**Group Project:** Design and Construction of a Micromouse

Group Members

* Yu Chang Ou [Computer Engineer 2019]
* Lisa Gu [Computer Engineer 2019]
* Veronica Tu [Electrical Engineer 2020]
* Aikaterini Petridou [Computer Engineer 2021]
* Mari Jimenez [Biomedical Engineer 2022]

**Objective:** To build an autonomous, self-contained micromouse with the ability to traverse an unknown maze, starting from a specified corner to the center, in the minimal time.

**Project Description:**

Our team will research, model, and construct a micromouse with dimensions of less than 20 centimeters on each side. It will represent the Union College Robotics Crew in two annual micromouse competitions: the Brown University IEEE Robotics Competition and the IEEE Regional Micromouse Competition.

*Micromouse*

The micromouse is a self-contained robot that operates without remote control for the duration that it takes to navigate a maze. It must not employ “an energy source employing a combustion process” (Brown Robotics Competition Guidelines) and the micromouse cannot damage or destroy any part of the maze. No parts of the robot can be detached during its traversal of the maze and the micromouse may not jump, fly, or climb the walls of the maze. Finally, the total cost of building the micromouse may not exceed $500.

*Maze*

The goal of the micromouse is to navigate an unknown maze, composed of a 16 by 16 array of 16.8 cm x 16.8 cm unit squares, not including the thickness of the walls. The starting corner is set up to have an open wall to the “north” and maze walls on the “west” and “south” sides. From this starting corner of the maze, the micromouse will find its path to the center of the maze.

For detailed information of the Robotics Competition Rules, please read the following: <http://students.brown.edu/institute-electrical-electronics-engineers/competition/BROrules.pdf>

Project participants will be involved in learning both the hardware and software makeup of the micromouse. Members will research various electrical components needed to build the micromouse, taking into consideration cost effectiveness, compatibility among parts, and design constraints. Once components are selected, members will come up with a micromouse design that considers aesthetics, ergonomics, and innovation. Members will make drawings/CADs of the robot, block diagram of electronics, and a PowerPoint presentation of the micromouse design. In terms of software, members will research and learn the flood-fill maze-solving algorithm. Project participants will collaborate with other teams from the Union College Robotics Crew to submit an abstract for the Steinmetz Symposium, and will exhibit micromouse demonstrations during the event.

**Process and Approach:**

1. After receiving parts from the first order, we will begin prototyping the robot using perfboards and wires for modularity and testing purposes. The initial step will allow us piece together all the electronic components to make the robot move without “smart” algorithms for autonomous navigation or wall-sensing capabilities.
2. Once the robot moves accurately in predefined directions as instructed and without error, our team will move on to making the robot ready for the competition. Based on how our robot performs in step 1, how it follows our instructions (microcontroller and stepper motor, based on the rules of the competition, our team will reanalyze our initial parts order. We will document component inefficiencies and readjust our design, if needed, to derive an optimized modification of the robot. After another round of research, our team will make a second parts order with the parts needed to construct the final version of the micromouse.
3. After second parts order arrives, our team will replace our test breadboard with a customized 3D printed chassis and begin soldering parts to produce the robot with a much smaller footprint. This version of the micromouse will move faster than the test robot.
4. Using the final build of the micromouse, our team will simulate the contest environment by creating a practice maze. Our goal here is to add a “brain” to the robot. We will implement the flood-fill algorithm, so that the robot is able to scan and reproduce the maze as it traverses the maze. A successful implementation of flood-fill will enable the robot to find the shortest path to the center of an unknown maze.
5. Finally, with flood-fill successfully implemented, the team will modify the practice maze to reflect the maze dimensions used at the competition; the micromouse will tested on more complex mazes after each successful run. With multiple practice runs, we will be able to make the robot more efficient and responsive to different mazes. At this point, the robot is competition-ready.