

James Dyson Undergraduate Bursary 2017/18

Lego Mindstorms Outreach activity

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Both Michael and I undertook projects related to robotics, so decided to use Lego Mindstorms to introduce the pupils to some of the design considerations related to creating robots. The group was divided into teams of three and each given a laptop and a basic robot of our design (shown below) that was able to drive around and featured a downward-facing light sensor at the front. A short class was given in how to program the robot with the flowchart-based software developed for it. This culminated with a demonstration of the edge-following program employed by Maria Kettle in other outreach activities.



The pupils were instructed to create a robot that was able to perform each of the following tasks, and the robot that could achieve the most would be the winner:

1. Follow a line to an object, in this case a plastic cup
2. Stop when the robot reaches it
3. Pick up a small foam ball placed on top of the cup
4. Identify the colour of the ball
5. Turn around
6. Follow the line back to the start
7. Drop the ball in a different cup

This was designed to be extensible: it was not expected that any teams would accomplish all the tasks. As a minimum it was expected that they would be able to follow the instructions in a handout we produced to get their robot to follow the edge, which only required setting the values of two variables. While this was happening, the other members of the team would be building a simple gripper out of Lego to pick up the ball. These tasks were expected to take similar amounts of time, before the whole team could come together and think about how to create the full program and troubleshoot any issues. This would then illustrate hardware and software aspects of robotics design.

In a practice run, we found that the programming aspect was significantly too ambitious, so we reduced it to the level described above. All the teams were therefore able to get their robot to follow the edge effectively in little time. However, we overestimated their ability to build a simple gripper out of Lego, despite the fact this could be done in a variety of ways with only a handful of pieces. When helping the teams, we noticed that a lot of members were reluctant to experiment with the bricks, wanting to know exactly what to build before beginning. This led many teams to waste time waiting for one of us to come around and give them help before even starting building.

Overall, the activity was a success. All the teams were able to follow the edge to the cup and at least attempt to pick up the ball, which was normally successful. One team's robot was then able to turn around and follow the edge in the other direction. As expected, none had enough time to implement the colour sensing, but it was still good to include this as a goal in case any teams have members that are experienced with Lego Mindstorms.