Discover Robotics

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Course Details

Description

This curriculum outlines a hands-on workshop on learning robotics for middle and high school students. Robotics is explored through group discussions, instructor guided lessons and experimentation which presents engineering as a broad domain and attempts to bridge classroom lessons to real world applications.

The course uses the Arduino based robot MiniQ 2WD which is an affordable and accessible platform for schools. MATLAB and Simulink are utilized as an intuitive learning environment and as means to implement code on robots. Videos are provided for students to help demonstrate concepts as well as videos for instructors to learn about the Simulink models before carrying out each lesson. The curriculum maps to skills found in the Common Core Standards and the Next Generation Science Standards.

Course Length: 15 hours
Recommended Ages: 10+
No prior programing knowledge is required

Original Course Documents

- **Getting Started:** Start with this document. It contains the course overview, learning objectives, mapping to educational standards, material list and advice to instructors
- **Lesson Plan:** Recommended sequence of activities for the classroom, you could print or project this document for the students to follow
- **Study:** Interspersed within the curriculum are “Studies” which involve group discussions on a theme in robotics. There are five studies within this curriculum and this can be referenced by the green boxes in the graphic below.
- **Video Folder**: Contains videos referred to in the Lesson Plans for instructors and students. The lesson plans also have YouTube links to these videos.
- **MATLAB Code and Simulink Models (Folders) :** Contain the code files for each Unit

- Instructor Reference: Additional resources for the instructors for specific activities in the lesson plan

Course Contents

Unit	*Contents*
Videos	• Complete Video Playlist • Introduction to the MiniQ Video
Unit 1	• *Study 1:* What Is a Robotics Engineer? • Basic Math in The Command Window • MiniQ Motors from Command Window • MATLAB Functions in the Command Window • User Interface to Test Motors in the MATLAB Command Window • *Taking It Further*: PhotoSensor Robot from Command Window
Unit 2	• Introduction to Simulink + Basic Math • The Simulink "Magic Box" Concept • Simulink: MATLAB Functions with Lights • *Study 2:* Morse Code • Simulink: MATLAB Functions with Motors
Unit 3	• Setting Up External Mode: Using Simulink for Sensor Readings • Color Machine with Motors: Functions for Obstacle Avoiding Robot • *Study 3:* Observing The Natural World + Artificial Intelligence • Color Machine with Motors: Introduction to Stateflow Charts • *Study 4:* Dead Reckoning "Parking Bots" • Dead Reckoning with StateFlow Charts • Dead Reckoning with StateFlow Charts Advanced (adding color)

Unit 4	• "Stay In Box" Concept
	• *Study 5*: Ethics In Robotics
	• Line Following:
	  ◦ Stay in Box With Line Sensors
	  ◦ Two Sensor Line Following
	  ◦ Bang Bang Line Following
	• *Taking It Further*: PID Line Following With Proximity Stop
	• *Study 6*: Altruistic Robots

Unit 5	• Introduction to MiniQ Light Sensors:

	• *Study 7*: Telerobotics • Light Following Robot

Resources

1. Robot Hardware: MiniQ Robot (complete kit) by DFRobot

2. Computers with the following installed: MATLAB, Simulink, Stateflow, MATLAB Coder

3. Electrical Tape

4. Flashlights

5. Projector For Mirroring Instructor's Computer Screen

6. Stands for MiniQ robots (can be 3D printed)

7. AA batteries (4 per miniQ robot)