Formal Design Proposal for the ENPH 253 Robot Competition

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Executive Summary

The purpose of this document is to propose a robot design for the ENPH 253 robot competition for the year of 2015. This proposal will be outlining major components of the robot such as the chassis design, driver and sensor systems, as well as code and algorithms. The proposal will also be outlining non-technical information, such as the strategy our team has chosen to approach for the competition, any risk management and contingency planning in the event of slight or major deviations from the team’s primary strategy, a list of agreed upon responsibilities and tasks divided amongst the four team members based on workload, as well as a list of major milestones that are to be completed along the course of the design and construction process.

The competition will be held on August 13, 2015, which will give the team roughly 2 months by the time this proposal has been written to design and construct the robot. In the event of a milestone that is in danger of not being met all members of the team are to take drastic measures in order to meet this milestone, which will include, but not limited to, emergency meetings during non-lecture times, extra lab hours before or after the lab time set by the timetable given permission by lab supervisors, and any minor arrangements in personal schedule in order to make time to conduct work. Due to the nature of each team member’s timetable most courses will be finished around the end of June. This would mean that more time can be allocated in completing the robot and its design starting from late June and early July, and milestones can be met at more reasonable times and can be spaced out much less in order to accommodate minor milestones shifts in the milestone schedule, all of which have been agreed upon by all four team members.

The initial size of the robot will be determined by the dimensions of the doorway the robot must pass through, which is an archway that is 14” wide with an opening whose maximum height is 18” and radius curvature of 8”. Additionally, the size will also be determined by a box provided by the course with similar dimensions. However, in order to meet the strategy set out by the team, the robot’s design will incorporate an extending arm that may exceed the dimensions stated earlier, which will be used in later portions of the course after the doorway.

Materials to be used when constructing the robot will mostly be provided by the ENPH 253 course. The only components not provided by the course that will be implemented onto the design of the robot will be compressed carbon dioxide tanks, fitted for bike tire inflation, which will be used to eject the first basket (details are outlined in the Overview of Basic Strategy section). However, by the time of this proposal’s completion, if any changes to the design that require materials not provided by the ENPH 253 course, and agreed upon by all of the team’s members, happen to arise at some point during the design process, then procedures for requesting and procuring outside materials will be followed, which include purchasing materials not above the worth of $50.

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# Preface

# Overview of Basic Strategy

The strategy our team will be approaching given the circumstances of the competition is as follows:

The robot will be using a tape following mechanism that utilizes a QRD1114 Infrared Reflective Optosensor in order to follow the path set out for the course. It will also be using these optosensors to detect tape markings that represent the location of a pet. The first three pets are located to the side of the path, directly beside the tape marking. Our robot will utilize an arm located directly above the optosensors in order to retrieve the pet. The arm is equipped with a permanent magnet, which will be used to connect to the pet’s magnet on its head. A switch in the arm next to the magnet will tell the robot to raise the arm and release the pet onto a basket carried by the robot.

The basket itself is designed as two separate parts, essentially two baskets on top of one another. The first basket will be designed to carry the first three pets. After climbing the ramp, the robot will proceed to eject the first basket carrying the first three pets towards the start/rescue area, which is located next to the top of the ramp and a level below.

At this point the operation of pet retrieval will be changing in order to accommodate each of the special cases of the last three pets. The fourth pet is located on the path in front of the robot, and marked with tape markings. Thus, once the robot locates the tape marking, as it did with the first three pets, it will attempt to grab the pet by reaching out in front rather than from the side. The pet will be carried on the second basket now exposed after the ejection of the first basket earlier. After locating the tape marking for the fifth pet, located in the rafters, the arm will extend upwards and grab the pet using the magnet. This is similar to the first three pets to the side on the ground, the only difference in operation being that the pet is located at a higher location.

After retrieving the fifth pet, the robot will utilize a QSD124 phototransistor in order to detect the IR rescue beacon in order to locate the sixth pet buried in rubble made of soft foam. Once it reaches the container with the pet and rubble the robot will use sweeping motions in order to locate the pet in the rubble. Once the switch in the arm detects that a pet is grabbed the robot will proceed to release the pet onto the basket.

The robot will proceed towards the rescue beacon where the zipline is located. The second basket will be raised and will grab the zipline, separating it from the robot. The basket will travel down the zipline, powered with a separate motor or not depending on materials available and tests that will be conducted later.

# Chassis

# Drive System

# Sensor System and Electrical Design

# Software Code and Algorithms

# Risk Assessment and Contingency Planning

# Major Milestones, Task List, and Team Responsibilities

Some major milestones include, but not limited to: chassis design and construction, driver system and construction, sensor system design and construction, robotic arm design and construction, code completion and implementation, system testing, assembly, and overall quality assurance/testing and possible redesigning for improved efficiency.

# References and Appendices