Restated Project Plan and Design Specifications

Robo-Weeder

Team #11

1/15/16

Submitted to: Dr. Gupta (Faculty Advisor)
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Abstract

The objective of the RoboWeeder senior design project is to design and create a remotely operated robotic system with the capability to aid in the removal of weeds on an organic farm. The following report will explain any changes that were made from the previous semester as well as provide a clear explanation of future tasks that will be completed.

I. Introduction

The RoboWeeder project's primary purpose is to design and create a remotely operated vehicle that can provide a "proof of concept" for the sponsor's weeding mechanism. Over the course of the previous semester, the Roboweeder project team completed detailed designs for the Roboweeder chassis, steering, and weed shearing mechanisms. Designs for the electrical systems were also analyzed and a preliminary program to operate the robot is in progress.

II. Restated Objectives

During the previous semester the project sponsor, Mr. Jeff Phipps, identified a need within the organic farming industry. The identified need was in part that organic farming techniques rely heavily on labor intensive methods which create large production costs for organic produce. With the need identified, Team 11 proposed key objectives and goals for the project while identifying restraints that the team would need to consider during the design process.

The established goals for Team 11 remain constant from the previous semester and are to create a machine that effectively eliminates unwanted plants by the root, function remotely through wireless communication, be splash proof, and have an option to interchange weeding implements.

Moving forward, the ME portion of the project primarily moves into a fabrication and installation phase in which raw materials will be used by the machine shop to create the needed components. With individual components fabricated, installation can then commence. The EE portion of the project holds primarily on the design of the operational program, or code that will allow for the accurate control of the electrical systems on board of the RoboWeeder.

Current Objectives:

- Fabrication of Chassis
    - Fabrication of Frame
    - Fabrication of Steering Assembly
- Fabrication of Weeding Mechanism
- Complete a Fully Operational Control Program (Arduino Code)
- Fabricate the Weeding Mechanism Lift Assembly
- Test All Systems on the Full Assembly
- Compile Accurate Documentation for all Aspects of Project

III. Challenges/Lessons Learned

During the previous semester, Team 11 encountered many challenges. The challenges that were experienced were primarily in the area of communication. Team 11 tried to keep a steady open channel of communication with the sponsor and in doing this, communication with the team's faculty advisor faltered. The lack of communication with the team's faculty advisor limited input from a professional source and therefore some tasks became more difficult. To improve upon the experience this semester, Team 11 is making a conscious effort to seek assistance from their advisors and other faculty and staff.

IV. Procurement

Team 11 has begun to order components for the Roboweeder project. The following table lists both the ordered components as well as the items that have been approved and submitted for order but have not yet been procured by the ordering department.

Ordered Items						
Vendor	**Item Description**	**Part Number**	**Quantity**	**Price**	**Total Cost**	**Status**
Robot Shop	Arduino Mega 2560 Microcontroller	RB-Rlk-03	1	49.99	49.99	Ordered
Robot Shop	Radiolink Transmitter and Receiver	RB-Ard-33	1	36.81	36.81	Ordered
Bloom MFG	Auger Flighting - Right Hand	528	1	61.00	61.00	Pending
Bloom MFG	Auger Flighting - Left Hand	528L	1	61.00	61.00	Pending
Northern Tool	10" Pneumatic Tire/Wheel	2252	2	9.99	19.98	Pending
Amazon	12V 30A DC Universal Power Supply 360W	S-360-12	1	23.97	23.97	Pending
Amazon	Heavy Duty Power Cord - 6 Feet	N/A	1	9.99	9.99	Pending
Amazon	16 Pack 2800 mAh Rechargable Batteries w/ Charger	N/A	1	39.99	39.99	Pending
				Total	**302.73**	

In the near future, our team will be purchasing other components and raw materials for the RoboWeeder project. Of the additional components, the team will purchase the motor controllers to control the motors as well as the individual motors that will be used to operate the shearing mechanism and propel the robot forward and reverse. The team will also look to order the raw materials for use by the machine shop for component fabrication. Other miscellaneous purchases will include items such as screws, flange bearings, bushings, etc.

V. Resources/Budget

The total budget for our design project has a limit of $3000 that is provided by our sponsor, Mr. Jeff Phipps. Most of this budget will be used primarily on the electrical components and the 6 motors that will be onboard the RoboWeeder. Of this $3000 budget, roughly $300 has already been spent, or has been approved and are pending through the ME department. Other components, such as the motors and motor controllers, are awaiting approval before the team submits order forms for those items.

During the previous semester, the resources that Team 11 utilized primarily involved faculty and staff in the form of design advice. These faculty included, but were not limited to, Dr Hollis, Dr Moore, Dr Gupta, Dr Hooker, Mr Jeff Phipps as well as the Civil Engineering soils laboratory. During the spring semester, the design team will incorporate several additional resources. These resources include the Machine Shop, Dr Ordonez, and Mr Larson.

VI. Project Plan

Tasks have been developed after understanding each team member's strongest attributions to the project. ProE CAD have been developed by Chris Murphy and Steven Miller, and now will be critiqued by the project advisor Dr. Gupta and Keith Larson. Given their feedback the drawings will then be subjected to the suggested changes and then then reevaluated. Once the drawings are satisfactory, the drawings along with raw material will be submitted to the machine shop for component fabrication.

The RoboWeeder must be able to turn and align with rows of crops. In order to effectively steer, the design team needed to determine the torque needed for effective steering. The steering analysis was completed by Zhang Xiang using MathCad and the optimum torque needed was determined to be approximately 200 in-lbs. The listed torque value would account for a worst case scenario and a friction coefficient matching rubber and asphalt was used. To insure that this calculation is correct, Arriana Nwodu will be conducting an analysis of the force needed to turn the steering assembly using ADAMS. This analysis will be beneficial in finding the exact minimal and maximum turning force needed. By doing this the correct motor can be selected for the steering.

The programming code for the RoboWeeder will be required to perform 3 major functions: the drive feature, steering feature, and shearing feature. The code will be written by the electrical engineers, Aquiles and Steven, and will require some time due to debugging and testing. Once the motor controllers that we will be using are obtained along with the corresponding motors, testing will begin shortly to utilize our time most effectively.

A more detailed explanation of the expected tasks can be found in Appendix 1, Gantt chart.

VII. Conclusion

The goal and objective for this semester will remain constant from what it was the previous semester. A remotely-operated vehicle with interchangeable shearing elements will be constructed for our sponsor, Mr. Phipps. However, this semester our team will use our advisors at the College of Engineering more effectively in order to maximize our resources that are available to us.

Part orders have already been initiated and will continue as materials and parts are approved by our advisor, Dr. Gupta. Most of the electronics have been ordered already or are pending in the ME department. Once these electronic components have arrived, the electrical engineers will begin testing the developed code to ensure proper operation.

Appendix 1: Gantt Chart