeve to protect and manage the hose and power cord
- Find a non-obtrusive method to measure the length of the hose deployed
- Use aluminum for both electrical boxes, incorporating heat transfer mechanisms to manage internal temperatures
- Replace additively manufactured components with injection molding for bulk production

Problem Statement: The existing prototype of the Rainbot, a robotic watering system, faces challenges in hose coiling, straight-line driving, and overall intelligence. These limitations hinder its effectiveness in autonomously watering American football fields.

Objective: To enhance and optimize the Rainbot to address these limitations, ensuring it can autonomously and efficiently water a 28,800 ft² section of a football field.



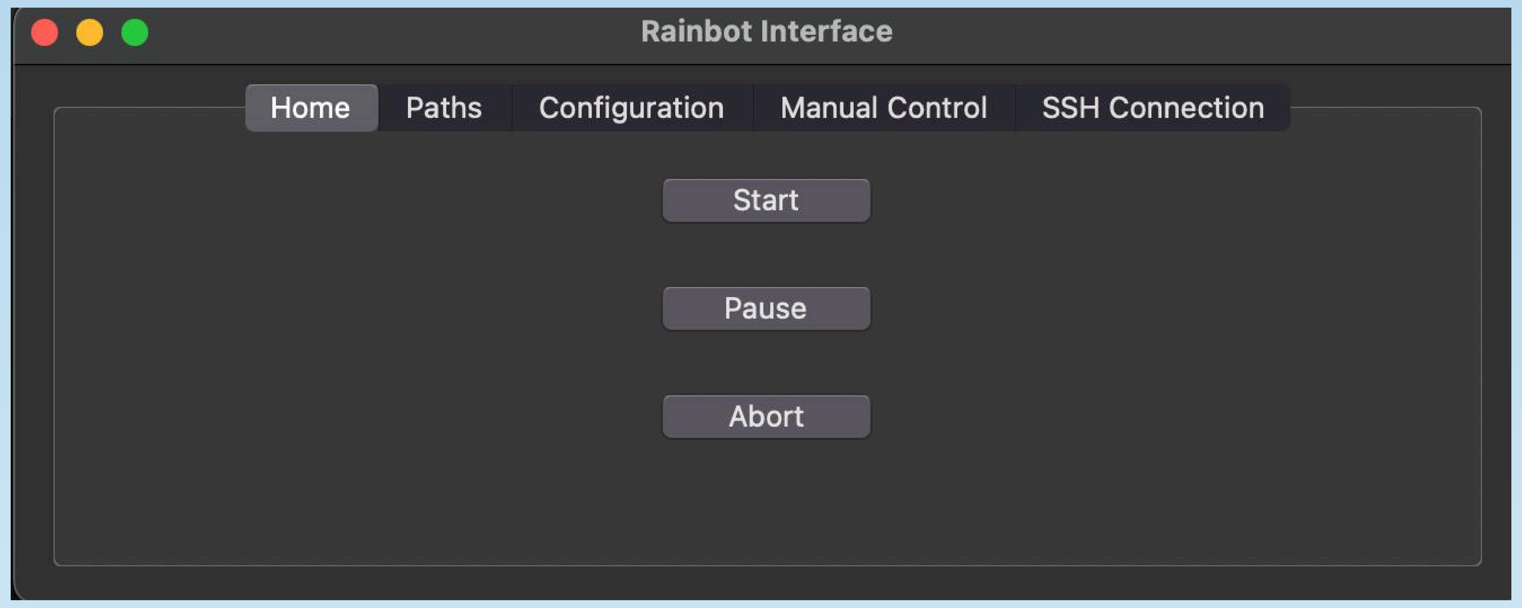
Background: The Rainbot project was initiated to automate the irrigation of American football fields, reducing labor and water waste while ensuring even water distribution. The initial prototype, developed by DISHER, watered effectively but struggled with hose management, straight-line navigation, and lacked intelligent controls. This project aimed to refine the Rainbot's design and functionality to overcome these challenges, providing a robust, autonomous solution for sports turf irrigation.

Key Specifications

- Autonomous navigation with less than ± 1 ft deviation over a 180 ft path
- Ability to apply 1/4 inch of water to a 28,800 ft² area within 12 hours
- Simultaneous retraction and coiling of hose and power cord
- Waterproof casing for electronics
- Safety features including emergency stop buttons and obstacle detection sensors
- User-friendly control panel with remote monitoring and control capabilities
- Weather-resistant exterior

Notable Challenges

- Retraction of hose and cable simultaneously without tangling
- Maintaining straight-line navigation
- Adjusting system output based on user input
- Optimizing the planned path for the Rainbot to travel
- Developing a user-friendly GUI for remote control
- Designing a drive train and frame that could bear the substantial weight of the Rainbot
- Identifying a method to track how much hose and power cord is off the reel at any given time



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