University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

UCARE Research Products

UCARE: Undergraduate Creative Activities & Research Experiences

Spring 5-8-2016

Agricultural Field Robotics for Plant Data Acquisition

Jeremy S. Blackford
university of Nebraska lincoln, jblackford400@gmail.com

Jared Werner
University of Nebraska-Lincoln

Tyler A. Troyer
University of Nebraska-Lincoln

Ethan Nutter
University of Nebraska-Lincoln

Follow this and additional works at: http://digitalcommons.unl.edu/ucareresearch


Part of the Biomedical Engineering and Bioengineering Commons, Electrical and Computer Engineering Commons, and the Mechanical Engineering Commons

Blackford, Jeremy S.; Werner, Jared; Troyer, Tyler A.; and Nutter, Ethan, "Agricultural Field Robotics for Plant Data Acquisition" (2016). *UCARE Research Products*. 97.
http://digitalcommons.unl.edu/ucareresearch/97

This Poster is brought to you for free and open access by the UCARE: Undergraduate Creative Activities & Research Experiences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in UCARE Research Products by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Agricultural Field Robotics for Plant Data Acquisition

Jeremy Blackford, Jared Werner, Tyler A. Troyer, Ethan Nutter

Advisor: Dr. Santosh K. Pitla, PhD, Assistant Professor

Advanced Machinery Systems Laboratory (AMSL)

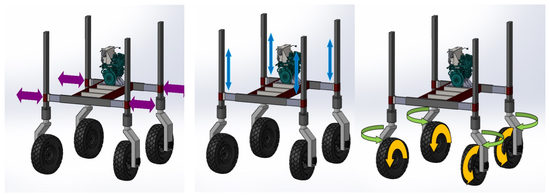
Department of Biological Systems Engineering

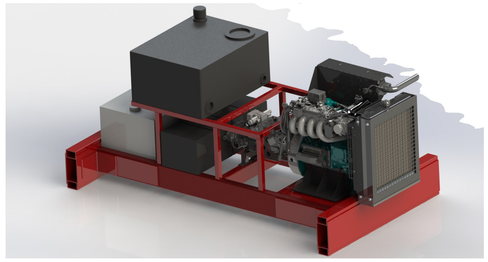
Introduction

As the demand for food increases, we are presented with the challenge of producing food more efficiently. With the help of agricultural robots it will be possible to achieve greater yields by the application of seeds, fertilizers and chemicals in the most efficient way possible. With more advanced robotic systems accurate crop data can be obtained to improve farming products and techniques.

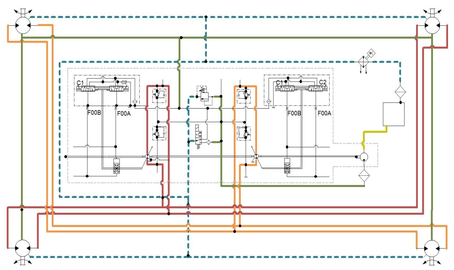
Flex-Row Ag-Robot

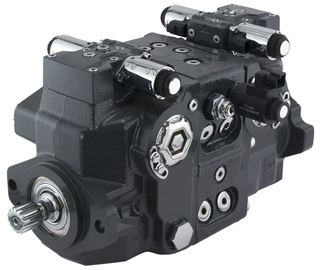
Background: Flex-Row is a medium sized agricultural robotic platform built for autonomously traversing through rough fields during multiple crop growing stages. This platform consisting of a flexible frame with the ability to vary both width and height will initially be implemented with sensors to monitor production plants throughout the growing season. Furthermore, the robot will perform low draft applications such as spraying. The intended goal for this project is to develop a tele-operated platform that can be automated in the future.



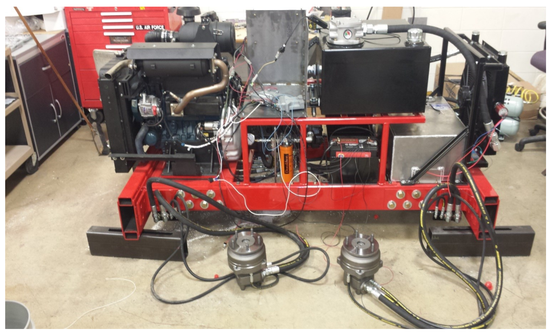


Drivetrain: A Kubota 57HP gasoline engine (WG1605-GL-E3-KEA-1, Kubota), which powers an H1 Series Danfoss tandem hydrostatic pump powers the machine. The flexible structure requires each wheel to be independently driven and steered. Four fixed displacement hydraulic motors, one for each wheel, are engaged by the pump.





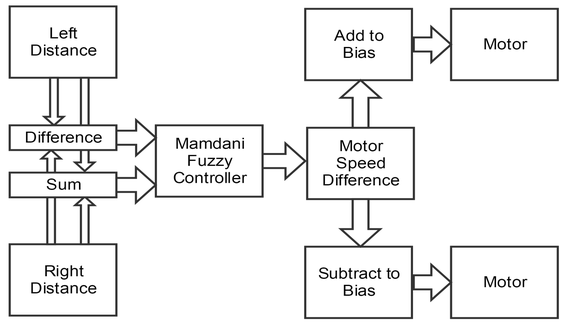
Embedded Programming: The platform is currently controlled with embedded Danfoss Plus +1 programming to control engine startup and speed, as well as the displacement of each pump.

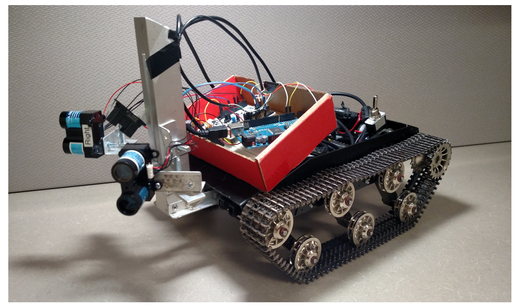


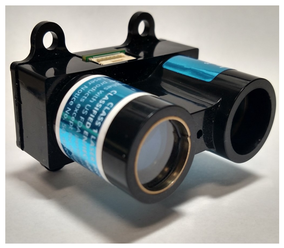
Inter-Row Ag-Robot

Background: Inter-Row is a much smaller robot designed specifically for plant data acquisition. Tall height is not needed as it individually scans each plant a few cm from the base of the plant. The robot will help eliminate the need for manual labor when counting number of plants per row, which is beneficial on a large acreage field.

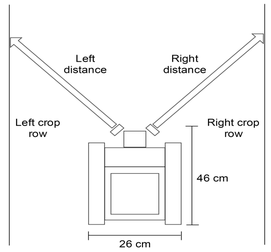
Navigation: Inter-Row, based on the tracked chassis, is guided by the use of several components. The fuzzy control model shows that the robots navigation is defined as a left and right distance, and a left and right wheel/track velocity. .



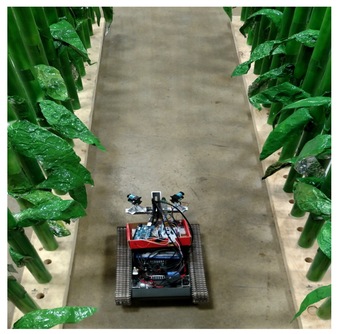


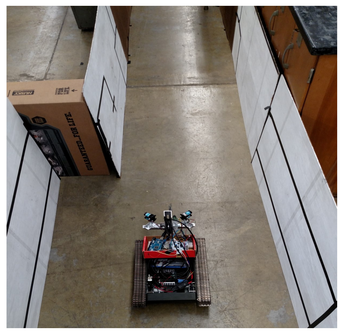


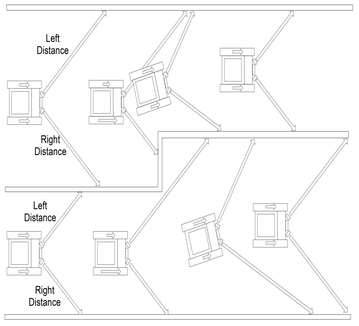
- LIDAR ranging sensors monitor the left and right distances at the front of the chassis aimed at a 45 degree angle.



- This control model was based on the single goal of maintaining a centered position between crop rows.







Conclusions

With the future use of agricultural robots crop inputs can be managed much more efficiently than current day tractors. Managing fields per square meter basis rather than per hectare basis will be possible. Decrease in soil compaction, increased soil and plant monitoring; and less human error will occur when conducting repetitious work using agricultural robots