Lab 23 Report – ESD measurement and Mitigation   -Rishab Shah

Goal: Analyze the impact of the ESD on the circuits by looking at the output of an ADC and incorporate best practices to reduce the amount of ESD introduced.

Setup: An arduino with inbuilt ADC – A0 and a simple wire as an antenna was used to sense the ESD present in the environment. An averaging filter was used to suppress the environmental charges present so as not to interfere with the ESD readings under consideration. Averaging was also used to remove the 60 Hz frequency present in the nearby AC lines.

Code referred from the class notes:

```
// Measure static electric fields for n PLC
int pinADC = A0;
int nPLC = 1;
long iTime2Average_usec = (1000000.0 * nPLC )/ 60.0; // time we want to average
float V_ADU;
long nCountsActual;// number of actual measurements averaged
long iTimeStart_usec; // start of averaging time
long iTime2Stop_usec; // stop of averaging time
//////////////////////////////////////////////
void setup() {
Serial.begin(2000000);
/// this routine will get the input to the ADC into a steady state value
for (int i = 1; i < 3000; i++) {
V_ADU =analogRead(pinADC);
}
}
void loop() {
////initialize variables at start of loop///
V_ADU = 0.0;
nCountsActual = 0;
iTimeStart_usec = micros();
iTime2Stop_usec = iTimeStart_usec + iTime2Average_usec;
//////////////////////////////////////////////
while (micros() < iTime2Stop_usec) {
V_ADU = V_ADU + analogRead(pinADC) * 1.0;
nCountsActual++;
}
V_ADU = V_ADU / nCountsActual;
//Serial.print(nCountsActual); Serial.print(", ");
Serial.println(V_ADU);
}
```
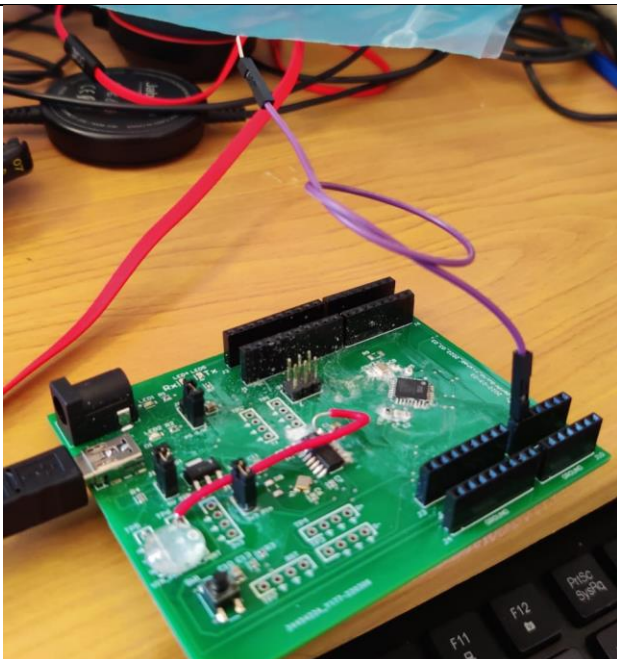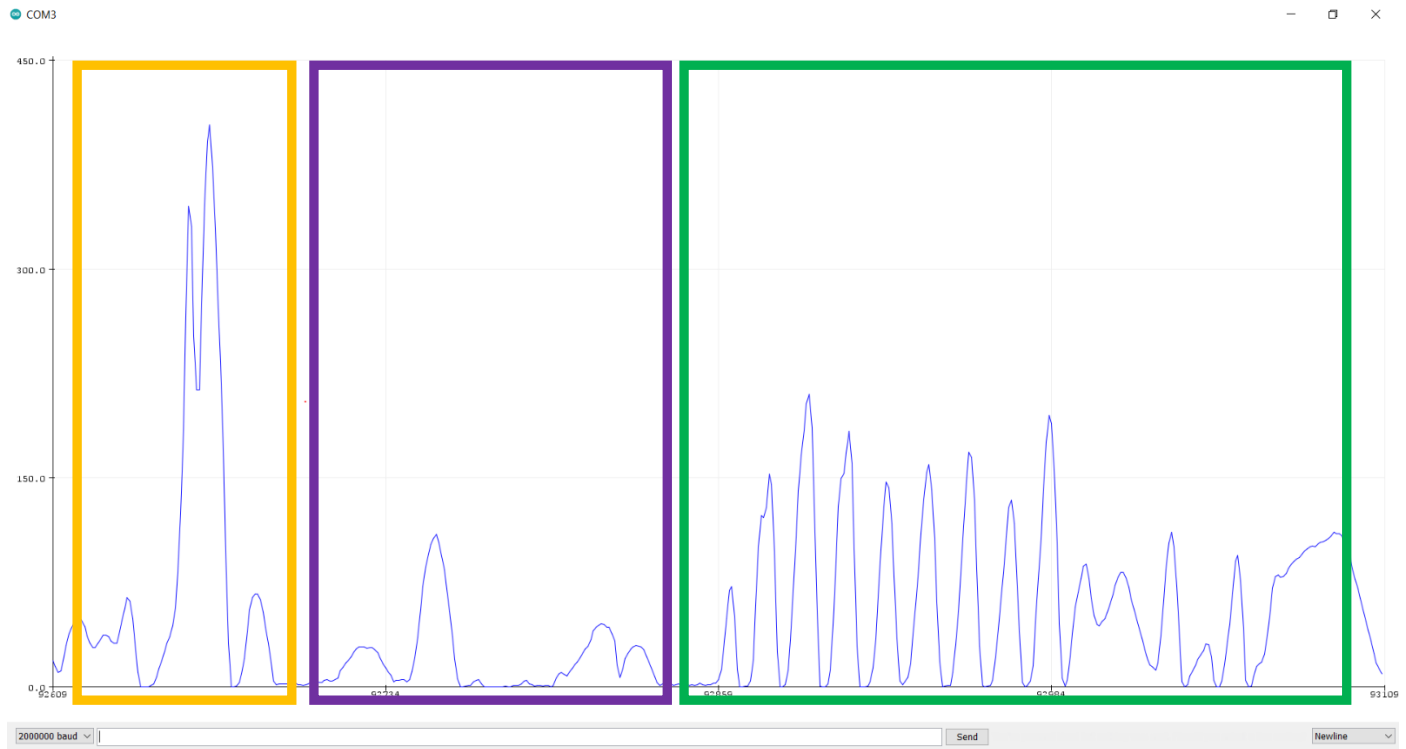

The purple wire act as an antenna which is connected to the A0 pin of the arduino. Analog pin.

ESD event detected:
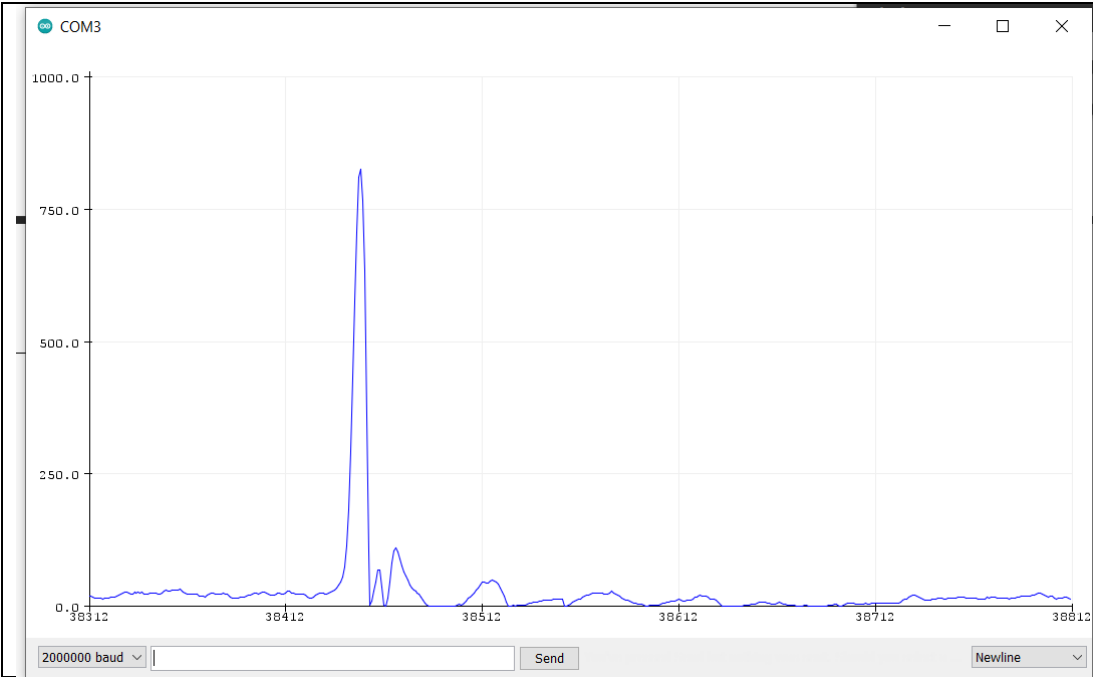
The spike which has crossed 750 mV was picked up the antenna when hands were rubbed on the clothes and was taken near to the antenna.

ESD event as well as technique used to suppress the ESD spikes

In the above image,

Orange indicates the region when a large amount of ESD was detected when hands rubbed on clothes were moved towards the wire.

Violet indicates the region when the user was away from the antenna and hence the spikes picked up were from the environment.

Green indicates the region when the user has touched his one hand to the ground of the equipment and the other hand was moved closer. In this case, the spikes picked up the circuit were very less than comparatively. The spike slook periodic because the user had periodically moved hand closer to the antenna and away.

Learnings:
It is important to make use of the ESD band, insulated mats, and grounding of every electronic equipment to bypass any ESD away from the operating circuit as an ESD event can damage the circuit components.
The ESD events are instantaneous in nature which is also dependent on the charge. More the charge, higher the voltage spike and more time taken to come to normal voltage.