College of Engineering
College of Education

Line Follower Robot

Project Overview
This Arduino-based project will be focused on building and programming a robot that will follow a line.

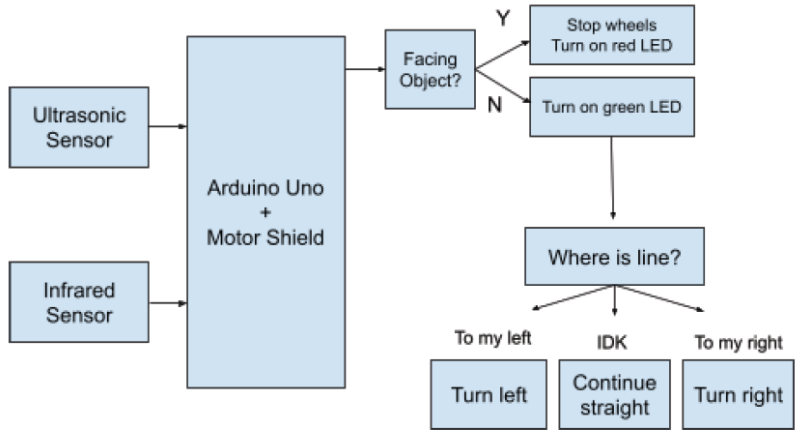
Course Connections	21st Century Skills	CTE Alignment
Middle School Science High School Physics High School Engineering	Communication, Critical Thinking, Collaboration	Energy, Environment, and Development Pathway

Objective
Students will build and program a line-following robot that detects a line on the floor using IR sensors.

Materials

- Laser cut robot car kit (designed by Wrebotics)
- Arduino board and motor shield
- Two infrared sensors and one ultrasonic sensor
- Two wheels and one ball caster
- Two wheel motors
- 2 LED's, 1 green and 1 red
- Wires (Male to female)
- Screws, nuts, and screwdriver
- USB Cable
- Computer
- Portable battery

Block Diagram



Robot car kit provided by Wrebotics with the assemble instruction

Application

A line-following robot typically uses sensors and cameras to follow a predetermined path on the ground. In the real world, these robots are used extensively by some companies to automate industrial tasks such as material handling, product assembly, and quality control. The robots are able to follow lines on the floor to transport goods and carry out tasks. Another application of these robots can be seen in agriculture. These robots can follow lines in the field to plant, harvest, and do other tasks. Lastly, a line-following robot can be used in surveillance or entertainment to patrol an area for suspicious activity or an interactive experience with visitors, respectively.

Outline/Schedule

Part 1: Introduction to line-follower robot project

- Introduce the project and the applications of line-following robots
- Introduce the problems that arise for line-following robots in the real world
- Review the material needed for the project and their functions

Part 2: Assembling the robot

- Explain how to assemble the prefabricated robot, attaching the wheels, ball caster, and wheel motors
- Show how to mount the infrared and ultrasonic sensors to the front of the robot
- Demonstrate how to connect the wires to the sensors, motors, and LED's, using the motor shield and Arduino board
- Allow students to work on assembling their robots

Part 3: Programming the robot (Line following)

- Explain how the robot will detect and follow a black line using the infrared sensors
    - Forward: no line found (only whitespace)
    - Turn right: line on right side (whitespace on left)
    - Turn left: line on left side (whitespace on right)
    - Stop: blockage found (no whitespace)
- Explain how motor movements will operate individually and together
- Discuss how to translate these concepts into code by using pseudocode
- Allow student to write the programming of the robot, testing certain aspects along the way

Part 4: Programming the robot (Object Avoidance)

- Show how to use the ultrasonic sensor to avoid obstacles and modify the code accordingly
- Discuss how to translate these concepts into code by using pseudocode
- Allow student to write the programming of the robot, testing certain aspects along the way

Part 5: Testing and troubleshooting

- Explain how to test the robot's movement and sensor readings using the USB cable and computer.
- Discuss common issues that may arise, such as incorrect wiring or programming errors
- Allow students to fully test and troubleshoot any problems that arise, helping as necessary

Part 6: Finalizing and Testing the Project

- Design the testing plan based on the project objectives and requirements.
- Discuss the troubles that students may encounter and how to troubleshoot.

- Allow teams time to finalize their project and test it according to the testing plan provided.
- Have teams present their projects and demonstrate their functionality.
- Record video clips for important steps.
- Prepare the project presentation and make the video demo.

Reflection
Reflection (embedded into each lesson): ● Have students reflect on their experience with the project and what they have learned about programming, robotics, and Arduino. ● Discuss how STEM skills and knowledge can be applied to real-world problems and applications. ● Allow time for students to provide feedback on the project and suggest improvements for future iterations.

Sample Code
Sample Code