Layfield, Aidan
4/24/23
CPE Final Project, 1001 1102

Project EMF “Ghost” Detector

Project Overview:
Final project for my CPE class. Electromagnetic Field (EMF) Detector built in Arduino.
Layfield, Aidan

The file "Arduino_EMF_Prot1" is the code for my first prototype and original design. The file "Project_EMF_Layfield_Aidan" is the code for my final design. Both are shown in the video.

This project is a challenge that was presented to me from Shawn in one of the labs (more so as a brief suggestion for a creative outlook). The idea was creating a "ghost detector" in Arduino, otherwise known professionally as an EMF detector. I decided to try and accomplish it in Arduino and it was more than possible. Electromagnetic field detectors, or EMF detectors, are devices used to detect and measure the strength of electromagnetic fields. EMFs are produced by various sources such as electrical appliances, power lines, wireless devices, and other electronic equipment. EMF detectors typically work by using sensors or antennas to detect changes in the electric and magnetic fields in the surrounding environment. Which all of this was more than provided in the Arduino kits we use for class. I created in the first prototype a simple design that gave an EMF reading using resistors and 10 LEDs. As more of the LEDs lit up, the more energy was being detected. In my final design I added a buzzer that makes a sound when energy is being detected (just like the real ghost detectors). I also added a 16x2 LCD display to give you a "ghost level" or level of energy being detected. I really enjoyed working on this project and can't wait for more challenges in the future!

Constraints on the system: The only constraints on the system is based on the material you use for the antenna. On the first prototype I created, I ran into the issue with choosing the proper resistor. Anything that wasn’t the right amount of ohms would either cause too much sensitivity or not enough and the Arduino wouldn’t read any activity. On the final design this issue was avoided because I went straight to using soldering wire which caused me the least issues. I found any metal would work just fine as an antenna. This caused a bit more complication in the code though.

Here is a brief description of what the code's function is:

This code reads an analog value from a specified analog pin (A0) which is connected to an antenna or sensor that measures an electromagnetic field (EMF) level. The code then displays the EMF level on a 16x2 LCD module using the Arduino LCD library.

The LCD module is connected to Arduino pins 12, 11, 5, 4, 3, and 2, which are specified when initializing the LiquidCrystal object (lcd) in the setup() function. The LCD is used to display two lines of text: "EMF Level: " on the first line and "Last Hi EMF: " on the second line.

The analog value read from the antenna is stored in the variable 'val'. The code then updates the LCD display with the current EMF level by setting the cursor to the appropriate position and printing the value of 'val'. It also updates the 'high_emf' variable with the highest EMF level seen so far.

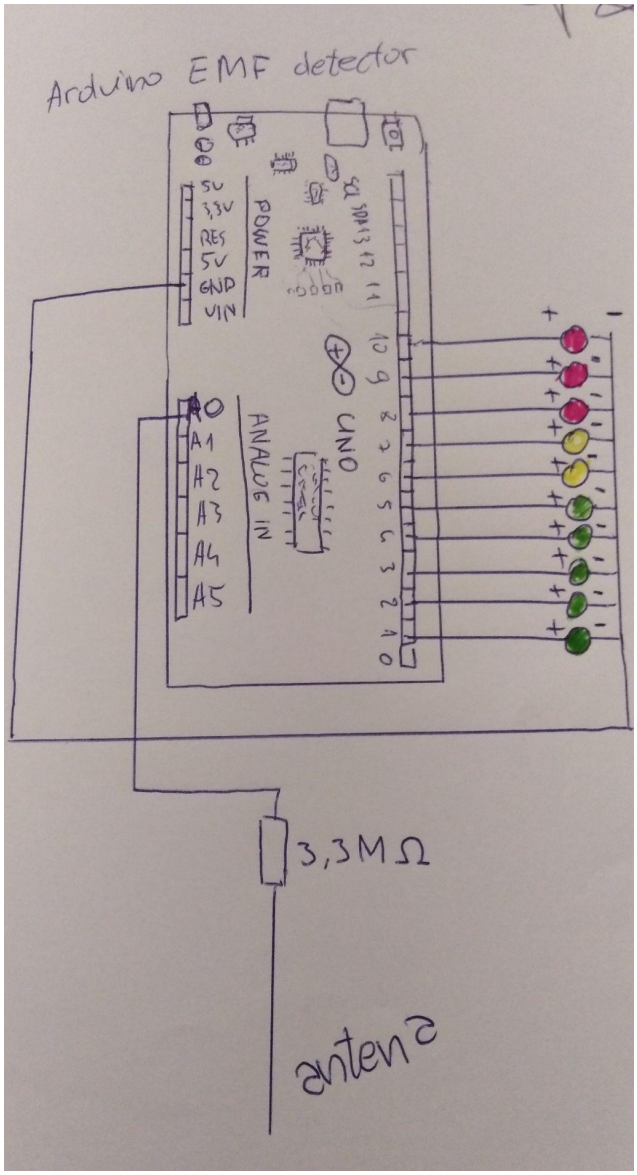
If the EMF level (val) is greater than or equal to 2, the code further processes the value by constraining it to a range of 2 to 100 using the constrain() function, and then mapping it to a range of 1 to 255 using the map() function. The resulting value is then used to control the brightness of an LED connected to pin 11 using the analogWrite() function. The buzzer connected to pin 6 is also turned on by setting its output to HIGH using digitalWrite().

If the EMF level is less than 2, the LED is turned off by setting its output to 0 using analogWrite(), and the buzzer is turned off by setting its output to LOW using digitalWrite().

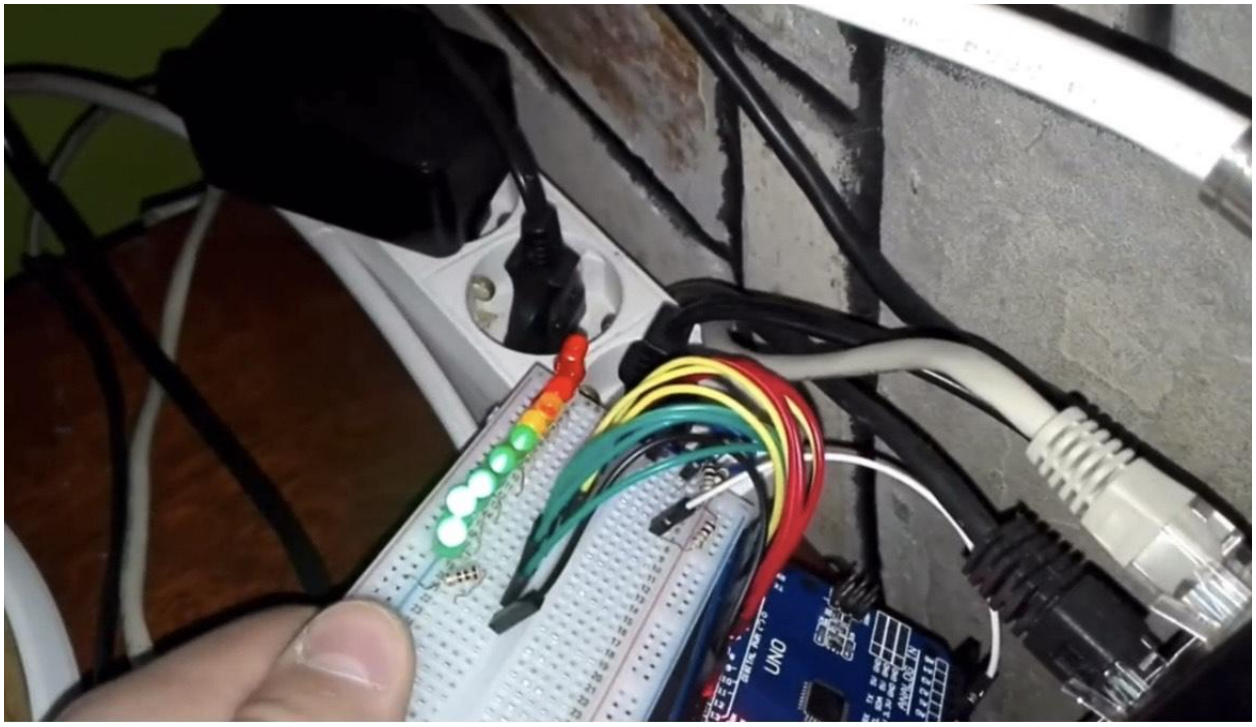
The code also includes Serial communication at a baud rate of 9600, but it is not used in this specific code.

Prototype 1:

Here is my hand drawn and rough schematic for the first prototype of the EMF detector. This design functioned well, but was generally too simple for what I had in mind.

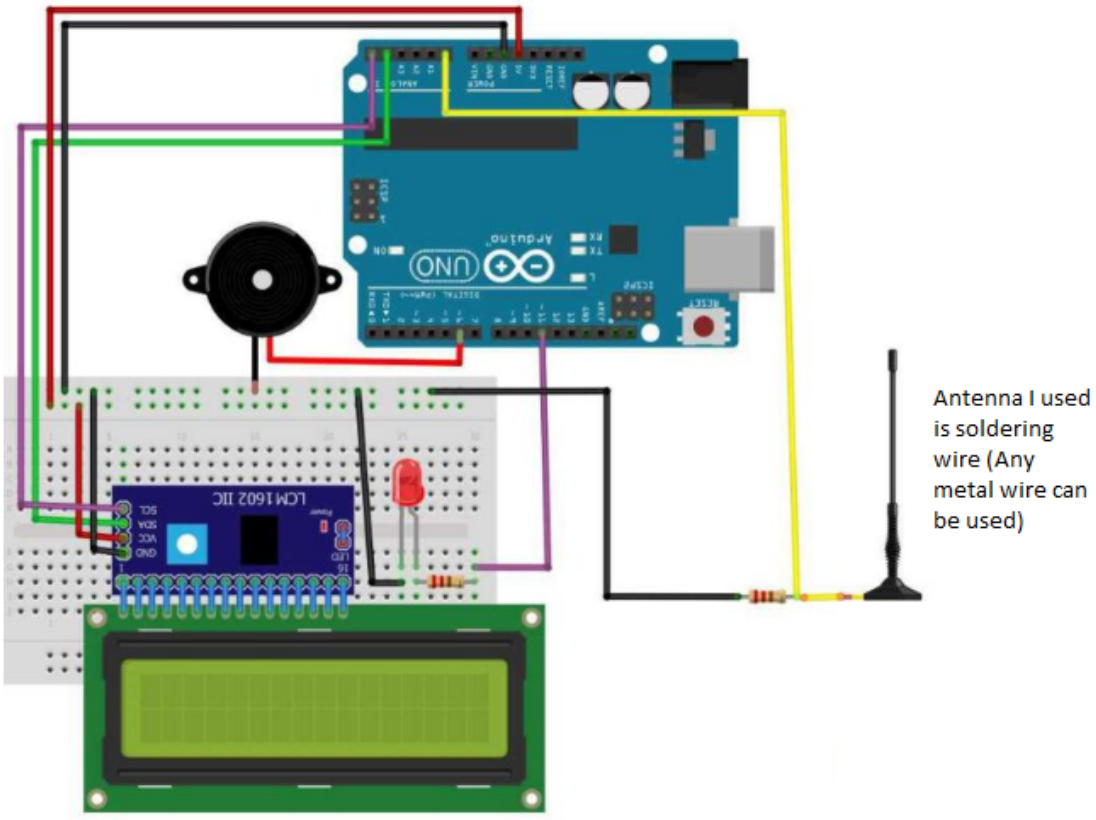


Here are some images of the prototype in use. You can see the LEDs lighting up as I move the antenna (resistor) closer to a hot wire. As more LEDs are lit up, they change to the color red, indicating that the EMF is detecting a lot of energy. This design was inspired by the real EMFs or ghost detectors that paranormal investigators use.

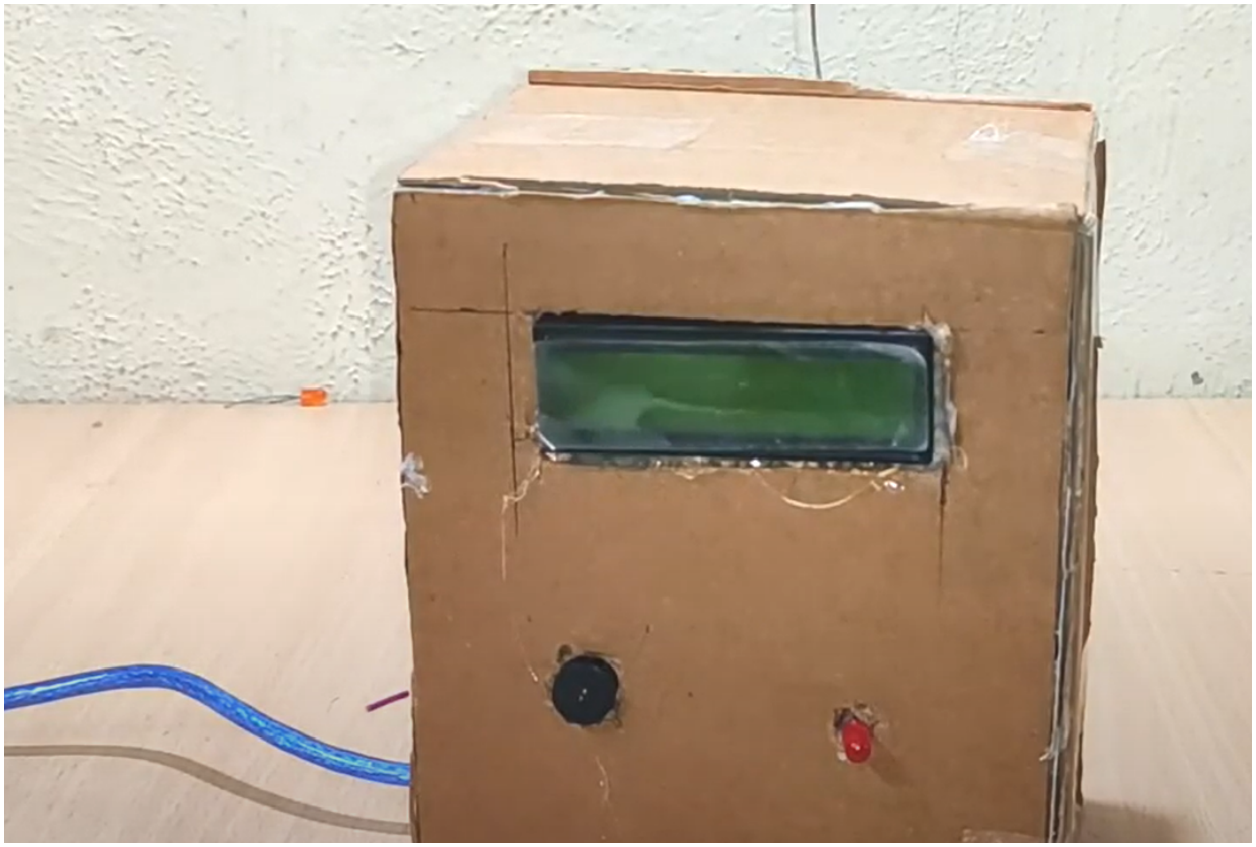


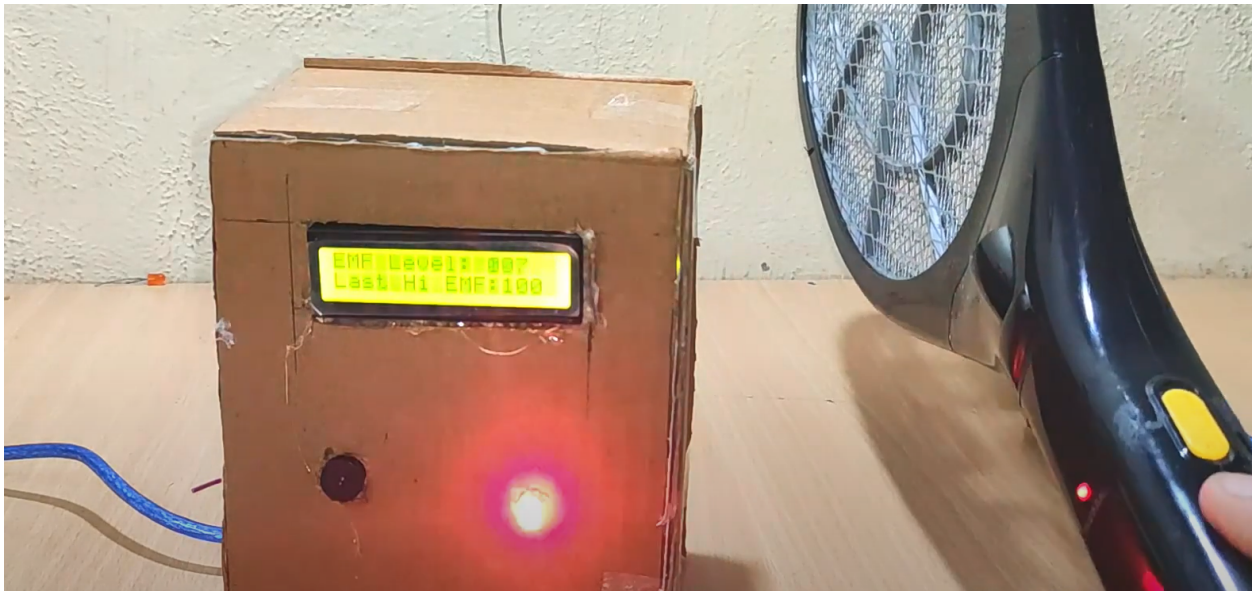
Final Design:

Here is the schematic (designed online) for the final design. The website I used to make the design made the antenna look weird, but all I used was soldering wire. This design is a bit more complex compared to the original prototype, but the functionality is generally the same. The addition of the 16x2 LCD display and the buzzer allowed me to remove the ten unnecessary LEDs and just use the display to give a “ghost level” or energy level. The buzzer was also incorporated to make the final design similar to real EMFs that paranormal investigators use. Just like the real EMFs, as energy is being detected the buzzer will make a noise and the red LED will turn on. The screen also displays the previous highest recording on the device. This resets every time it is turned off and on. The “ghost level” ranges from 0-100. This range was set just because instead of 10 LEDs representing the energy being detected like in prototype 1, the new code allows for a more sensitive detection that is represented in the same way.



Here are pictures of the final design in action. You can see the red LED lights up as I turn on the bug killer and the level of detection is adjusted. The next image shows the previously detected high for the energy level and also reads the new energy being detected. The buzzer is also sounding off, but that can't be represented in these images.





Here is a poor quality photo I took of the device being used at night. This was just to make it look like it was being used in action by a paranormal investigator.

Here is an image I found online of a real EMF being used for comparison to my design:

List of Components and Links to Datasheets:

Prototype 1:

Arduino:
https://docs.arduino.cc/static/6c5154126b43d7374876dd6dfee93656/A000067-datasheet.pdf
LED: https://www.arduino.cc/documents/datasheets/LEDRGB-L-154A4SURK.pdf
Jumper wire:
https://media.digikey.com/pdf/Data%20Sheets/DFRobot%20PDFs/FIT0010_Web.pdf
3M ohms Resistor: https://www.arduino.cc/documents/datasheets/Resistors.pdf

Final Design:

Arduino:
https://docs.arduino.cc/static/6c5154126b43d7374876dd6dfee93656/A000067-datasheet.pdf
LCD display: https://docs.arduino.cc/learn/electronics/lcd-displays
Piezo Buzzer: https://www.arduino.cc/documents/datasheets/PIEZO-PKM22EPPH4001-BO.pdf
LED: https://www.arduino.cc/documents/datasheets/LEDRGB-L-154A4SURK.pdf
470K ohms Resistor: https://www.arduino.cc/documents/datasheets/Resistors.pdf
Jumper wire:
https://media.digikey.com/pdf/Data%20Sheets/DFRobot%20PDFs/FIT0010_Web.pdf
Soldering wire or any solid wire as an antenna:
https://cdn-shop.adafruit.com/datasheets/1886_solderwire.pdf

GitHub Repository:

https://github.com/1103-Layfield-Aidan/CPE-Final-Project-EMF-GHOST-DETECTOR