Bullets

- No prerequisites are required; all necessary skills are included in the course.
- Focusses on fun ways to understand the use of simple sensors and to control robot movement.
- The course ends with a friendly competition, which parents and guardians are very welcome to attend, in which robots compete to solve a problem in the shortest amount of time.

Description

This is a weeklong introductory robotics course that is targeted at middle schoolers. It is intended to be both fun and informative and may help students to choose between liberal arts and engineering/science pathways in high school.

Preferably, students will be paired, in teams, although a student may choose not to be paired, but to work on their own. Students working on their own will be at a considerable disadvantage, however, as teamwork makes both troubleshooting and recognition of conceptual and understanding errors easier and quicker. Students working as a member of a team will be compelled to develop a method of working in which cooperation, listening, and respect all play a part.

Monday

The first class begins with students building, using detailed plans, a small Lego® Technic® robot that is equipped with motors, a variety of sensors, and a battery powered embedded computer (that is more capable than a Lego® Mindstorm® computer).

Once construction of the robot is complete, it will be inspected. The inspection will include, from a small height, a drop test.

The students will then begin to program their robots, using the C/C++ programming language, to drive through a simple obstacle course. The students will be provided with sample code that they will need to modify and expand.

Instruction in coding and debugging will be provided throughout the course as new programming techniques become necessary.

Tuesday

The second class will focus on the robot detecting and following a black line that meanders around a four-foot by four-foot flat MDF panel.

Sample code, that students will need to modify and expand, will again be provided.

Students will explore how the robot's infrared sensors "see" the black line. This work will include using code to upload data from the robot to a PC and to graph it. The students will also learn how to display the data on the computer's LCD panel.

Students will then explore the programming needed for a robot to navigate along the line by detecting the line and maneuvering such that it travels along the line without deviating so much that it can no longer "see" the line.

Students will discover that speed is a significant factor and will have the opportunity to make changes to the robot's gear train to achieve different speed ranges.

Wednesday

The focus of the third class will be the detection of visible light and programing the robot to always travel toward the light as the light moves around the robot.

The robot's sensors include a differential light sensor that can be used to determine if a light source is to the left or right of the robot.

The students will initially write code to upload data from that sensor to a PC and display and analyze it there.

The students will then create programs to command the robot to turn to face the light an to then drive toward it while the light moves around the robot.

If time permits, as an additional activity, the students will create a program to enable the robot to search for the light in the event that contact with the light is lost.

Thursday and Friday

Thursday and Friday are devoted to preparing the robots to compete in a competition and then actually competing.

In the interest of "Surprise!" no details of the competition will be revealed here.

However, the competition will require the students to employ new techniques.

The first part of Thursday will be devoted to explaining the competition to the students. They will then be encouraged to conduct a series of experiments to better understand the techniques needed to solve the competition's main problem. Advice and help from the instructors will be freely available during this process.

During the remainder of Thursday and during all of Friday afternoon, the students will be expected to design, build, and program a competition robot.

The competition will take place Friday afternoon, after a late lunch. Parents and guardians are encouraged to attend.

The competition will comprise two events, each of which will be timed. Students will be permitted, taking turns, as many attempts as they desire, up until a deadline near the end of the day. The times for each attempt will be recorded with the shortest time for each robot for each of the two events being carried forward and then being combined to form a total time. The robot with the lowest total time will be declared the winner. In the event of a tie, the final result will remain a tie, i.e. ties will not be broken.

Throughout the course, from time to time, as appropriate and relevant, the instructor will introduce a real-world science or engineering project, incident, or accident and discuss its connection with the current class activity. The intent of this being to illustrate that the knowledge and skills being imparted in this course are relevant to the real world.