Solar Agribot

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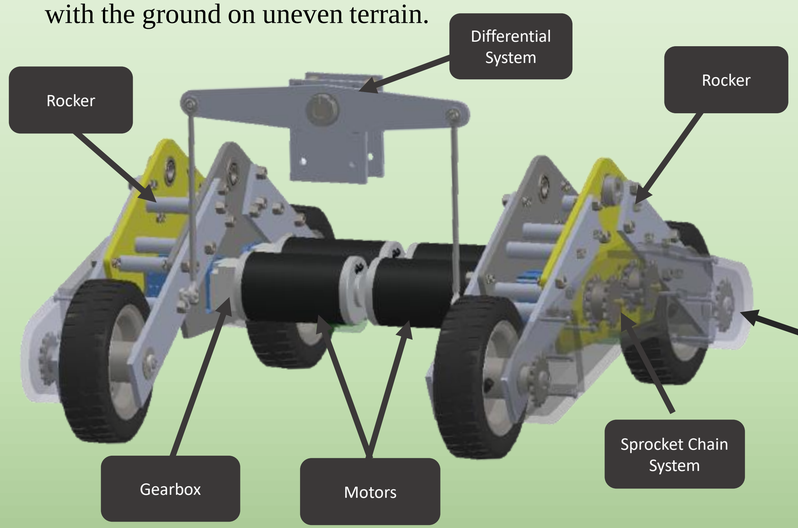
Abstract

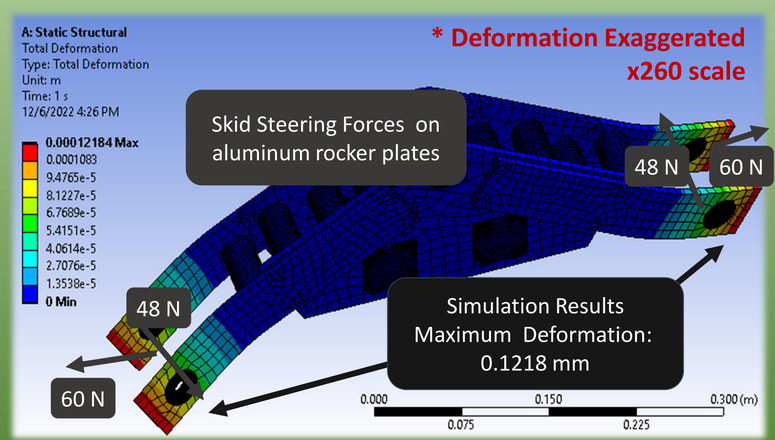
We developed a battery-powered robot prototype to improve corn production efficiency while limiting use of fossil fuels. The robot takes soil samples and selectively administers fertilizer.
It communicates with and parks in a hub station that refills the fertilizer tank and uses a solar collector to recharge the battery.

Suspension and Transmission

- A rocker suspension was chosen to ensure maximum wheel contact with the ground on uneven terrain.

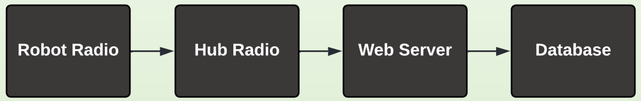


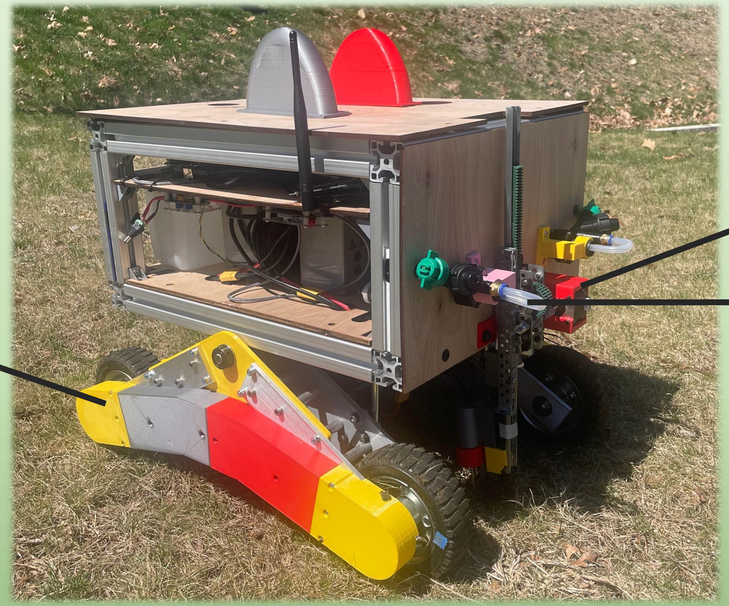
Deformation of Rocker During Skid Steering



Communication

- The robot's radio transceiver sends soil sample data to the hub's radio, which then relays it to a web server and stores it in a database.





Solar Charging

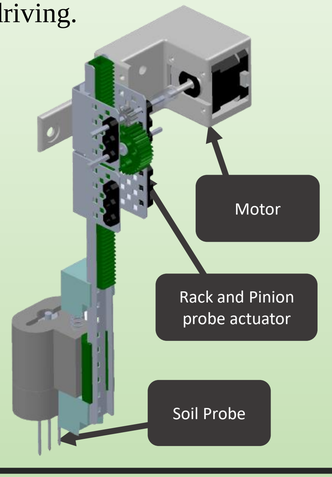
- The hub's solar panel can fully charge its internal battery in 6 hours. This is sufficient to fully charge the robot's battery in 4.1 hours.
- The robot can operate for a minimum of 13 minutes, even while operating in suboptimal driving conditions.

Navigation

- RTK (Real-Time Kinematic) positioning utilizes triangular coordinates of the satellites, custom signal tower and the dynamic location of the rover's receiver. A tilt-compensated IMU (Inertial Magnetic Unit) module gives magnetic heading.

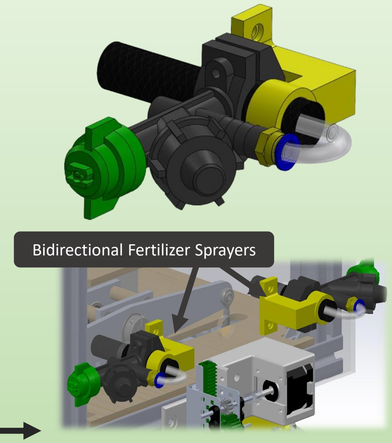
Soil Probe

- The probe extends into soil to measure NPK (Nitrogen Potassium Phosphorus) values and retracts while driving.



Fertilization

- Bidirectionally sprays fertilizer on nutrient depleted soil as needed.
- A float switch sensor monitors tank fluid level.



Farmer Soil Data Dashboard

- Interactive website that allows farmers to visualize soil conditions around the farm.

Acknowledgements

Washburn shops staff, PracticePoint staff, Neil Rosenburg, Brad Miller