

Teaching Plan: Engineering and Technology

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mBot Rovers

Summary

Students will work with Makebot mBots as space rovers. They will be introduced to programming using the kid friendly Arduino IDE and sensors by learning how to program the mBot. The students learn how connect their computers to the mBot and download their own self-made programs onto it in order to learn about serial connections. The students developing their own programs introduces them to programming (in essentially the C programming language). Students will be split into three groups to work on the mBot together. A power point presentation introducing the kids to the programming language and to the mBots.

Engineering Connection

Learning to program is critical if one is to go into any engineering/science/math field. Engineering use programming for software, mechatronics, and design, while mathematicians and scientists use programming to build models for high-level simulations. The mBots act kind of like the Mars Rover and the students are equivalent to the scientists and engineers at NASA designing the functionality of the Rover for when it lands on mars. Software engineers play a key role in developing programs that enable remote communication to control the Mars Rover. Understanding how these programs works challenges students to think carefully about the logic used in an automated program and strengthens their abilities to confront difficult tasks systematically.

Learning Objectives

After this activity, students should be able to:

- Develop a simple C program and talk confidently about programming logic.

Materials List

Each group needs:

- Makebot mBot
 - [link](#)
- computer, with internet connection

Instructor Needs:

- Associated Microsoft® PowerPoint® file
- computer with Internet connection and projector, to show the power point and to demonstrate to the class how to upload to the mBot using the Arduino IDE
- measuring tape or ruler, to measure for miniature soccer fields
- black electrical tape, to create track for robots to follow
- template code printed out on pieces of paper for the students

Introduction/Motivation

Interested in the Mars Rover? Well today we are going to be treating mBots like Mars Rovers and learning how to program them. That means making their motors run, having them look for danger and avoiding obstacles. Over the next couple lessons, you are going to learn about how this is possible.

Additionally, the skills you will hopefully take from this will help you get into university, get a software job, or maybe help you provoke an interest in another field.

Vocabulary/Definitions

Electrical connection: The link or bond that passes electricity between two or more things.

Bit: The bit is a basic unit of information used in computing and digital communications.

Byte: a byte is a unit of data that is eight bits long

Interface: a point where two systems, subjects, organizations, etc., meet and interact

Serial connection: interface through which information transfers in or out one bit at a time

Procedure

Day 1

Before the Activity

- Assemble the makeBots by following instructions in the core set.
 - Each group get one mBot
 - [Link to pdf instructions](#)
- Set up black tape track to conduct the first presentation/example of what the mBots can do.
- Go through the first couple slides with the students showing them how to download the Arduino IDE onto their own computers, and also install the package/drivers for uploading code to the mBots. The slides also show the students how to upload the code onto the mBots.
- Leave the power point on the summarize the steps slide and have the students all do what you said.

With the Students: Uploading template code to the mBot.

- Work with the students to have them as a minimum be able to upload the template code to the mBot.
 - The template code has the mBot follow black tape.
 - This part of the activity is individual, it important for the students to at least get the basic knowledge of how to use the materials. But obviously students can help each other.
- Hopefully all the students will eventually be able to make the mBot run along the black tape.
- Any students that finish early(hopefully there will be time for everyone) will work on making a Github and/or LinkedIn Account and learning to upload code onto there to show off to companies and universities.
- Once everyone is done, we will start to leak into the material of Day 2.

Day 2

Before the Activity

- Bring up the power point again and start going over the slides about basic coding techniques and principles.
 - From introduction, learn how many students have coding experience and adjust.
 - For the presentation part of the session have the students in the classroom, then for the demo part, move them to the computer lab
- Then go over the slides of how c structured programming works.
- Then go over the mBot specific functions
- Split the students into groups of 2 or 3:

With the Students: Program for going through obstacle course.

- This is an activity that hopefully the students can accomplish in a day.
 - How this part goes and if it leaks into Day 3 will depend on the students' skill level in coding.
- In their groups, the students will design a program that will have the bot automatically navigate an obstacle course that the instructor creates.
- One thing that is important in this activity is that if the groups are relatively large, to make sure all the kids know what is going on. One will probably be coding on the computer and uploading and the rest might end up watching. In this case the instructor needs to get them together and walk them through the logic of the code.
- The obstacle course can be pretty spontaneous for the instructor. (course could be as simple as going around the classroom)
- Any group that finishes will work on uploading their code to Github then working on the assignment for day 3.
- Groups that do not finish will not have to work as this is what they will be working on tomorrow also.

Day 3

Before the Activity:

- Sumo wrestling robots. Print out the rules sheet for the students.
- Additionally, go through the robot arm activity at the beginning of class.
- Students will work in the same groups they did as yesterday.

With the Students: New Obstacle Course/Ideas they want to work on/Fair project

- Robot arm with students
- Give the students some time to code their sumo wrestling program.
- Have the sumo wrestling tournament specified in the power point file.

Assessment

- Do the students have the code or not.
- Were they able to upload their code to Github (the cloud)
- Were they able to have the robot navigate the course
- If everyone is done early or a significant group is done early, we can do a pop quiz on the black board software interview style

Contributors

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