CALIFORNIA STATE UNIVERSITY | Chico

Autonomous Farming Agricultural Research Initiative and LaserMan

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Project Overview

The purpose of this project is to develop an automated way of marking seeding points to reduce the cost of labor and time.

The objectives of this project include:

- Navigate given GPS locations
- Traverse typical farm terrain
- Avoid obstacles
- Accurately mark points
- Be easy to operate

The constraints of this project include:

- Rugged
- Autonomous
- Easy to operate
- Weather resistant
- Mark points
- Accurate

The Topcon GPS Unit

The Conventional Way

Currently farmers are using strings and stakes to mark out seeding points in a field. This method takes considerable time and man power to complete.

Farmers Manually Marking A Field

How the New System Works

An automated electric vehicle uses GPS feedback to locate the desired seeding points. The vehicle marks these points using a paint marking mechanism.

Benefits

In addition to furthering autonomous farming technologies, this project provides the following immediate benefits:

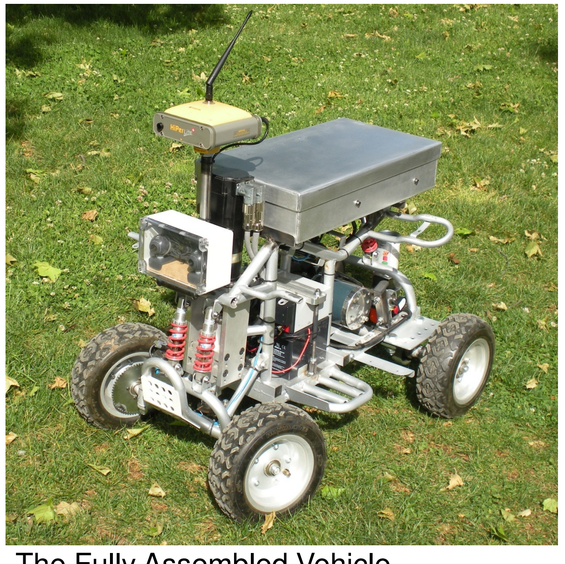
- Reduces the cost of labor
- Expedites marking process

Feedback

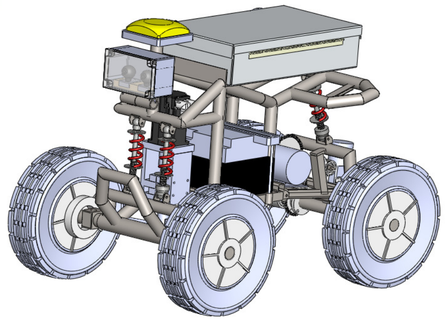
The vehicle uses GPS to receive heading feedback, relative to the target direction. The motion controller uses encoder feedback to govern the motion of the vehicle as desired.

Testing

To test the vehicle, the user should locate a number of GPS points, designate the desired seeding row, and specify row spacing. The vehicle will drive autonomously along the row. When the vehicle reaches each seeding point it will use a spray paint can to mark the point clearly.



The Fully Assembled Vehicle



SolidWorks Model Of Vehicle

Control Algorithm

The software is designed to run on any Windows machine, and communicates to the vehicle using standard RS232 and Ethernet communication protocols. A PID controller automatically directs the vehicle accurately to the next GPS location. A microcontroller actuates the spray paint mechanism at the commanded GPS location, while maintaining the desired spacing between points.

Mechanical Modifications

The vehicle was modified to include:

- GPS and Stereo Vision Camera mounts for navigation
- A more powerful drive train system
- Increased ground clearance
- Limit switches and motor encoders to ensure vehicle position
- Spray can marking mechanism to indicate points for future planting