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PY 371 Final Project proposal

Electromagnetic Field Sensor

Abstract of Concept:

This project will use a Hall Effect sensor and an I2C LCD display to output the magnitude of a magnetic field in units of Gauss. A 49E linear Hall Effect sensor will be wired to the Arduino which will take the analog voltage input from the sensor and convert it to Gauss. This particular sensor will be of use because it outputs a voltage proportional to the magnetic flux density (the strength of the magnetic field) through the detector. This voltage can then be used to calculate the magnitude of the magnetic field around the sensor. The voltage increment output by the sensor for a 1 Gauss increase in field strength and the baseline voltage output for a 0 Gauss field will have to be taken into account. The calculated value will be displayed on the LCD screen.

Essential Concepts:

1. Reading the analog output of a 49E Hall Effect sensor with an Arduino
2. Converting the analog from the sensor into the magnetic field magnitude
3. Digitally outputting this value to an LCD display

Stages to be Completed if Time Allows:

- Stage 1:
 - LCD readout accurately displays magnetic field strength in Gauss
- Stage 2:
 - Automatically changes to Teslas if the magnitude of the field is lower than one Gauss
- Stage 3:
 - Add the option to use the flux density reading to calculate the current through a circuit
- Stage 4:
 - Attach a partial ring of conducting material to make the current calculation more accurate

Required Parts (URLs included for necessary orders):

- Breadboard
- Arduino microcontroller
- 49E Hall Effect sensor
- I2C LCD Display
 - <https://www.amazon.com/SunFounder-Serial-Module-Display-Arduino/dp/B019K5X53O>
- Wires
 - https://www.amazon.com/EDGELEC-Breadboard-1pin-1pin-Connector-Multicolored/dp/B07GD312VG/ref=sr_1_1_sspa?dchild=1&keywords=wire%2BBfemal%2Bto%2Bfemale&qid=1586485350&sr=8-1-spons&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUEyUDQzSUVNWldSOEhWjcnlw3J5cHRIZElkPUEwNTc4Nzg5M0ZUV1FMVjNMTOTYyTCZlbnNyeXB0ZWRBZEIkPUEwMjE3NTQ2UUFsREQzREM4MTNTJndpZGdldE5hbWU9c3BfYXRmJmFjdGlvbj1jbGlja

Main Code:

Aside from initializing Arduino pins and formatting the LCD screen properly, the main code necessary for reading the sensor output and writing it to the screen is expected to look something like:

```
magnitude = (analogread(0) – zeroSensorOutput)*  
sensorGaussIncrement;
```

```
lcd.print(magnitude);
```

Where zeroSensorOutput corresponds to the output from the sensor in the presence of a 0 Gauss field and sensorGaussIncrement is the increase in voltage from the sensor for every 1 Gauss increase in field strength divided by the maximum voltage output of the sensor.

Circuit Diagram:

