Robotic Lawn Mower

Saharnaz Hadavandkhani

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Project Concept

The robotic lawn mower is designed to work autonomously in outdoor environments, using sensor-based
navigation similar to robotic vacuum cleaners. The purpose of the project is to create a time- and cost efficient
solution for homeowners and individuals who typically hire lawn care services. By developing this device, users can maintain their lawns without manual labor or the need to hire external services.
The intended audience for this project includes homeowners, elderly individuals, and those with large
lawns who seek a hands-off approach to lawn care.

Design Principles

The design will incorporate the following principles:

- Aesthetics: A sleek, compact design using durable, weather-resistant materials.
- Functionality: Equipped with rotating blades, self-navigation capabilities, and solar charging to ensure efficient mowing over varying terrain.
- Usability: An intuitive interface for setting schedules and monitoring performance through a smartphone app.
- Sustainability: Powered by rechargeable batteries and optional solar panels, reducing energy consumption and environmental impact.

Action Plan

Electronics and Assembly

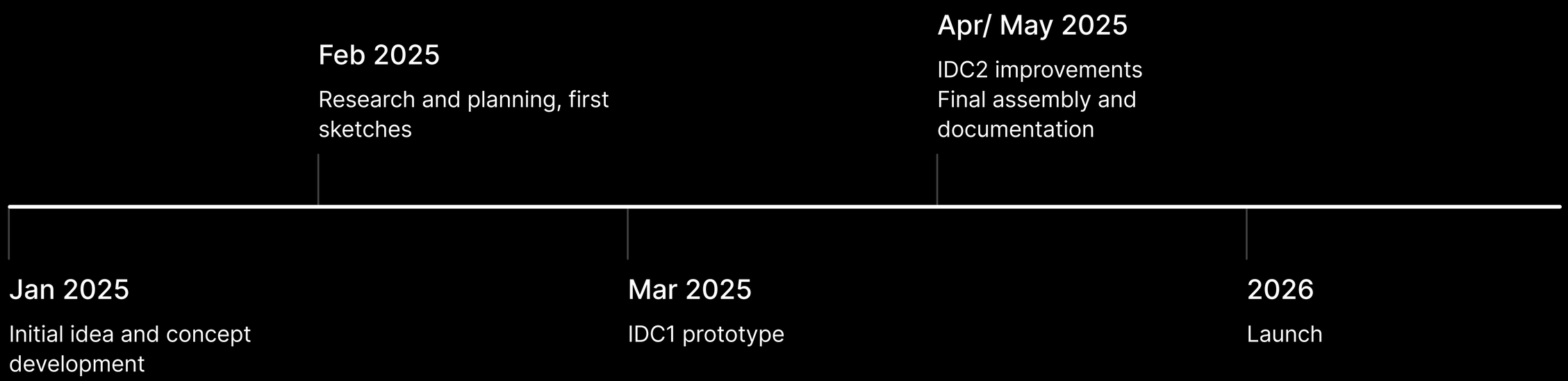
• Microcontroller: Implement Arduino with motor driver shields for controlling
wheel movement and blade rotation.
• Sensors: Install ultrasonic or LiDAR sensors for obstacle detection, GPS for navigation, and wheel encoders for speed calculation.
• Motors: Use DC motors for both the wheels and blade system.
• Power: Use lithium-ion batteries for power, with an optional solar panel for charging.
• Assembly: Wire the microcontroller, sensors, and motors, and install everything into the protective casing.

Action Plan

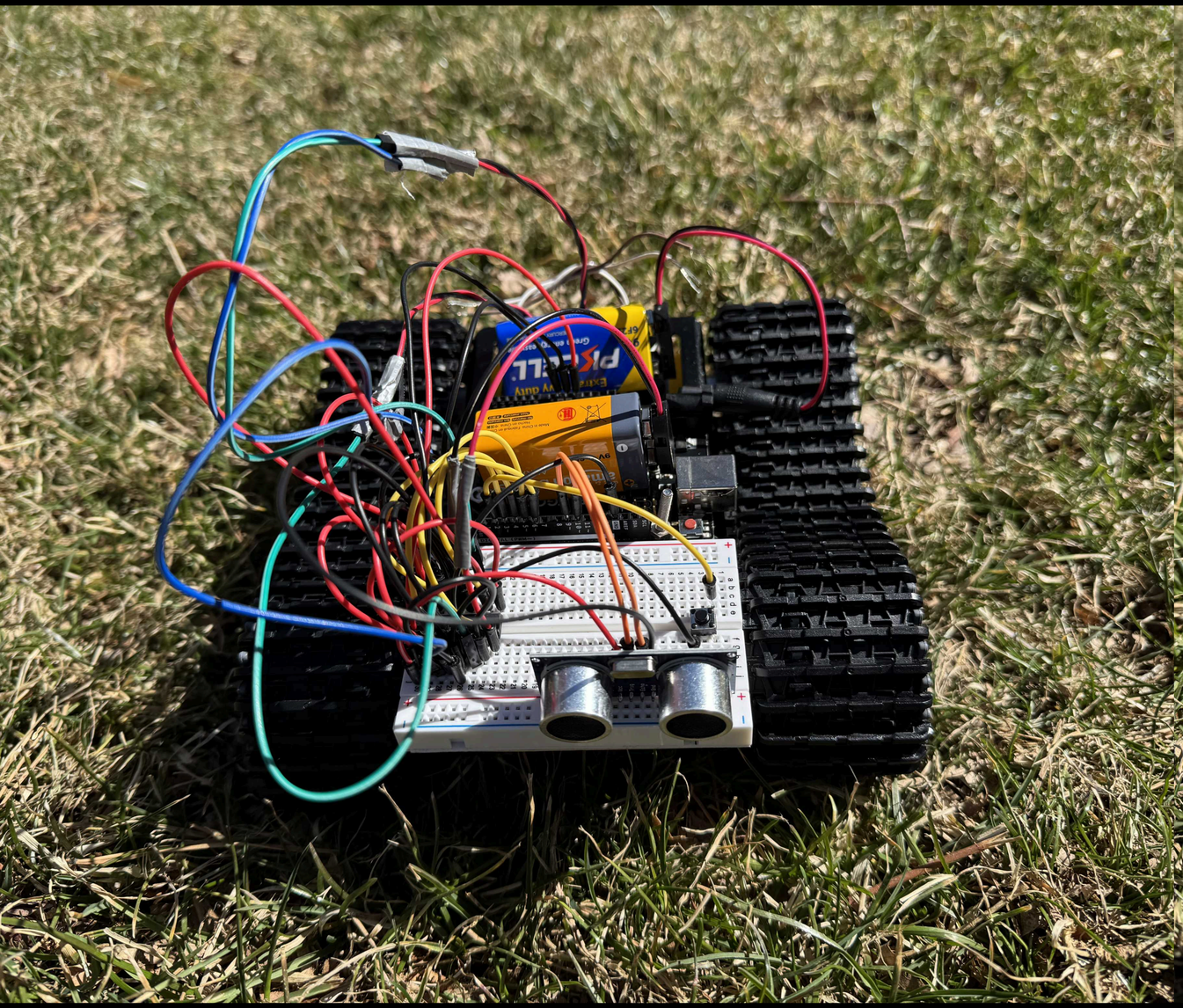
Software and Programming

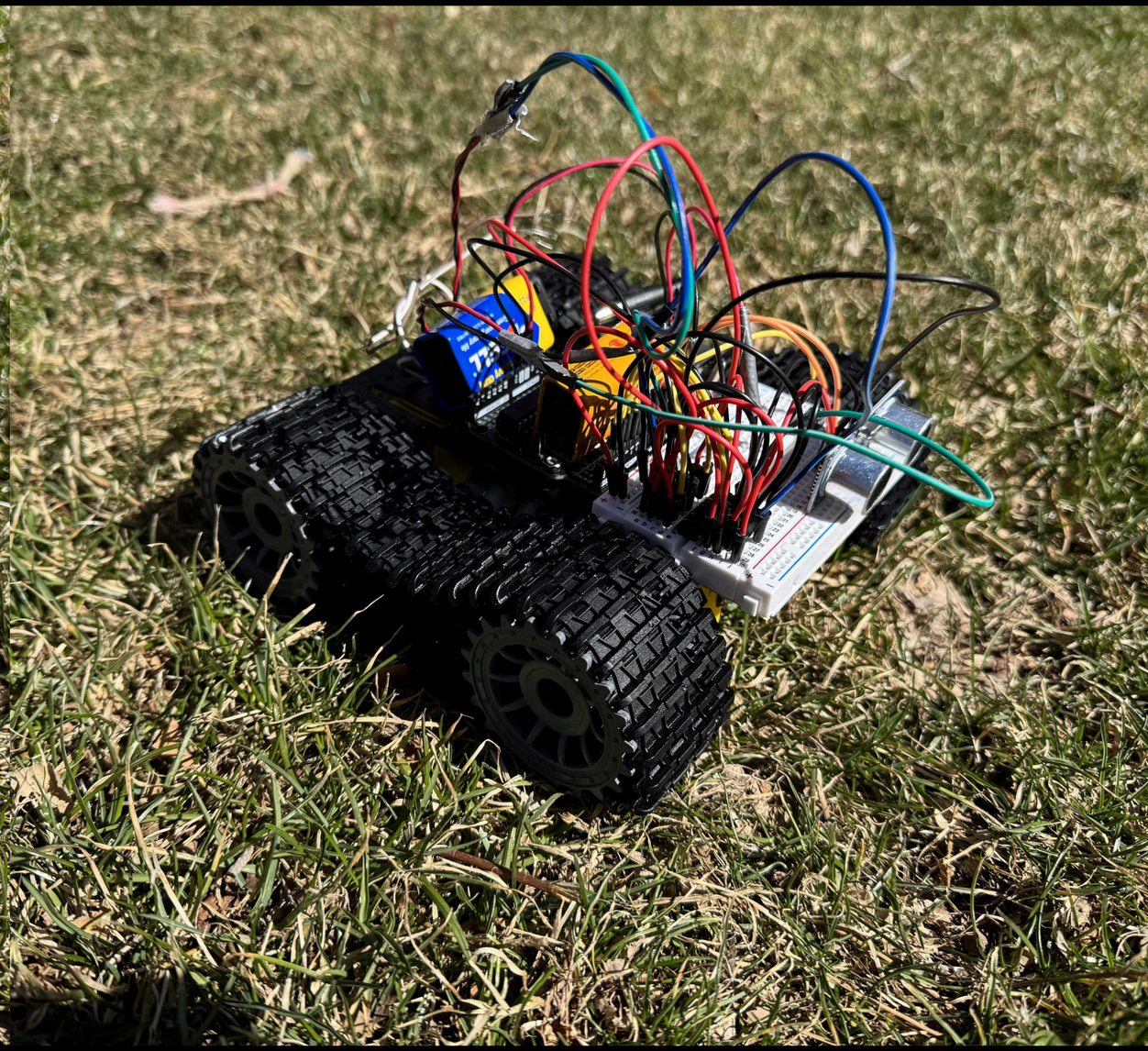
- Navigation Algorithm: Program the mower with a random walk or GPS-based lawn mapping algorithm for efficient coverage.
- Obstacle Avoidance: Write code to stop and reroute the mower when detecting obstacles.
- Safety Features: Implement automatic blade shutoff and manual stop buttons.
- Battery Management: Write software to monitor battery life and trigger return-to-base charging.

Timeline


Jan 2025
Initial idea and concept development
Feb 2025
Research and planning, first sketches
Mar 2025
IDC1 prototype
Apr/ May 2025
IDC2 improvements
Final assembly and documentation
2026
Launch

IDC 1:





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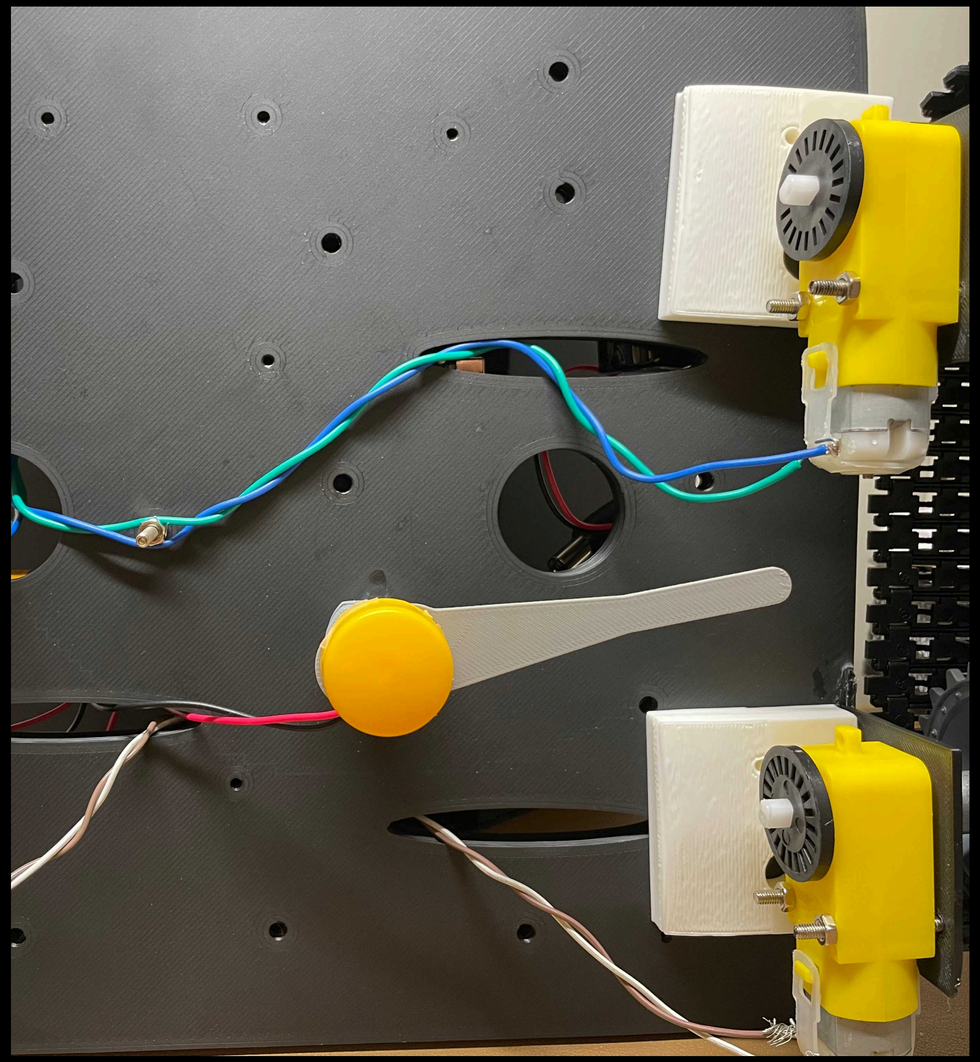
IDC2

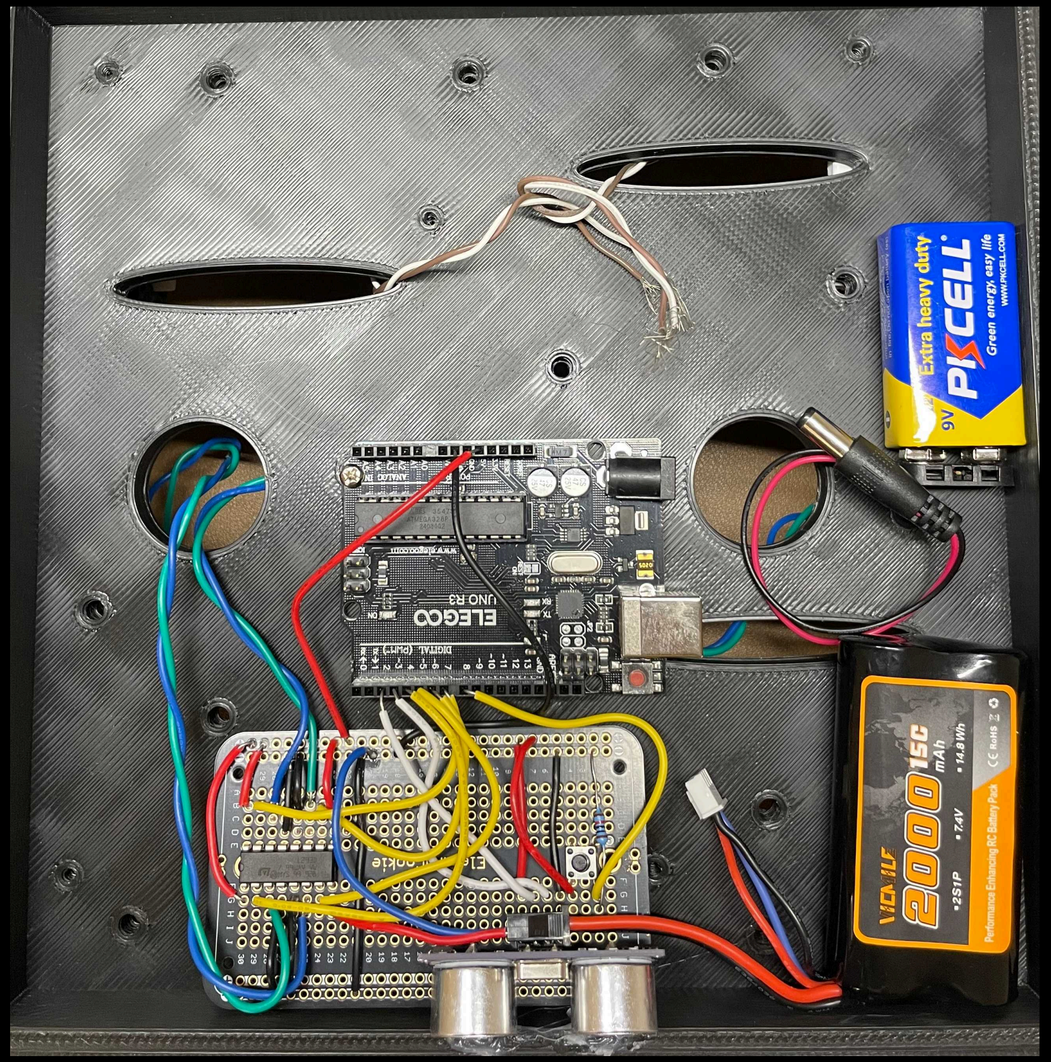
For my IDC2 project, I developed the second iteration of my robotic electric vehicle from IDC1. Based on feedback from my professor and classmates, I focused on improving durability, power supply, and overall construction.

Key Improvements:

- I designed and 3D printed a new, larger casing with a closable lid to better protect and organize the components.
- I resolved the motor direction issue from IDC1, and the robot now moves as intended.
- All necessary circuits are now soldered, replacing the previous breadboard setup.
- I added a simple blade connected to a DC motor to begin transforming the vehicle into a lawn mower.
- I integrated a 2000mAh rechargeable lithium-ion battery, addressing specific feedback on power reliability.



Underside view



Internal view

Key Improvements:

New Fabrication Element:

The custom 3D-printed case improves the layout, protection, and professional appearance of the device.

Craft Quality & Construction:

All wiring is soldered and enclosed, and no temporary materials like tape are used. The result is a more refined and durable prototype.

Challenges Overcome:

I overcame issues with motor function, unstable wiring, and limited space by improving the power system, soldering connections, and designing a better enclosure.

Future Improvements:

I plan to add a control panel and display screen, along with a solar charging system to enhance usability and sustainability.