For the DHT-11 sensor, we had to get two different ground truths (measurement from reliable source)- one for temperature and one for humidity. To measure temperature and humidity, we needed an isolated environment whose temperature and humidity we could measure without interference from other sources that could produce these two quantities (humans especially), as such we used a car whose temperature and humidity could be isolated.

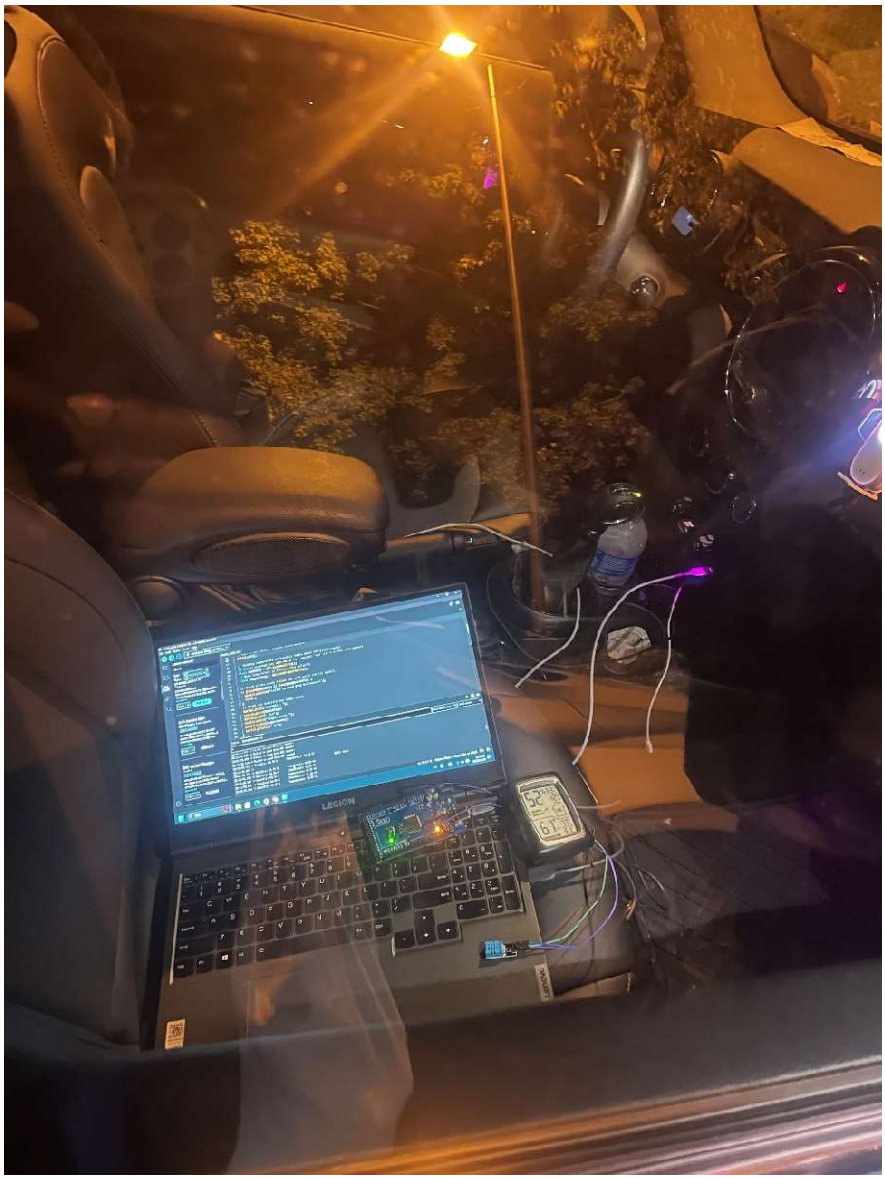
Ground Truth

With a car, the ground truth could easily be gotten as a car has a more accurate temperature sensor but we while a car can accurately measure temperature, it does not have a mechanism for humidity so we used the Accurite Humidity Monitor to accurately measure the actual humidity which served as the ground truth. Pictures below

Ground truth for temperature

Ground truth for humidity

Testing Setup



With this setup, to get the data needed to analyze the sensor, all we needed to do was get different readings which we did simply by auto tuning the car to provide the temperatures and automatically humidity we wanted or could get (as the car could only provide temperatures from 11 deg C to 23.89 deg C, but this is still good enough for the quantification we need to perform!) which we then measured using the sensor (and the Accurite humidity monitor to get the actual humidity).

Like said before to quantify the performance of a sensor, we need to measure/calculate its static characteristics and then analyze. For this sensor, the characteristics we measured (or could try to with the setup we had) were drift static error and linearity which we then used to quantify the performance of the sensor as can be seen in the result file.

Below are the measurement processes of the static characteristics;

- Drift
  For drift, we put the sensor outside to measure the temperature of the surrounding and check the verified the actual temperature using the reliable weather app on a phone. We then kept the sensor running for one minute.

- Static Error
  Varying the temperature and thus humidity inside a car, we kept the sensor inside to measure (or try to measure) that same temperature and humidity, the data gotten from the sensor at these varying temperatures is provided below and then we went ahead to calculate the static error which can be seen in the result file

- Linearity
  This was another one of those characteristics that could only be quantified and to do that, we plotted the values (actual and measured against each other) and extracted the information needed to determine linearity.