

Michigan State University
College of Engineering; Dept. of Electrical and Computer Eng.
ECE 480 Capstone Design Course Project Charter

Team 6: Autonomous Robot Navigation

Sponsoring Company/ Organization: CANVAS

Contact Information:

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Background Information:

Business Case:

Achieving autonomous robot navigation has many potential applications from self-driving cars to robot assistants. This project focuses on giving a small robot the sensing and intelligence and control to navigate around a building. We anticipate that these capabilities will transition to the MSU CANVAS vehicle as well as contribute towards the Autodrive competition.

Project Intellectual Property Considerations:

- Will the student Design Team be required to sign a Non-Disclosure Agreement?
 - o No
- Will the Design Team be able to post their work on the course web site?
 - o Yes
- Will the student Design Team be working with technology contained in pending patents not yet granted?
 - o No
- Can the electronic design be shown, but the embedded software protected?
 - o Yes

Opportunity Statement:

- What **clearly defined Customer Problem** you hope to solve with this project?
 - o Using an iRobot platform, a laptop and a camera, create a robot that can navigate around the Engineering hallways without markers. The robot should be able to drive down the left, right or center of the hallway without colliding into a wall. In addition, the robot should detect people and stop before colliding into one.
 - Note: for person detection, a standard off-the-shelf pedestrian detection algorithm can be used. The challenge will be to use these detections to control the robot.
 - Note: for navigation, we encourage a learning-based system in which the robot is taught to detect where to navigate rather than

using hard-coded techniques. This will enable the system to be used on other robots in different environments, such as a vehicle driving on a road. To achieve this there are easy-to-use learning systems that the team could leverage, such as TensorFlow.

- o Is this problem solvable in a 13 week working semester with students?
 - Yes
 - o Does the design challenge need to be run across two back-to-back semesters?
 - No
- Does this problem exist now, or in the future?
 - o How long will the window of opportunity be open to alternative solutions?
 - The problem exists now
 - o What will drive the window of opportunity closed in the future?
 - This capability is needed this school year in order to contribute towards the Autodrive competition in May 2018
- Who is the customer?
 - o Who makes the buying decision?
 - Dr. Morris
 - o Who will the ECE 480 Design Team deliver their project to at the end of the semester?
 - Dr. Morris
 - o Describe the benefit to the end Customer for this project.
 - This addresses a key needed capability for MSU's CANVAS program, as well as the Autodrive competition, hopefully contributing to a MSU win

Deliverables:

- Describe what is to be delivered at the end of the semester.
 - o Hardware specification for developed system
 - o Software running on a laptop that can read from the camera and interface to the robot controller.
 - o A demonstration of the robot navigating around the Engineering hallways.

Goals:

- Give a robot ability to navigate a complex environment using a camera as its primary sensor. Ideally, the robot can be easily re-trained to operate other environments.

Scope:

- Indoor navigation using an iRobot platform

Constraints:

- List all constraints on the project team.

Project Team: (Completed once semester begins)

Name	Responsibility

Faculty Advisor: (Assigned by ECE Dept . based on project requirements)
