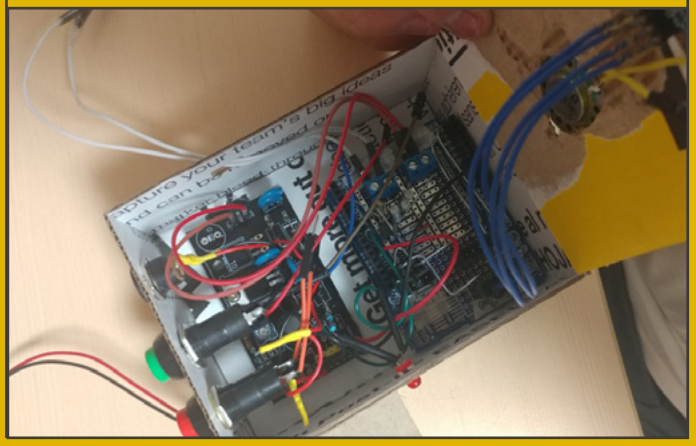
GEIGER COUNTER

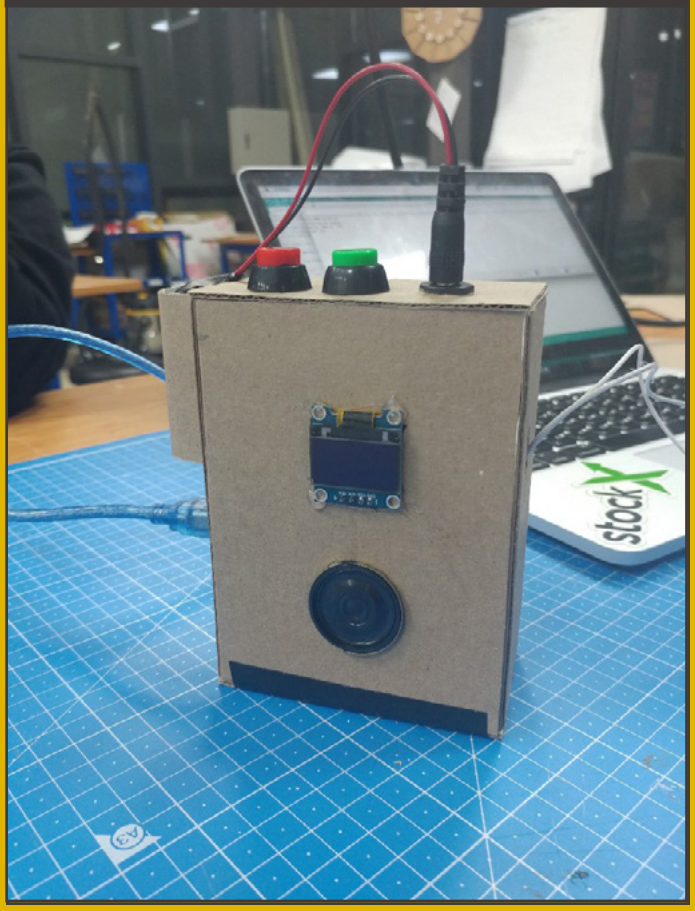
GEIGER COUNTER

CARDBOARD CASING 01

For the main circuit, a cardboard casing was built for protection

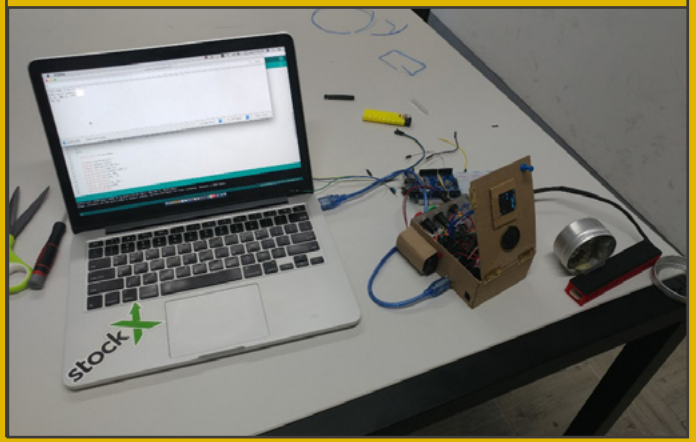


CARDBOARD CASING 02



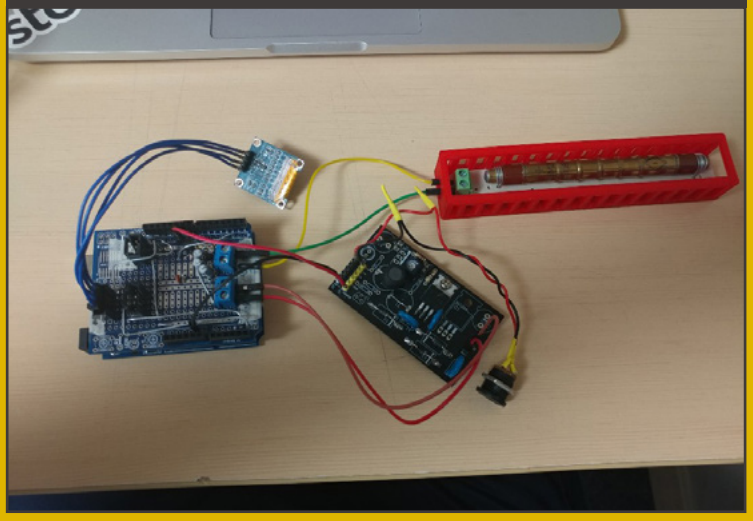
CARDBOARD CASING 03

For the main circuit, a cardboard casing was built for protection

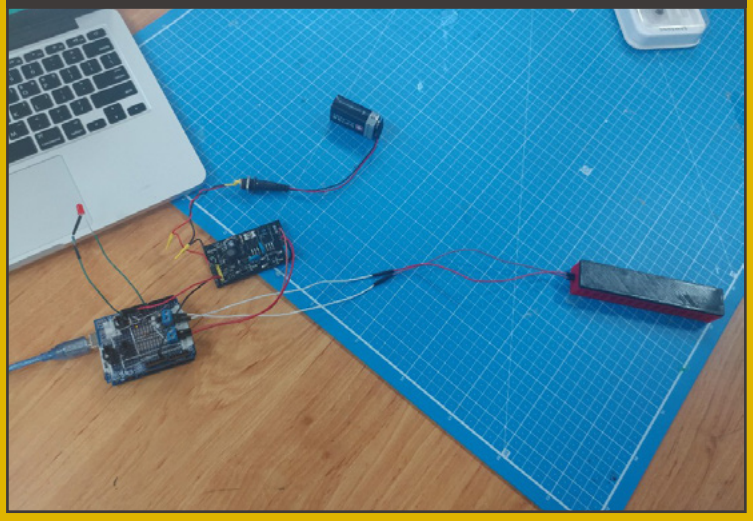


GEIGER COUNTER

COMPLETE CIRCUITRY 01

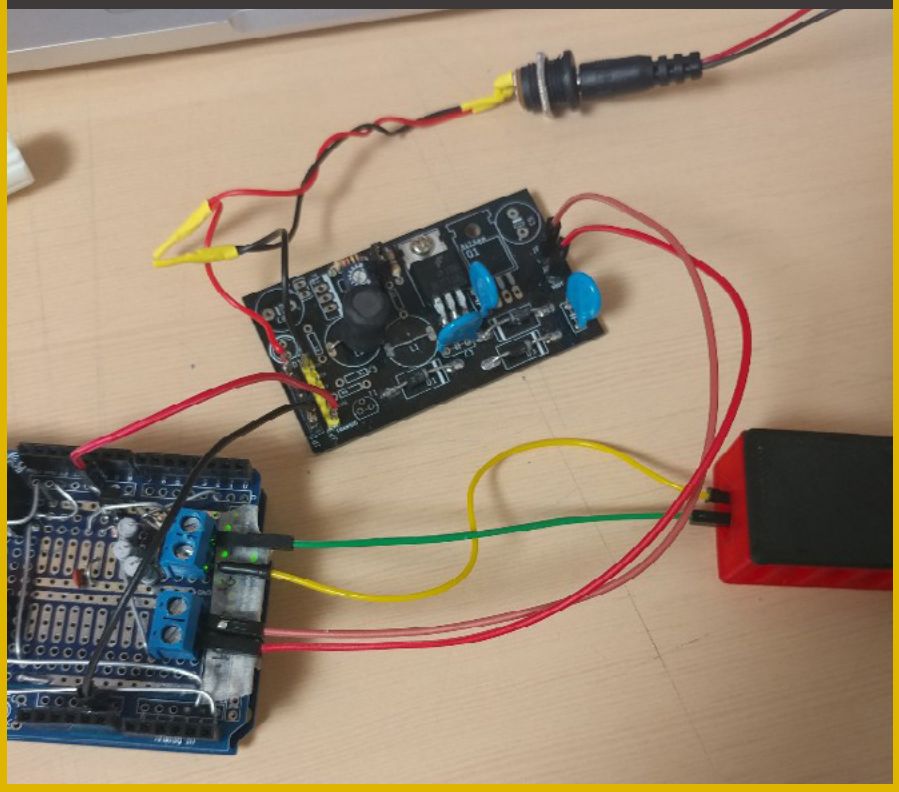


COMPLETE CIRCUITRY 02



After the connection testing was complete, all the parts were assembled and the Geiger Tube was encased into a 3D printed casing.

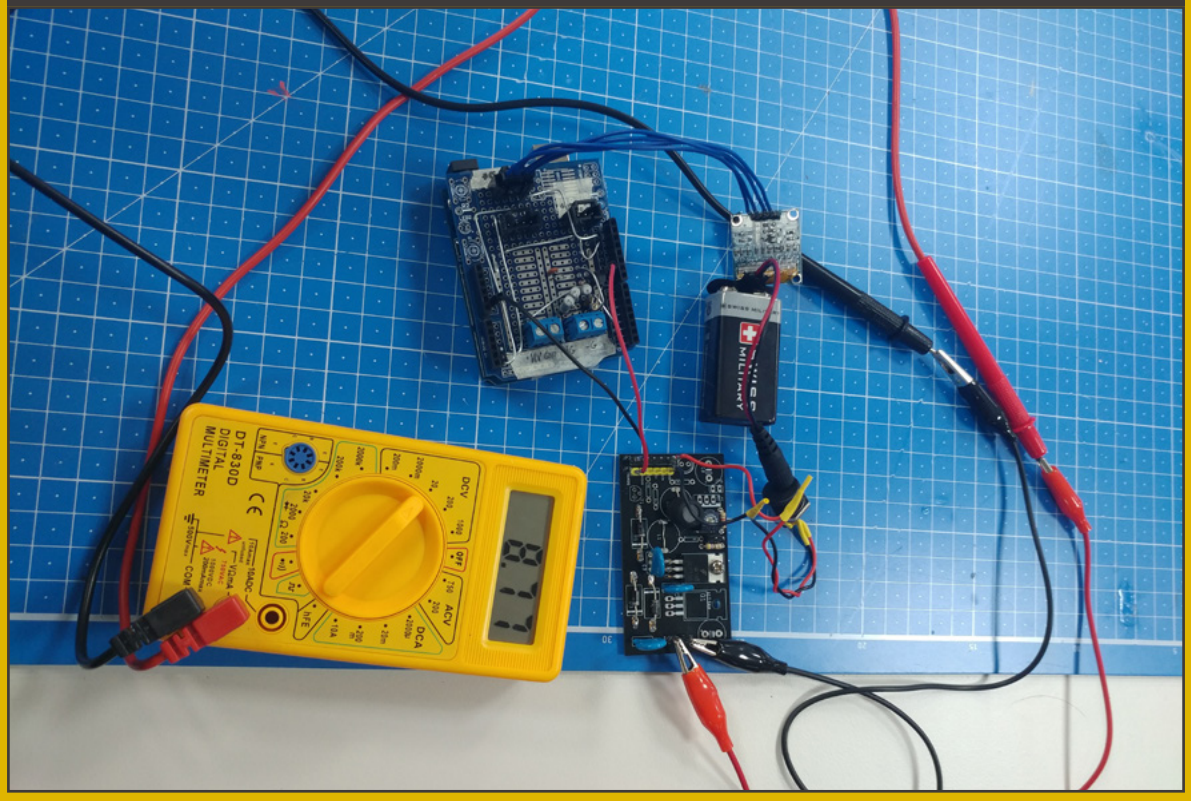
COMPLETE CIRCUITRY 03



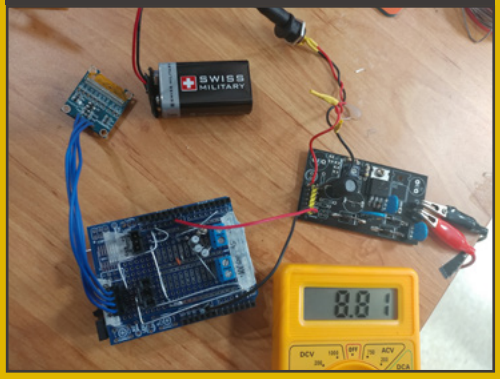
COMPLETE CIRCUITRY

GEIGER COUNTER

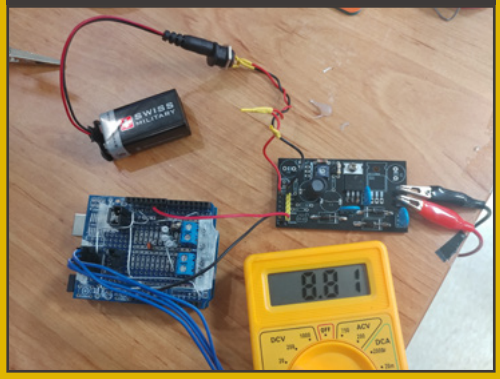
CONNECTION TESTING 01



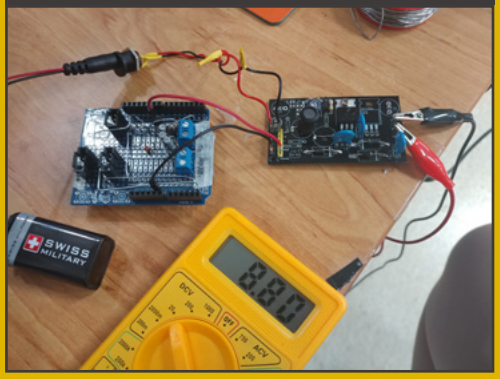
CONNECTION TESTING 02



CONNECTION TESTING 03



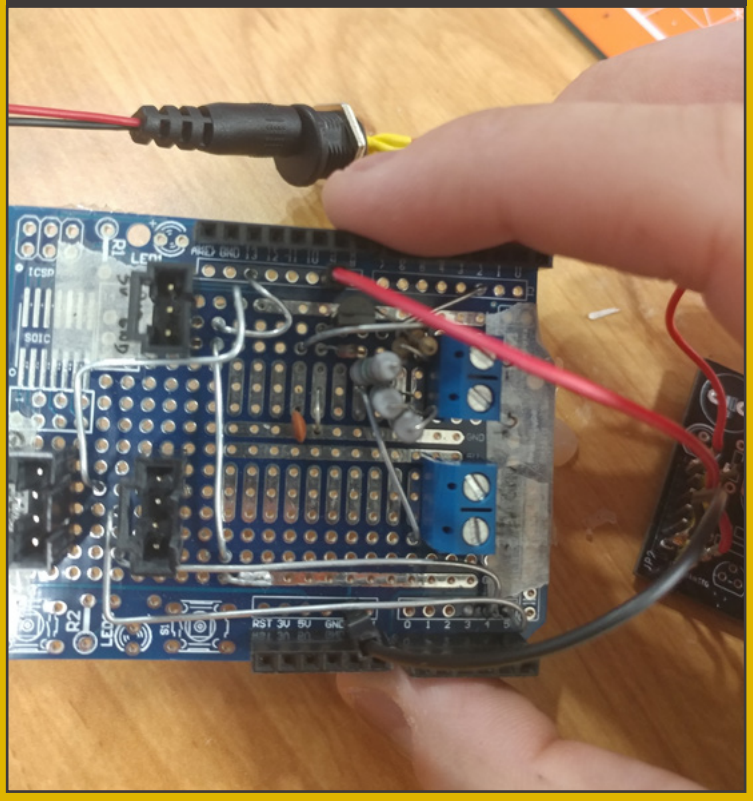
CONNECTION TESTING 04



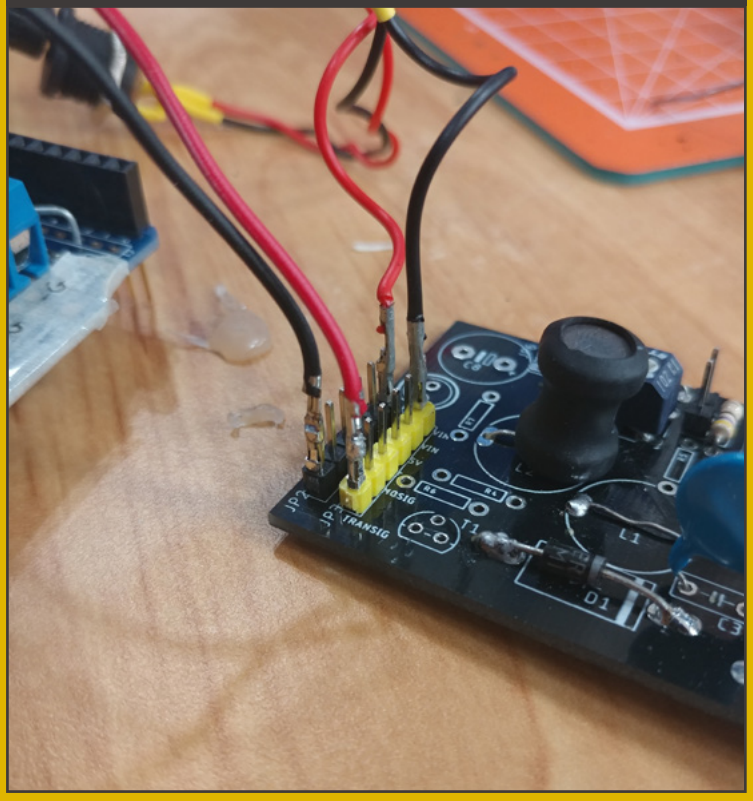
Testing the connection between 9V battery, Arduino Uno + Shield, and the 400V Voltage Signal Amplifier. The amplifier is supposed to give 400V but it is not. Later, this issue was fixed by changing the Arduino output pin from 9 to 7.

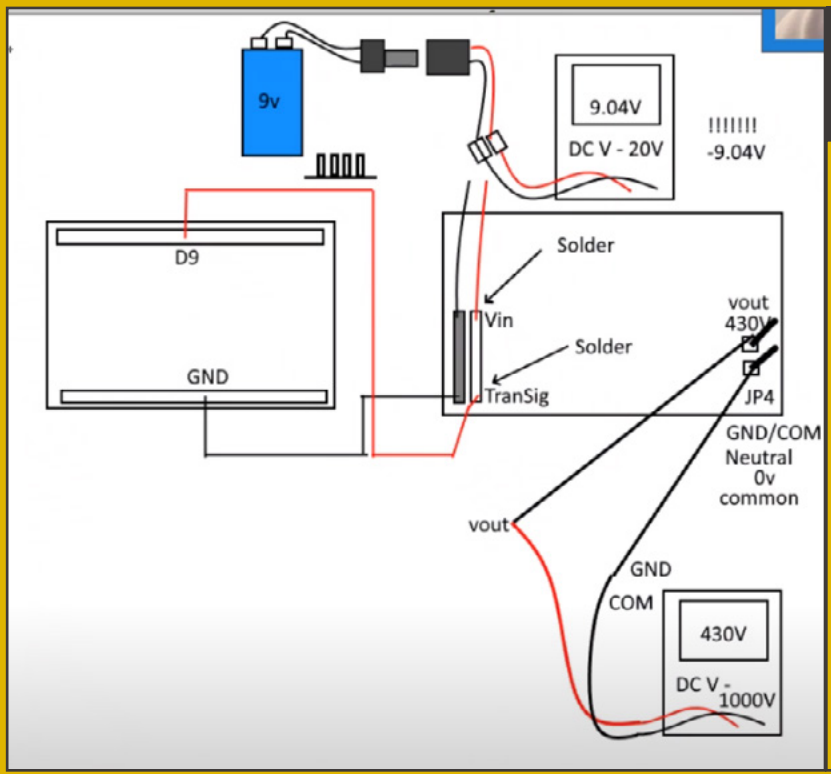
GEIGER COUNTER

CONNECTION TESTING 05



CONNECTION TESTING 06





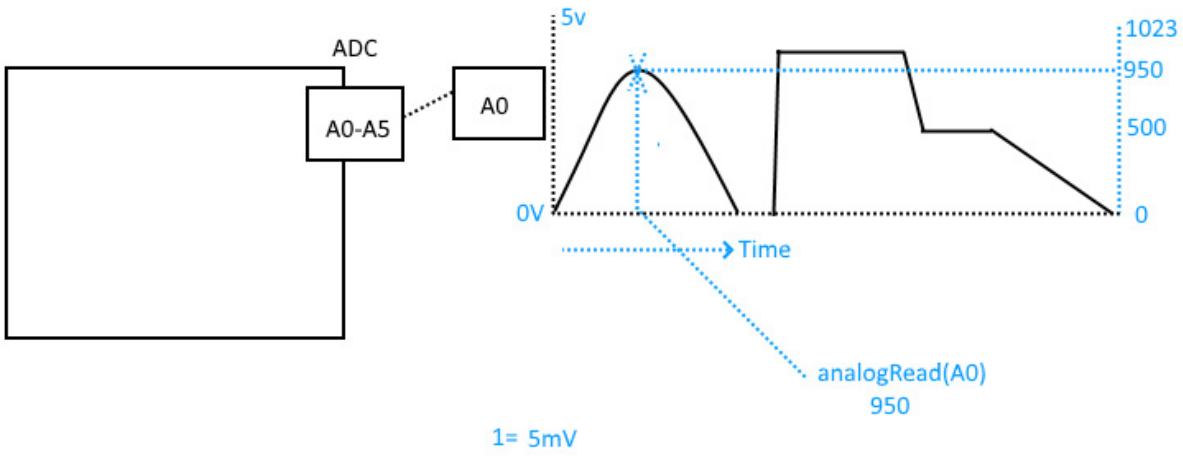
CONNECTION TESTING 07

Diagram of the connection testing between the Arduino + Shield and the voltage signal amplifier.

GEIGER COUNTER

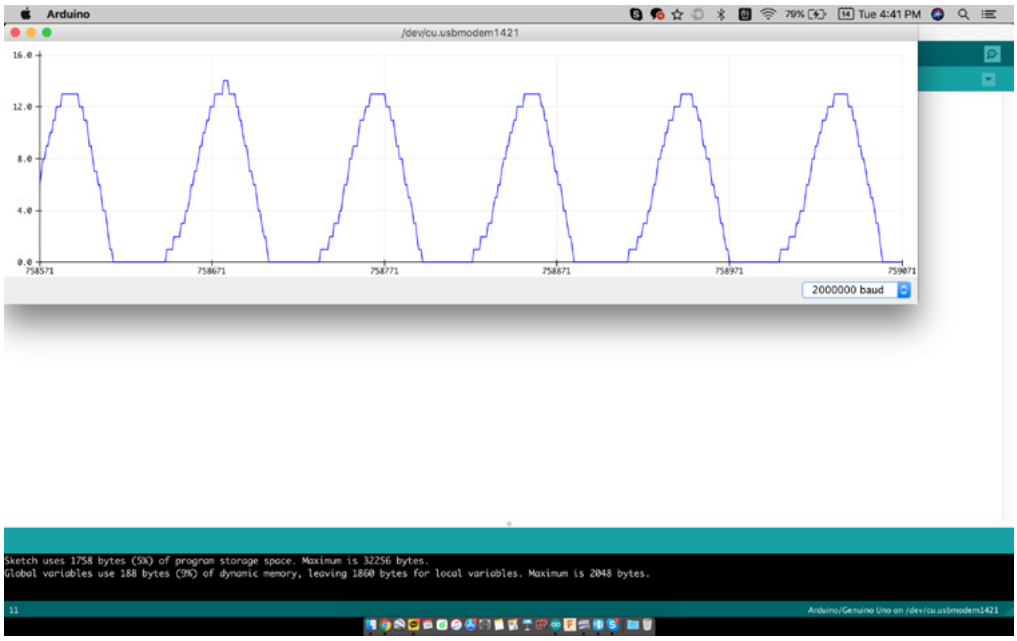
ANALOG-DIGITAL DIAGRAM

A diagram of the relationship between analog and digital.



DIGITAL PULSE

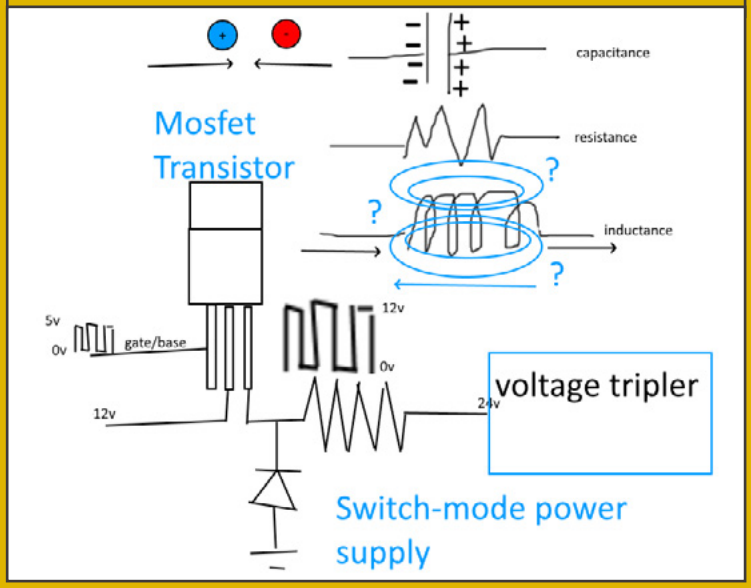
Digital Pulse is demonstrated using Arduino's Serial Plotter.



GEIGER COUNTER

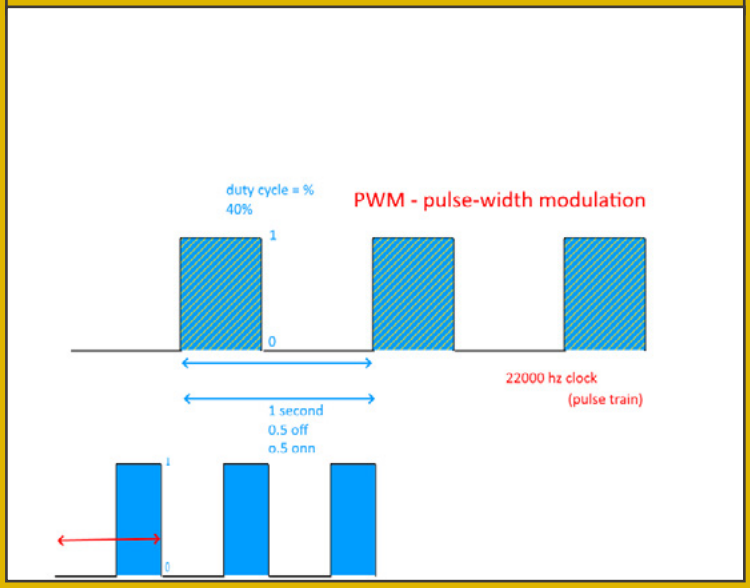
SWITCH MODE POWER SUPPLY

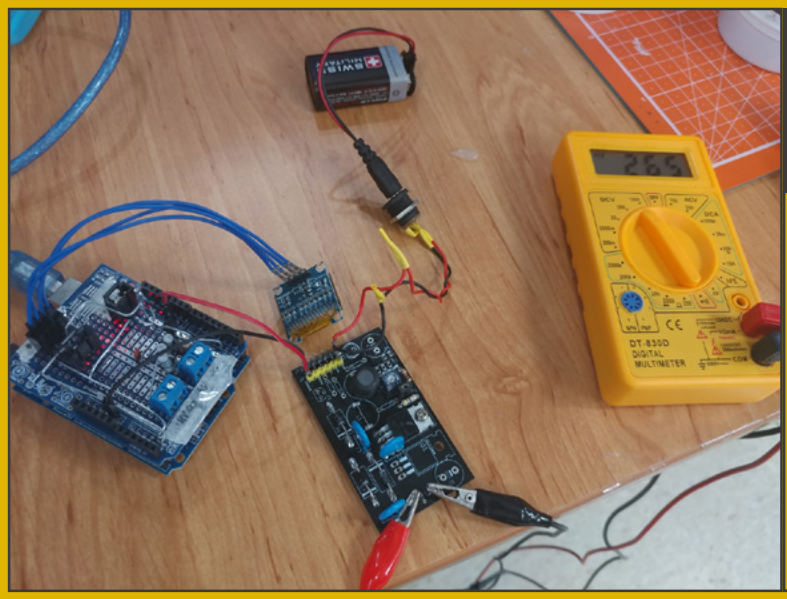
A diagram used when learning SMPS



PWM LEARNING

A diagram used while learning about PWM (Pulse With Modulation)

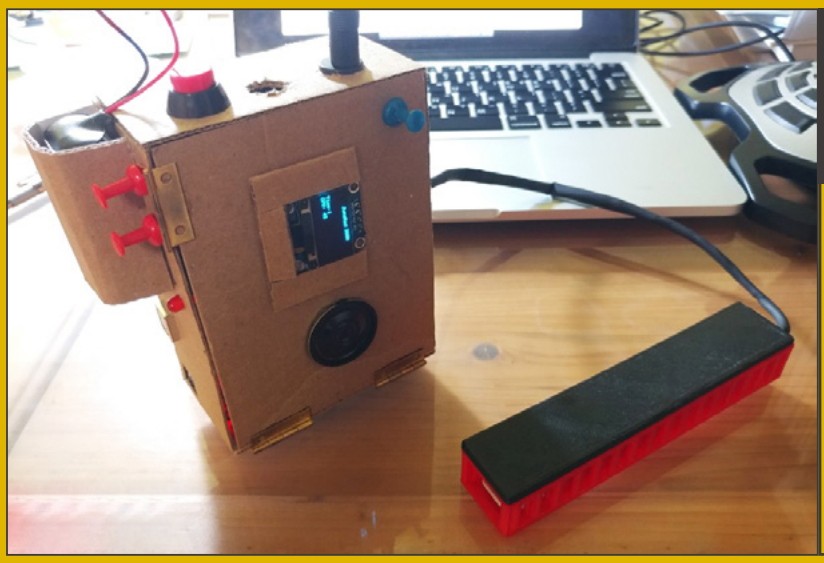




FINAL CONNECTION TESTING 01

After fixing the pinout issue, the final connection testing was conducted (the voltage displayed is around 260 because the battery is old)

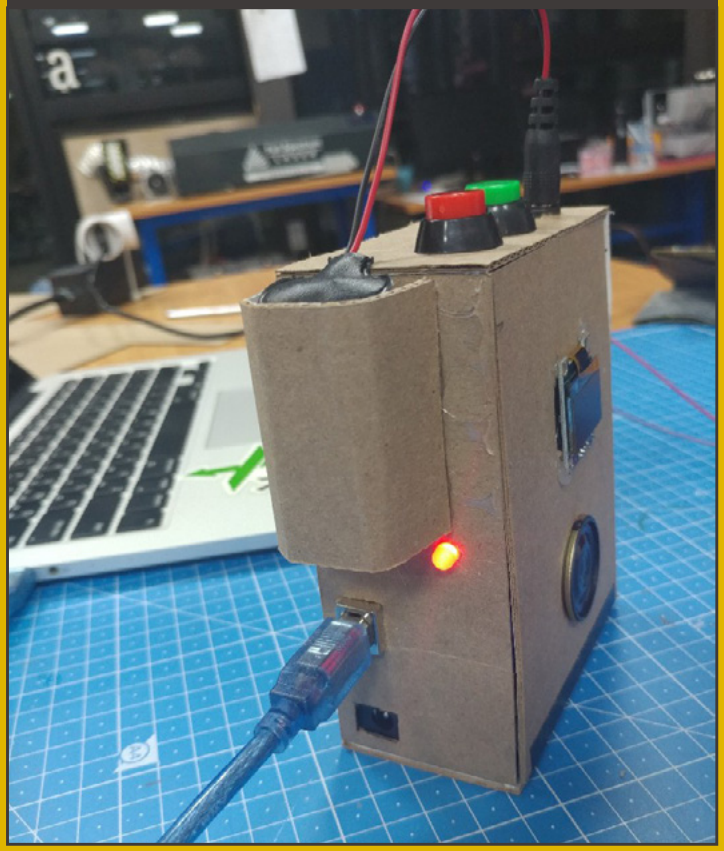
GEIGER COUNTER



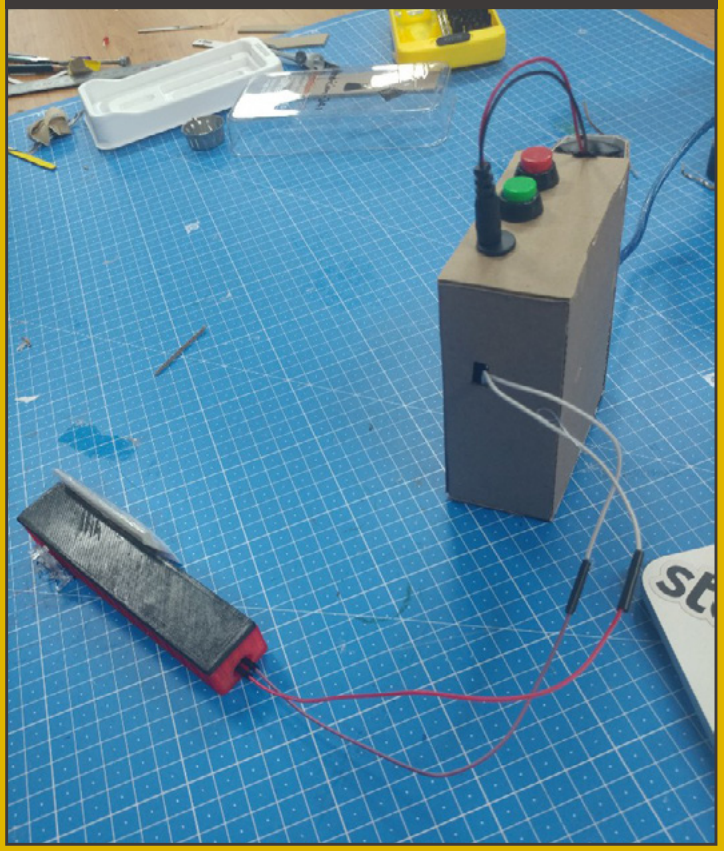
FINAL WORKING GEIGER COUNTER 01

The picture of the finalized Geiger Counter. The radiation is counted in CPM (counts per minute)

FINAL WORKING GEIGER COUNTER 02



FINAL WORKING GEIGER COUNTER 03

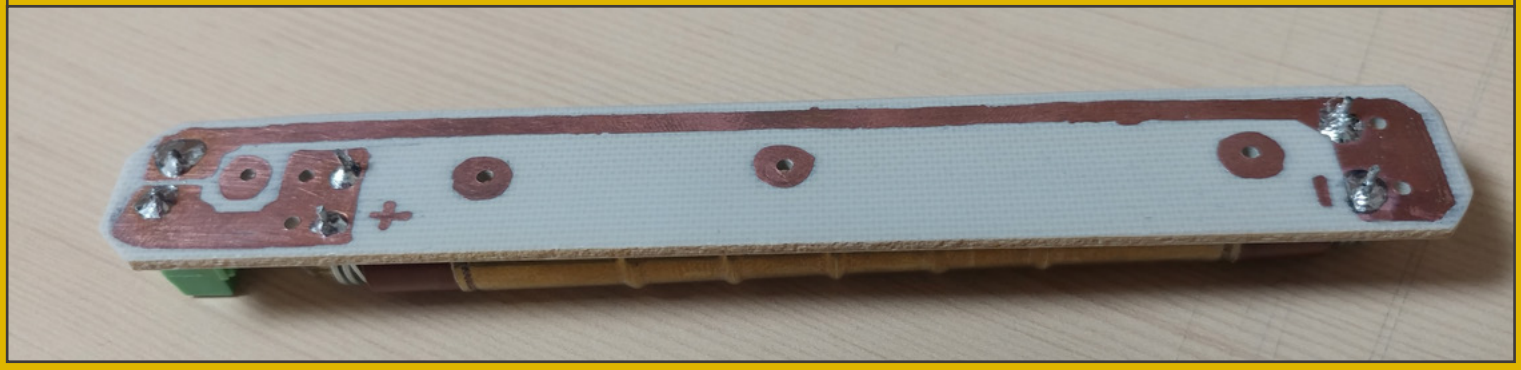


FINAL WORKING GEIGER COUNTER

GEIGER COUNTER

GEIGER TUBE 01

Geiger Tube SBM 20 is soldered onto the connection board.



GEIGER TUBE 02

GEIGER TUBE 03

SBM 20 Geiger Tube is soldered onto the connection board.

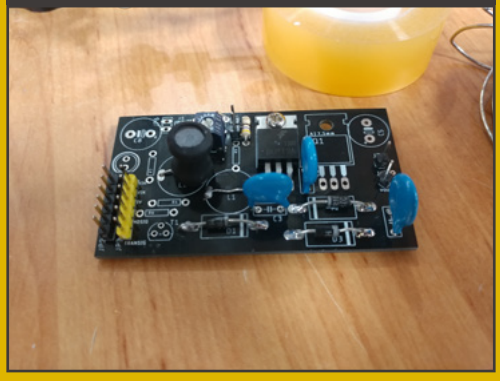
GEIGER TUBE 04

Top view of SBM 20 Geiger Tube soldered onto the connection board.

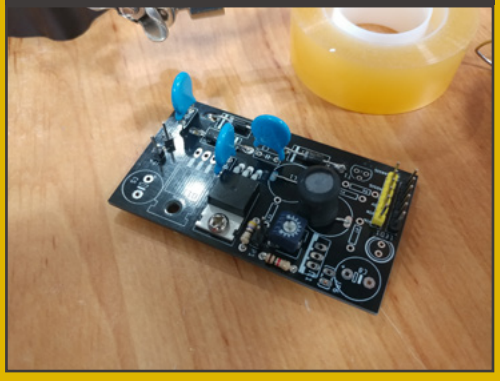
GEIGER COUNTER

VOLTAGE SIGNAL AMPLIFIER 01

VOLTAGE SIGNAL AMPLIFIER 02



VOLTAGE SIGNAL AMPLIFIER 03



This board, composed of a potentiometer, resistors, capacitors, transistors, and diodes, amplifies the 5V output from the Arduino to 400V that is required to operate the SBM 20 Geiger Tube.

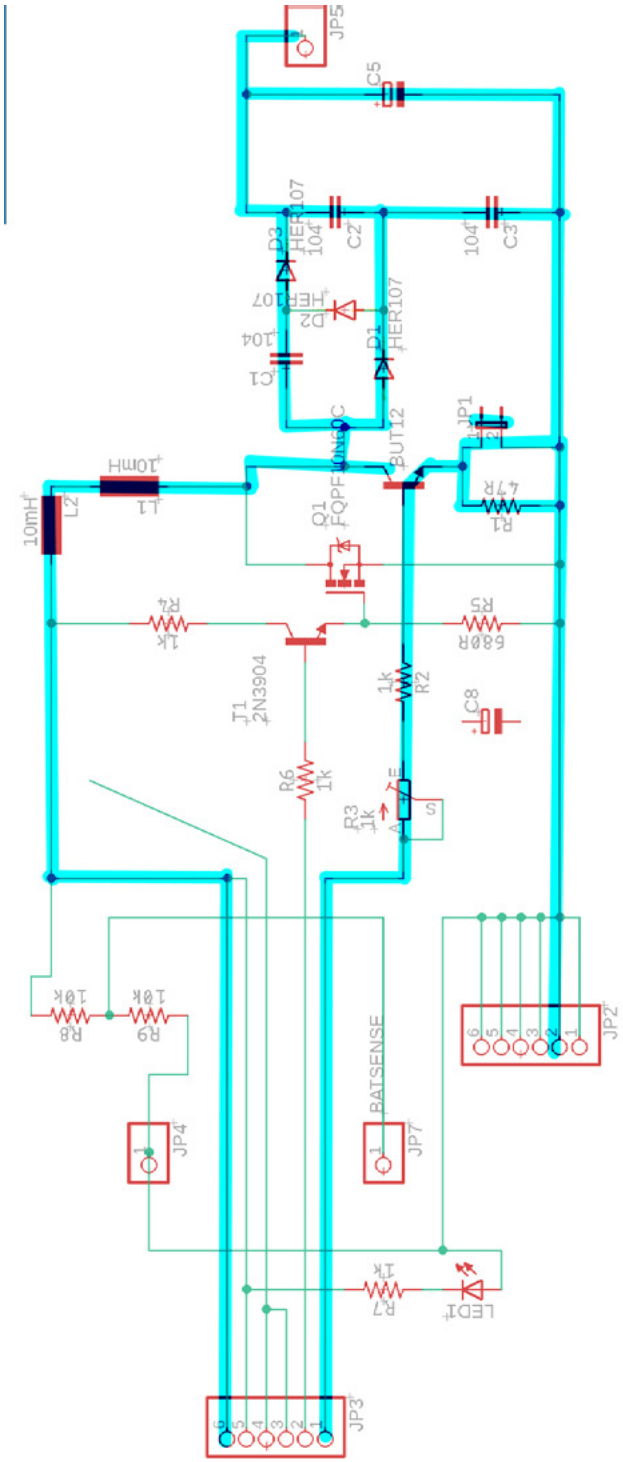
VOLTAGE SIGNAL AMPLIFIER 04

The backside of the board, composed of a potentiometer, resistors, capacitors, transistors, and diodes, amplifies the 5V output from the Arduino to 400V that is required to operate the SBM 20 Geiger Tube.

GEIGER COUNTER

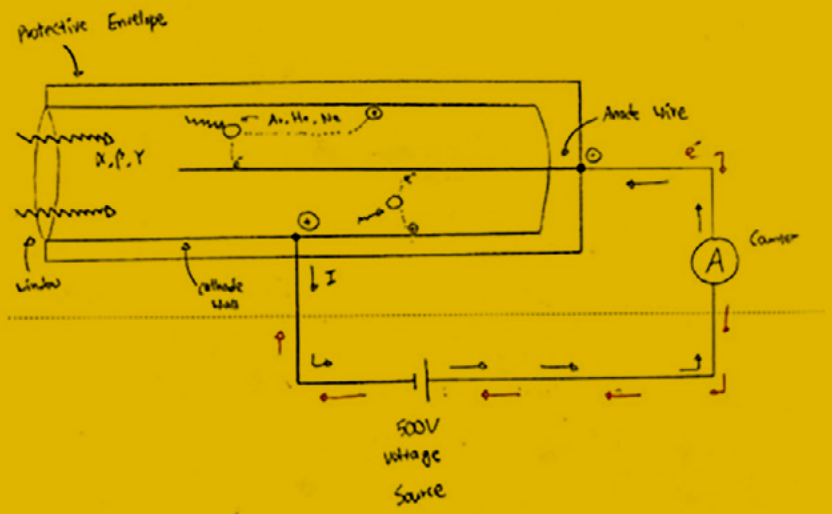
SCHEMA

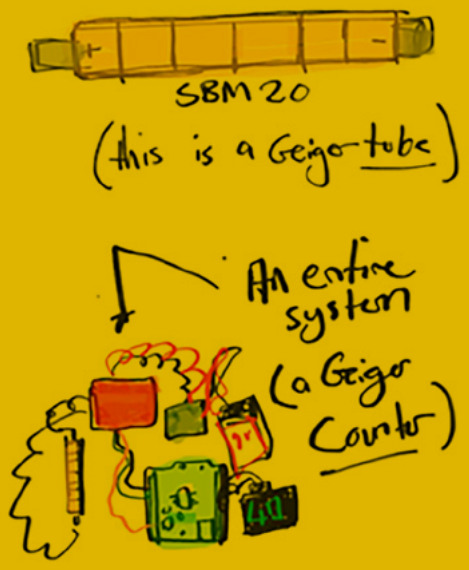
Schematic Diagram of the circuitry.



GEIGER COUNTER

DIAGRAM & DESCRIPTION





The Geiger tube mainly consists of the two most important parts: positively charged anode wire at the center of the tube and the negatively charged cathode wall. The tube itself is filled with low-reactive gaseous particles (noble gases), such as helium, argon, or neon. When ionizing particles collide with low-reactive gases in the tube, those gases get ionized and cations of gases will get attracted to the cathode wall and electrons will move to the anode wire, generating current (electric pulse) in the anode wire, which is then measured by the counter. These gases are mixed with 5~10% of organic vapor or chlorine gases to prevent spurious ionization (called current avalanche) through quenching. When positive, gaseous cations gain an electron from the cathode, the electron is initially placed at the highest shell of the cation, but as it moves down the energy level, it releases photons (or light or electric arc). These photons then can cause subsequent spurious ionization, or the current avalanche, disturbing with the actual electric pulse in the anode wire. Thus, quenching, either externally using voltage source or internally using halogens, is necessary to prevent these events.

There are two major types of Geiger counter: the windowed tubes and windowless tube. The windowed tube measures weak radiation particles such as alpha and gamma. The reason why the windowed tube has a clear window is that weak radiations cannot pass through metal walls. Windowless tube detects stronger radiations such as x-ray and stronger gamma. For the windowless tube, only the particles with strong enough energy to penetrate a steel wall (generally 1~2 mm of chrome steel) will be measured.

DIAGRAM & DESCRIPTION