Agriculture Robot - Team 20b: Daun Bot

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Summary

Manual soil sampling is inconsistent and inefficient, making crop management challenging. Our autonomous soil sampling robot improves precision and efficiency by navigating various terrains, extracting soil at consistent depths, and storing samples for analysis. Designed for all-weather conditions, it reduces labor costs, enhances data accuracy, and supports sustainable farming.

Key Features

Unmanned Ground Vehicle:

- 4 large tires, DC motors, and a multi-level storage system.

Soil Sampling Probe:

- Designed for minimal soil disturbance while ensuring consistent depth.
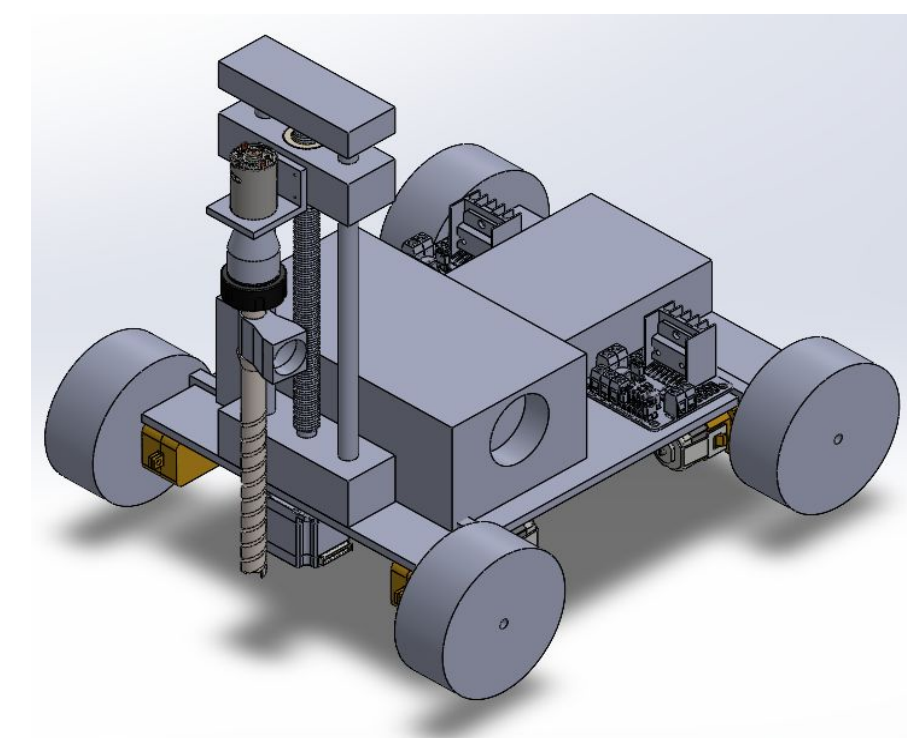
Power System:

- 6+ hours of continuous operation.

Navigation System (Potential Feature):

- Exploring GPS-based tracking for precise sample location recording.

Goals & Objectives:

- Precision Sampling: Extract soil at consistent depths with minimal disturbance.
- Robust Navigation: Operate in varied terrains without damaging crops.
- User Accessibility: Easy access for farmers to retrieve samples.

Engineering Design & Analysis

Chassis & Mobility:

- Tires vs. Treads: Tires improve maneuverability, cost, and efficiency.
- Material Selection: PETG offers superior weather & impact resistance over PLA.
- Power System: DC motors chosen for compactness and lower maintenance.

Sampling Mechanism:

- Probe vs. Auger: Auger chosen as it utilizes rotational force for better penetration in compact soil.
- Actuation Comparison: Pneumatic actuation was chosen due to its lightweight and efficient performance.

Analysis Highlight:

- Required Probe Force: 300 psi for compact soil penetration.
- Ensured 6+ hours runtime based on power draw calculations.

Future Improvements

- Increased Sampling Depth: Optimizing penetration for harder soils.
- Enhanced Navigation: Greater accuracy in dense crop fields.
- Solar Integration: Investigating renewable energy solutions for prolonged operation.

References

Soil Sampling Guidelines: Environmental Protection Agency (EPA)
https://www.epa.gov/sites/default/files/2015-06/documents/Soil-Sampling.pdf

Soil Probe Accuracy: Research USDA Forest Service
https://research.fs.usda.gov/treesearch/61636

Direct Push Soil Sampling: Technology Geoprobe Systems
https://www.geoprobe.com/direct-push-soil-sampling

Acknowledgements