Graphite resistive rain sensor

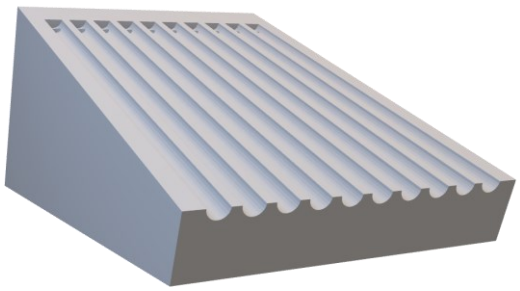
I was using a FC-37 rain sensor for rain detection. This sensor uses a printed circuit board with parallel tracks connected to a board which checks sensor resistance. When sensor board is dry the resistance is high, and the sensor analog output gives a high voltage above 2.4-2.5 volts. When it rains, the sensor resistance is lower, and voltage drops below 1.5 volts. Measuring this on the analog input of a NodeMCU, we can detect if it is raining.

The problem with these printed circuit board sensors is the corrosion. After some time, the water oxidizes copper tracks, and the sensor board becomes conductive even if it is dry. The sensor needs maintenance, cleaning and sanding the tracks time to time, or you will get false positives on rain detection.

The sensor

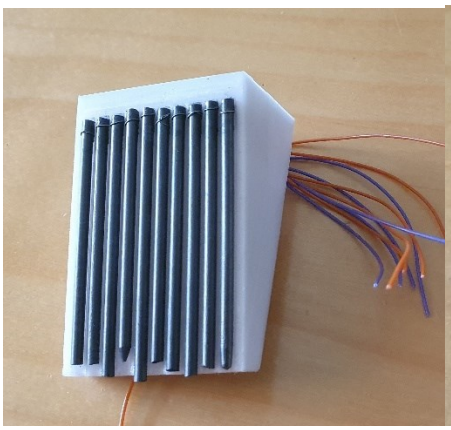
A member of the astronomy club to which I belong give me the ide of using a non-corrosive material, like graphite, and I started to work on develop it.

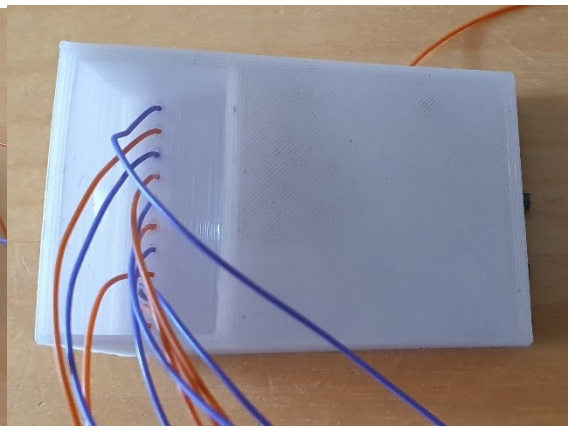
I decided to use 3 mm diameter leads from a mechanical pencil for the experiment. I designed a holder with 10 slots for the pencil leads.



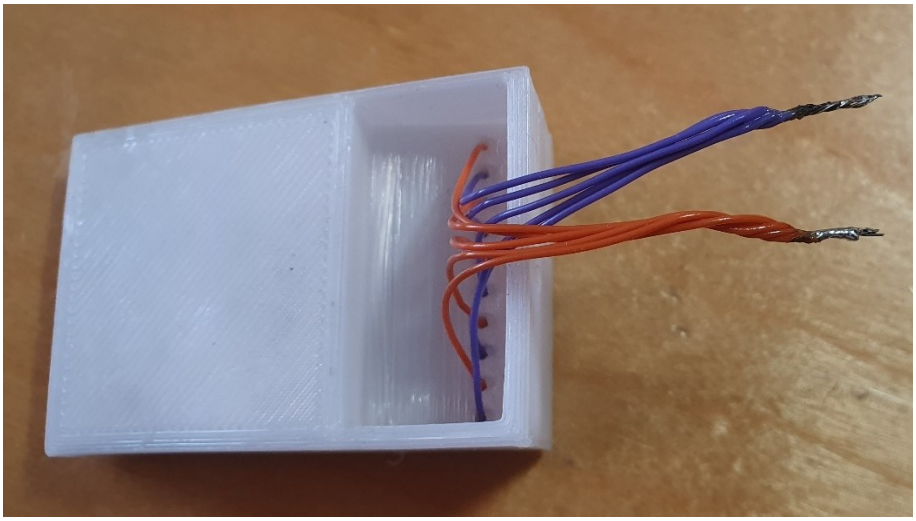
Find the SLT files for 3D print the holder in: https://www.thingiverse.com/thing:6521227

And cutted the pencil leads to the length of the slots, and coil an electrical cable on the end of the lead, and fixed all leads to the holder.



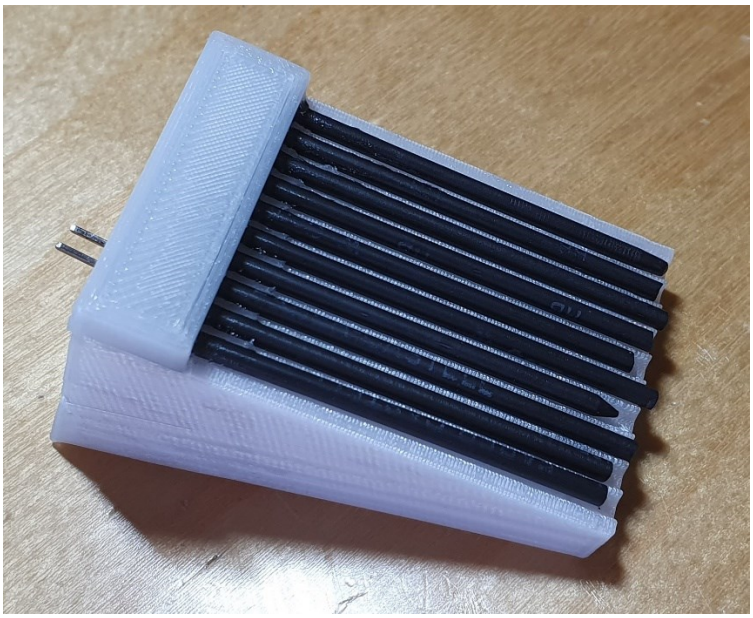


Cables are alternated of two colours, blue and orange, in order to connect all blues together and same with all oranges, having side by side graphite bars connected to a different colour cable.



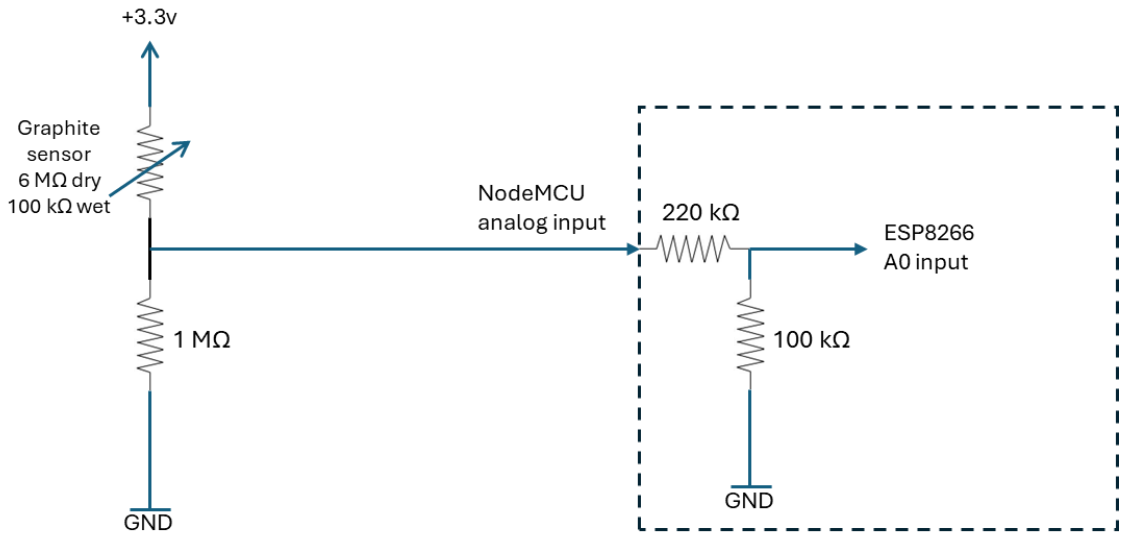
In this way, when the water drops wet the graphite bars, the resistance between two side bars will drop. When the graphite bars are dry, resistance will be very high.

In order to protect the connections from the cooper cable and the pencil leads from direct exposure to water, I printed a plastic cover and fill it with silicone.



Testing the resistance of this “graphite” sensor gives 6 to 8 MΩ when dry and it drops to around 100 kΩ when wet. These values didn’t work well when I connected this sensor to the FC37 electronic board, which has a pull-up resistance of 10 kΩ, which in comparison with the graphite sensor resistance is very low and changes from dry to wet were very small.

The solution is to connect the sensor to +3.3v, and put a pull-down resistance of 1 MΩ. This, with the 220k/100k voltage divisor of the NodeMCU, give us a much better variation of voltage in the A0 entrance of the NodeMCU ESP8266.



The program

The Arduino program is very simple, just read the A0 input of the ESP8266 and check if it is below or above a threshold.

```
/*************************************************************************
  Arduino program for test the graphite resistive rain sensor

  v1.0 - 7/May/2024

*************************************************************************/

#define RAIN_ANALOG A0

#define RAIN_THRESHOLD  200


void setup() {

  Serial.begin(115200);
  Serial.println("\nGraphite rain sensor test");

}

void loop() {
int         rainA;
bool        rainD;

  // Read rain sensor on analog input
  rainA = analogRead(RAIN_ANALOG);
  rainD = ( rainA > RAIN_THRESHOLD );
  Serial.print("sensor analog read: ");
  Serial.print(rainA);
  Serial.print(", is raining: ");
  Serial.println((rainD ? "yes" : "no"));

  delay(30000); // wait 30 secs.

}
```