

Autonomous Soil Analysis Unit

Clare Keough, Matthew Kennett, Griffin Schroeder, Hayden Tillhof

Advisors: Dr. Sachit Butail, Dr. Iman Salehinia

Departments of Electrical Engineering and Mechanical Engineering



NORTHERN ILLINOIS UNIVERSITY

College of Engineering and
Engineering Technology

Abstract

The Autonomous Soil Analysis Unit (ASAU) designed by the Mars Rover Club is the first system to collect *and* analyze soil in real-time. While others have attempted this feat, the ASAU makes such soil collection and analysis autonomous and reliable. The ASAU applies multiple ideas and components to complete its goal and demonstrates versatility in doing so. This prototype version of the ASAU is built so that sensors can be exchanged to sense either nutrient deficiency, pesticide presence, or others.

Introduction

Soil testing and analysis in and of itself is not revolutionary. Global research is dedicated to discovering soil's multivariate contents both on Earth and other planets.

In agriculture, for instance, soil samples are taken directly from the field and sent to a testing facility for nutrient analysis. Implementing the ASAU, farmers can collect and analyze soil to detect potential obstacles in crop production instantly.

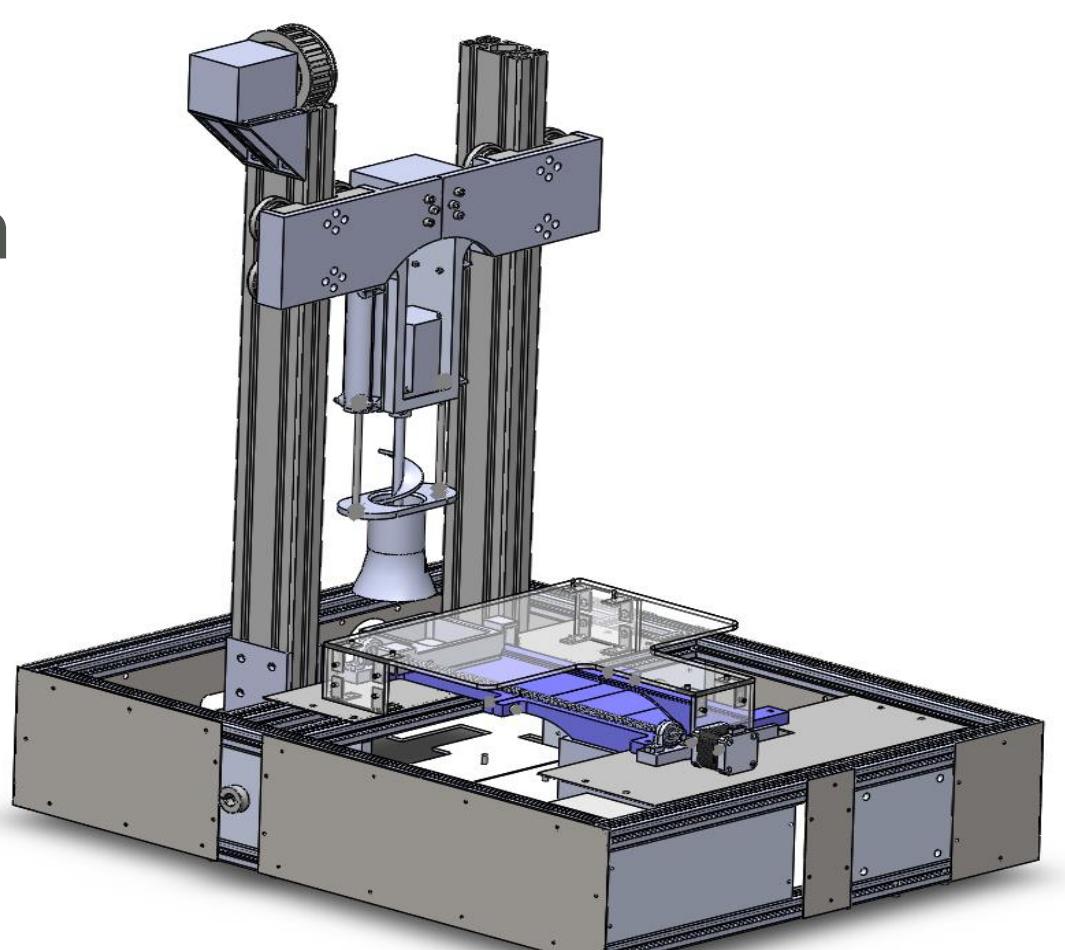


Figure 1: Full ASAU

Methods and Materials

Soil Collection: The ASAU operates using a timing belt pulley, two motors and an auger. The auger is lowered into the ground and acts as a screw conveyor to collect soil samples. The soil will remain in the auger's sheath until distributed into the collection cup.

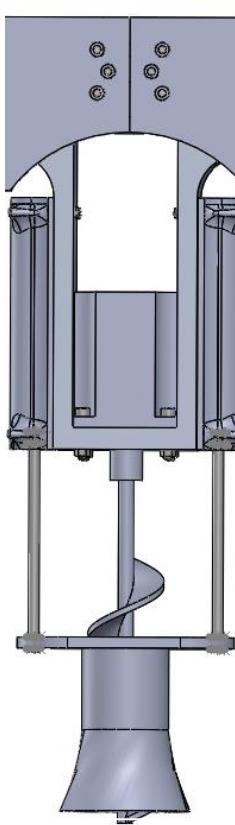


Figure 2: Auger Assembly

Soil Distribution: Once in the collection cup, a 3D printed track transfers the samples to the various sensors for analysis.

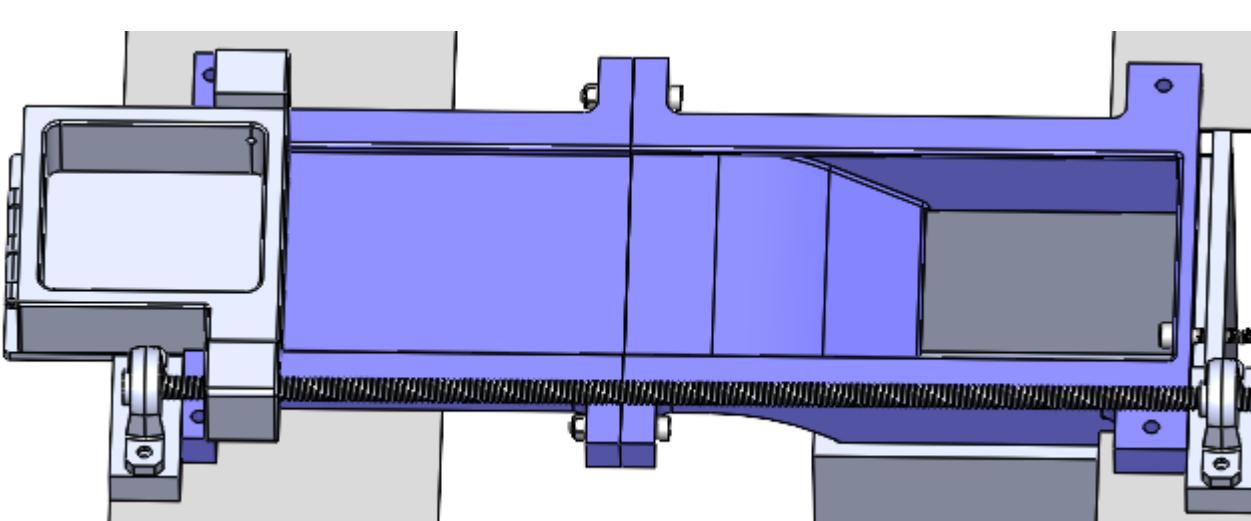


Figure 3: Track and Soil Collection Cup

Soil Analysis: The sensors measure CO₂ concentration levels, total volatile organic compounds, soil moisture, temperature, relative humidity, and, has the potential to detect other characteristics, such as pesticide content.

Applications

The ASAU is designed primarily for the NIU Mars Rover Club's University Rover Challenge. However, the system can be leveraged in an agricultural and scientific setting, too. This design will be given to the Mars Rover Club for future advancements and implementation.

Conclusions

The ASAU is a revolutionary system. It merges multiple fields of study – agriculture and geology, for instance - and can allow for greater harmony between researchers. This just scratches the surface. In more creative and entrepreneurial hands, such a device could impact the speed of market production.

Acknowledgements

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