# Final Project Proposal - ECE 110 (ABC) Lab

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## 1  Introduction and Problem Statement

Electronics is a vast field and we, as a team, have just begun exploring the plethora of tasks that can be accomplished using some very simple but powerful electronics concepts. After having learnt a lot about electronics from the ECE 110 Lab section, we have decided that our final project is going to be a robot car which will be almost exclusively semi-autonomous and would follow a line and will stop and move, when it would hear a clap (or an audio cue with a large amplitude). Furthermore, for additional aesthetics and functionality, we plan to add a few more sensors - heat (IR) sensors and a few LEDs which can sense the environment temperature and display the heat index using the LEDs.

For this project, we have a few challenges to overcome:
1  No flex sensors were allowed and hence we used other sensors which added more functionality to the bot.
2  The robot could only be autonomous or semi-autonomous; we chose to go the bold way to make an autonomous car, in line with the modern trend of self-driving vehicles in the industry.
3  More sensors had to be used for extra-credit - for which we have used more sensors.

## 2  Solution Outline

For our final project we plan to use the following sensors: microphone (hears the clap from the user to perform an action based on the input), a temperature sensor (detects infrared waves and detects heat close to the sensor), 3 redbot sensors (tracks a line on a platform to follow the path).

After looking up more on microphones, we found that it works by detecting differences in air-pressure and then converts that into electrical signals. Hence, when it detects a loud clap, it signals the motor to stop and thereby breaks a circuit.

An IR sensor works on the principal that, by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which can be detected using a threshold.

The RedBot sensor we use in our project gives our robot the ability to detect lines or nearby objects. The sensor works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect transitions from light to dark (lines) or even objects directly in front of it. This is what allows it to follow a line on the platform.

## 3   Necessary Components

- SEN-11769 RedBot Sensor- Line Follower
- Arduino Uno- to build the circuit for car power-toggling by clapping
- Electret Microphone
- Basic Circuit Components
    1 Breadboard and wires- for navigating car circuit and for sound sensing circuit
    2 Resistors- for the navigating car circuit and for sensing circuit
    3 Capacitors- for sound sensing circuit
    4 Diodes- for building the navigating car circuit.

## 4   Schedule (in weeks)

1 Design and prototype the circuit for both the line-following car and the sound sensor
2 Test both circuits individually and then integrate them into one in the body of the car keeping in mind the space and weight distribution.
3 Fine tune and debug to iron out any problems that may have appeared during testing.

## 5   Conclusion

When electronics works hand-in-hand with theories of computer science, magic happens! We plan on making this one of our most successful projects yet and hope we learn a lot from this. Having learned concepts on motor control, transistors, diodes and using them in circuits (such as our project), we feel equipped with a solid foundation in electronics. This has definitely been a great learning experience and we undoubtedly have gained a lot from this class.

## 6   References

Carnegie Mellon University: Electronics > BOE Shield-Bot > IR Sensor > What is an IR Sensor?
   http://www.education.rec.ri.cmu.edu/content/electronics/boe/ir_sensor/1.html


SparkFun > Tutorials > Getting started with the RedBot
   https://learn.sparkfun.com/tutorials/getting-started-with-the-redbot