

Project Plan Design
SmartAg LLC Autonomous Planter
DEC1609

1. Our project, Autonomous Planter by SmartAg LLC, is the beginning of an autonomous seed planter. The project is based around an RC robot that will be controlled either through commands given through a user on an android app, desktop app, or remote control.

The overall goal of this project is to have a basic package for Colin that includes:

- Autonomous Robot Control
 - A user interface that is easy to use
 - Robot tracking, including status, fluid levels, and position
 - All done through server access for plug and play accessibility
2. Project Specifications:
 - Establish remote robot control
 - Use existing commands on the robot to perform basic motion
 - Drive a set distance without veering to either side on uneven terrain
 - Execute turns of veering angles while keeping in mind the equipment the robot is polling
 - Insure an emergency stop/shutdown
 - This will be done amicably to insure the safety of the robot and any other personal in the area. As well as the option to do so remotely at the users will.
 - Establish remote robot monitoring
 - Report all data that is available from the robot to the server
 - The GPS location
 - The current readout of all gages
 - The video/pictures captured from onboard cameras
 - Detect obstacles (if not already provided) such as rocks, fences, creeks, etc.
 - If an obstacle is detected send a message to the server, to ask the user what they would like to do
 - Go over the obstacle
 - Go around the obstacle
 - Do nothing and simple wait for the user
 - Server
 - Collect and store most recent data
 - Keep track of where the robot is and has been in the said field
 - Provide further instruction to the robot
 - Where the robot should go next
 - If the robot needs to engage or disengage the equipment it is polling
 - If the robot should stop or shutdown immediately

- When multiple robots are working in the same field, insure they are adequate distance from each other and they all know relatively where the other robots are to prevent a large number of false obstacle alarms.
- Provide a storage location for the users versus robot objects
- Provide a storage location for data on multiple field, which a user may upload
- Provide an API for a variety of path planning algorithms to use
- The starting algorithm will be a simple back and forth algorithm, the primary use will be for proof of concept.
- Create a web and android applications that will interact with the server, provide for the end user with an easy to use gui.
 - Show live read-outs of onboard gages
 - Provide alerts if any sensors detect a problem prompting the user to give forth instruction on how the issue should be handled.
 - False alarm
 - Go around
 - Wait for me to arrive
 - Stop all robots in the field
 - Show a google map view of the field with the current and past locations of the robot marked clearly
 - Allow the user to see and modify the path the robot will take
 - Allow the monitoring and control of multiple robots in multiple field
 - Provide shutdown and stop for any one or all robots
 - Provide an interface to assign specific robots to specific feeds
 - Provide live or recent picture from the robot to show the user what would normally be seen from physically being on the robot

3. Importance of specifications:

- Establishing robot controls is important because it is the base of our project.
- Robot monitoring is required because it gives the farmer a peace of mind that his robot is operating safely, as well as is in a condition to continue operating.
- Storing everything within the servers is important as it allows the farmer to connect through multiple devices, and still be able to get up to date, and accurate data of their machinery. It also gives an archive of information for the farmer to use to improve his farming capabilities.
- Creating the user interface is one of the final specifications, and it is what the farmer will actually be seeing and interacting with. It is important that it is easy to use, intuitive to the farmers needs, and functional with the rest of the project.

4. Project requirements are what the product must do from a business perspective and project specifications are for a more technical audience. The minimal requirements given by our client is that we will be able to control a robot that is given to us to sub inch accuracy, develop a mapping program to draw boundaries, create a coverage map,

waypoint following, replicated pattern programming, avoid obstacles, RC control take over, and monitor other data such as fuel level, speed, slippage, and planter row unit drive speed/planting population. We have based the project specifications off of the business requirements given to us by Colin.