Robotics

**Unit 8 User’s Guide**

Building a Line-Bot

horizontal line

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# **CONTENT OF UNIT 8 SLIDES**

**Unit 8 : Building a Line Bot**

**Section 1: Sensor Review**

* Ultrasonic Sensor:
  + What does it do?
  + How does it work?
* IR Sensor:
  + What does it do?
  + How does it work

**Section 2: Building a Line Bot**

* **Car Assembly**
  + H-bridge assembly
  + Arduino assembly
  + Motor assembly
  + Breadboard assembly
  + Ball Bearing assembly
  + Wiring
  + Attach Ultrasonic Sensor
  + Attach IR sensor
* **Car Programming** 
  + Arduino IDE program
  + Pseudo Code
  + Variations

# OVERVIEW

# Students will learn about Sensors and use the knowledge covered thus far in the curriculum to build a car that follow a designated path and stops if obstacles is placed in its front. In this unit, students will work with their hands to wired up the car. In this process they will put together an Arduino, Breadboard, IR sensor, Ultrasonic sensor, H-bridge, and two motor drivers. The car designed in this unit is an extension of the car previously build. Most of the wiring is the same except two sensors are added, an IR and ultrasonic sensors. This unit include both programming and hardware wiring.

# OBJECTIVES

By the end of this unit, you should be able to:

* Integrate sensors into projects
* Learn more about programming an Arduino Board
* Learn more about sensors and Breadboard
* Use and apply knowledge learned from previous units to build a car that can:
  + follow a designated path using sensors.
  + Sense obstacles and stop before running into them.
* To wire up sensors to a breadboard

# SAMPLE ACTIVITIES

The activities listed below are to completely by the end of this unit. All of them are build using the material covered thus far.

* Build a circuit using an Ultrasonic sensor, a Breadboard and an Arduino board
  + Write the program and test to make sure the sensor is working properly.
* Build a circuit using an Ultrasonic Sensor, a Breadboard and an Arduino Board.
  + Write a code that can can be used to program the Arduino.
* Build a circuit using an Color sensor, a Breadboard and Arduino.
  + Write a code that can read the colors from the color sensor.
    - Use the serial monitor window to read the OUTPUT generated.
* Build a circuit using an IR sensor and an Ultrasonic sensor.
  + Combine both sensors in one circuit
  + Write a program that can make the sensors work.
* Build the car using an IR sensor, an Ultrasonic sensor, a Breadboard, an Arduino Uno board, an H-Bridge, two motor drivers and a 9V battery.
  + Mount everything on a foam using double sided tape.

# WARNINGS AND PRECAUTIONS

* **IMPORTANT**: Never provide power to arduino using both Vin and USB or Barrel Jack.
* **IMPORTANT**: Never touch positive and negative battery terminals together.

# INSTRUCTIONS FOR ASSEMBLY

* Assembly (each instruction will be accompanied by a photograph to help understand each instruction
  + Attach the H-bridge to the foam board such that the leads from the motors can reach the drive pins
  + Attach the Arduino to the foam board (make sure that the proximity of the Arduino to the H-bridge and breadboard are conducive to efficient wiring)
  + Attach the breadboard to the foam board
    - **DO NOT** use the tape provide on the back side of the breadboard
  + Attach the Motors with wheels to the back end of the foam on the bottom
  + Attach the Roller bearing to the front-middle of the foam on the bottom
  + Attach the IR sensors to the front left and right of the foam on the bottom
  + Attach the ultrasonic sensor to the front of the foam (this requires tricky maneuvering of foam and double sided tape)
* Wiring
  + Attach the motor wires to the H-Bridge appropriately
    - red or yellow motor lead to H-bridge motor +
    - black or blue motor lead to H-bridge motor -
  + Wiring the circuit
    - M/F Jumper wire from Arduino pin 5 to H-bridge ENA
    - M/F Jumper wire from Arduino pin 6 to H-bridge IN1
    - M/F Jumper wire from Arduino pin 7 to H-bridge IN2
    - M/F Jumper wire from Arduino pin 8 to H-bridge IN3
    - M/F Jumper wire from Arduino pin 9 to H-bridge IN4
    - M/F Jumper wire from Arduino pin 10 to H-bridge ENB
    - M/M Jumper wire from Arduino Vin to line 1 of breadboard
    - M/M Jumper wire from line 1 of breadboard to H-bridge 5V
    - M/M Jumper wire from Arduino GND to line 2 of breadboard
    - M/M Jumper wire from line 2 of breadboard to H-bridge GND
  + Connecting the IR sensors
    - M/F jumper wire from IR sensor VCC to Arduino 5V via the breadboard
    - M/F jumper wire from IR sensor GND to Arduino GND via the breadboard
    - M/F jumper wire from IR sensor OUT to digital Arduino pin
  + Connecting the ultrasonic sensor
    - M/F jumper wire from Ultrasonic sensor VCC to Arduino 5V via the breadboard
    - M/F jumper wire from Ultrasonic sensor GND to Arduino GND via the breadboard
    - M/F jumper wire from Ultrasonic sensor ECHO to digital Arduino pin
    - M/F jumper wire from Ultrasonic sensor TRIG to digital Arduino pin
  + Connecting the battery
    - 9V battery connector, red wire to 12V on the H-bridge
    - 9V battery connector, black wire to GND pin on the Arduino
* Programming
  + **IMPORTANT**: Never provide power to arduino using both Vin and USB or Barrel Jack
  + Basic H-bridge functions
    - Motor forward (1 pin HIGH, 1 pin LOW)
    - Motor backward (1 pin LOW, 1 pin HIGH)
    - Motor stop (both pins LOW)
  + Functions that simplify these
    - Vehicle forward (both motors forward)
    - Vehicle backward (both motors backwards)
    - Turn right (left motor forward, right motor backwards)
    - Turn left (right motor forward, left motor backwards)
  + Sensor programming
    - Ultrasonic
      * If-else statement
    - IR Sensor
      * Function to see if on track

# BILL OF MATERIALS

* **List of Materials needed for this unit (per student)**
* Components
  + Arduino
  + Breadboard
    - Mini
  + H-bridge
  + 2 Wheels + Gearboxes
  + M/F Jumper Wires
  + M/M Jumper Wires
  + 9V Battery
  + 9V Battery cable
  + Ball bearing
  + Foam square (10cm x 12cm)
  + Ultrasonic Sensors
  + IR Sensors
  + Scissors
  + Double sided tape