Unmanned Ground Vehicle

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Introduction

Accurately finding leaks is increasingly important to the public, state and agricultural industries. Water leaks typically expand over time leading to even greater losses, if untreated. (CADWR) Routine scheduled maintenance can reduce the overhead costs and the amount of unexpected repairs. The DWR reports that savings can be achieved up to 80% with regular water leak detection and surveying at $200 per acrefoot. (CADWR) Leaks can extensively damage nearby infrastructure overtime such as roads and buildings.

Objectives

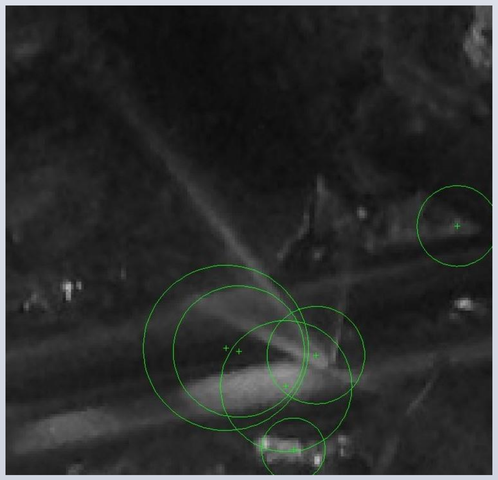
Finding water leaks in large densely cultivated farmland is costly and time consuming. Current methods for detecting water leaks requires the use of countless farm laborers who roam hundreds of acres at a time to detect a leak. The use of a fully integrated unmanned ground vehicle (UGV), which serves as a platform for a camera, will be instrumental in helping farmers save time, money, and water. Innovative image processing techniques coupled with the use of unmanned ground vehicles (UGVs) will have large farming implications which will lead to a decrease in overhead costs, assist in the conservation of water, and have a low margin of error.

Materials and Methods

We have two teams working on this project: the autonomous vehicle implementation team and the image processing team. The autonomous vehicle implementation team has outfitted a commercially available ⅛ scale 4x4 monster truck with a Pixhawk Autopilot System.

This model provides a strong platform that can withstand multiple crashes in case of error in navigation. The 4 wheel drive and clearance of the vehicle can handle different types of stress on multiple terrains.

Currently, the UGV utilizes the Mission Planner program with ArduRover 2.50 firmware. The UGV is controlled using a Panasonic Toughbook, essentially our ground station, and a Spektrum DX7S 8 channel controller for manual control. The UGV can successfully navigate using GPS waypoints. The image processing team has been working on techniques to detect leaks from a moving vehicle.



Results

Three features distinguish our proposed alternative:

1. Data collection platform
2. Algorithm design
3. Friendly user interface

Development over the next year:

We plan to fully implement these objectives over the next year in order to successfully complete

the project:

1. Have the vehicle be completely autonomous and dependent on only one input device.

Likewise, have the vehicle function autonomously in GPS denied environments.

2. Accurately capture water leaks through image processing techniques with a very low

margin of error (false positives).

3. Display the interpreted data in user friendly way

Conclusions

The image processing and UGV teams are already at work on completing these objectives; the UGV team is working on the final stages of the autopilot system and the image processing team continues to optimize the capture of water leaks. Over the next year, we plan to complete field tests with a local orchard that has given us permission to test. We believe we have strong team members that have the full capability to implement these ideas into a full working product.

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