Low-cost High-Precision PM Sensor

Purpose

Many families are unaware of the air quality in their homes due to the high cost of a high-precision PM sensor.

Some researchers wish to build large networks of accurate PM sensors but are hindered by the cost of buying large quantities.

Our GOAL is to design and build a PM sensor that has the same performance of sensors that cost multiple times our sensor.

How we get it?

The Low-cost High-Precision PM sensor is an idea from Dr.Zhenyu Zhang, developed by the 2022 ECE 492 Capstone Design team of

- Zhaoqi MA
- Xiaolei Zhang
- Siru Chen, and
- Zixuan Wan

The product version is expected to cost less than CA$36.87

Design files and documentation are available at
- https://github.com/Terry-One/LCHP-PM-Sensor
- By contacting the client at zhenyu15@ualberta.ca

Technical advice courtesy of Dr.Zhenyu Zhang.

How does it work?

1. Our device uses a cheap light-scattering PM sensor together with a temperature&humidity sensor to sense data. the light-scattering sensor will output a voltage value and the value can be converted into PM density

2. The sensed signals will first pass through a two-stage filtering algorithm to reduce short-term noise. Machine learning is then applied to the filtered signals for calibration.

3. Temperature and humidity are measured to offset the variations caused by temperature and humidity changes.
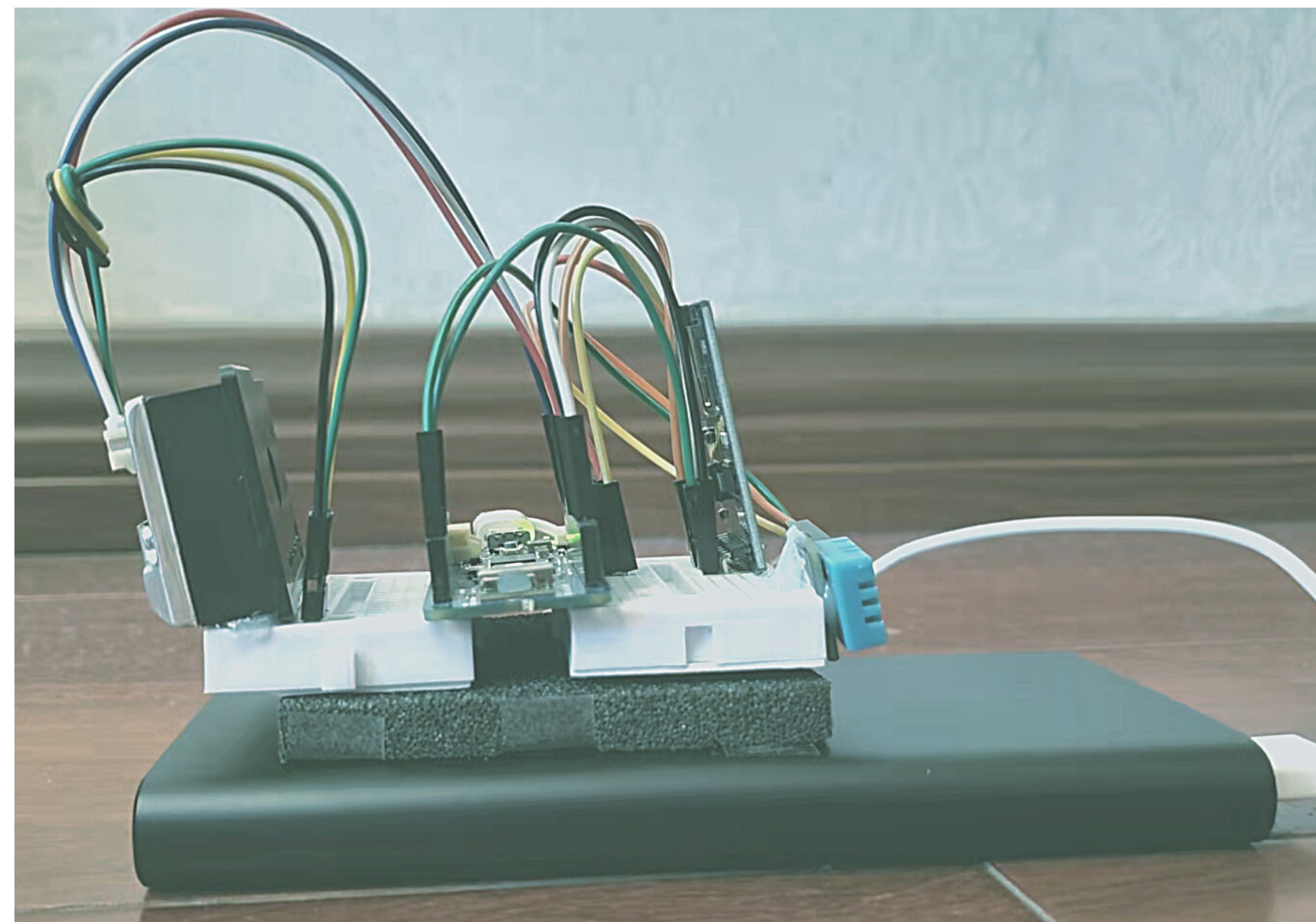
How to use it?

Download our App and connect our sensor with your phone. Now, you can view real-time PM density from our sensor or graph out historical data stored in our sensor.
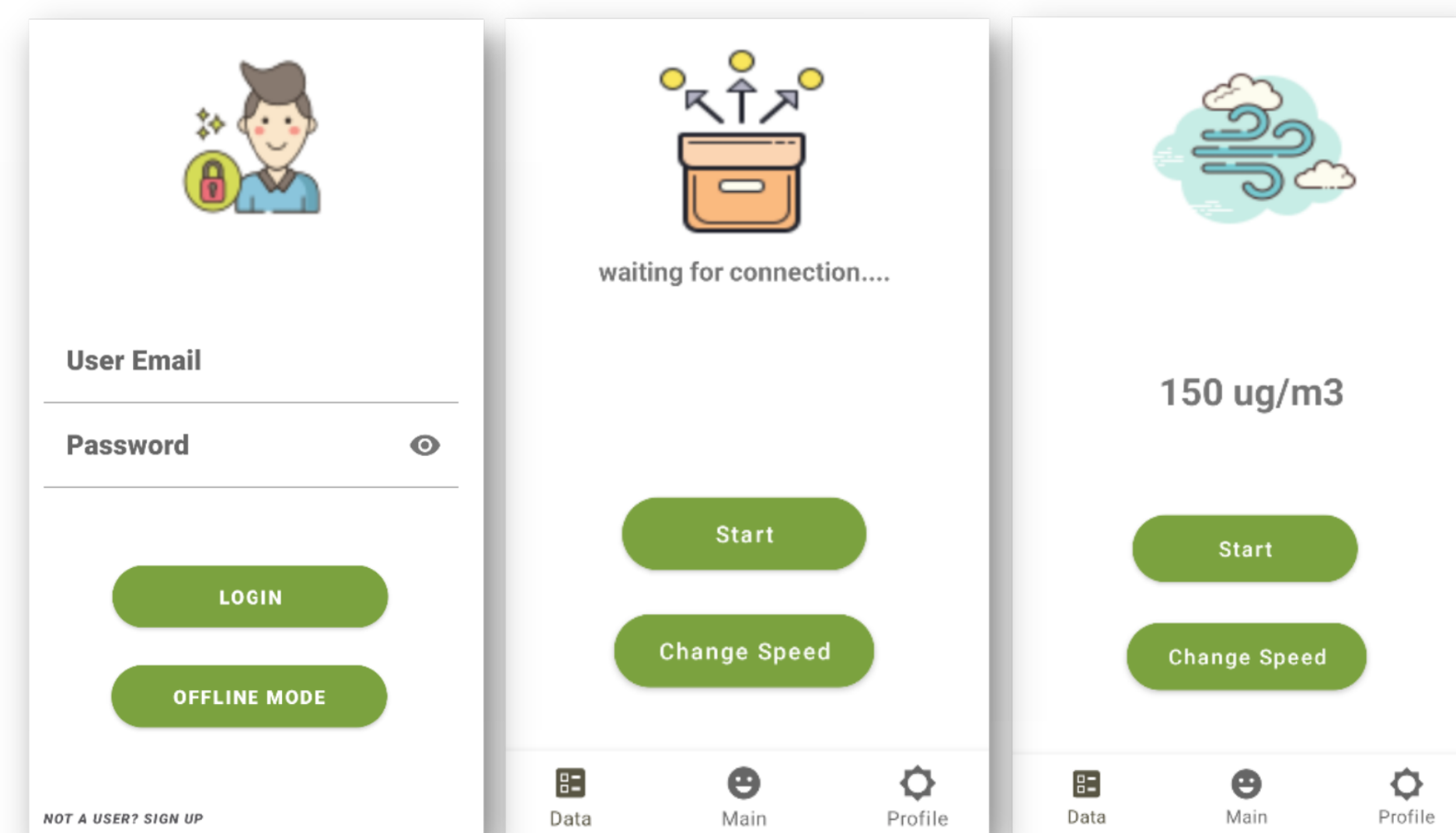

Our expectations

- Proper sensing with more accurate results thancrude conversion.
- Functional android application with an easy-to-use graphic interface.
- Wireless connection using Bluetooth and wired connection using SD card.
- Long battery life
- 3 PM sensors + 1 temrpature&humidity sensor combination to offset part-to-part and environmental variations

Outcomes

- Machine learning + filtering algorithms successfully made the sensing more accurate. The Temperature & humidity sensor also contributed to greater accuracy.
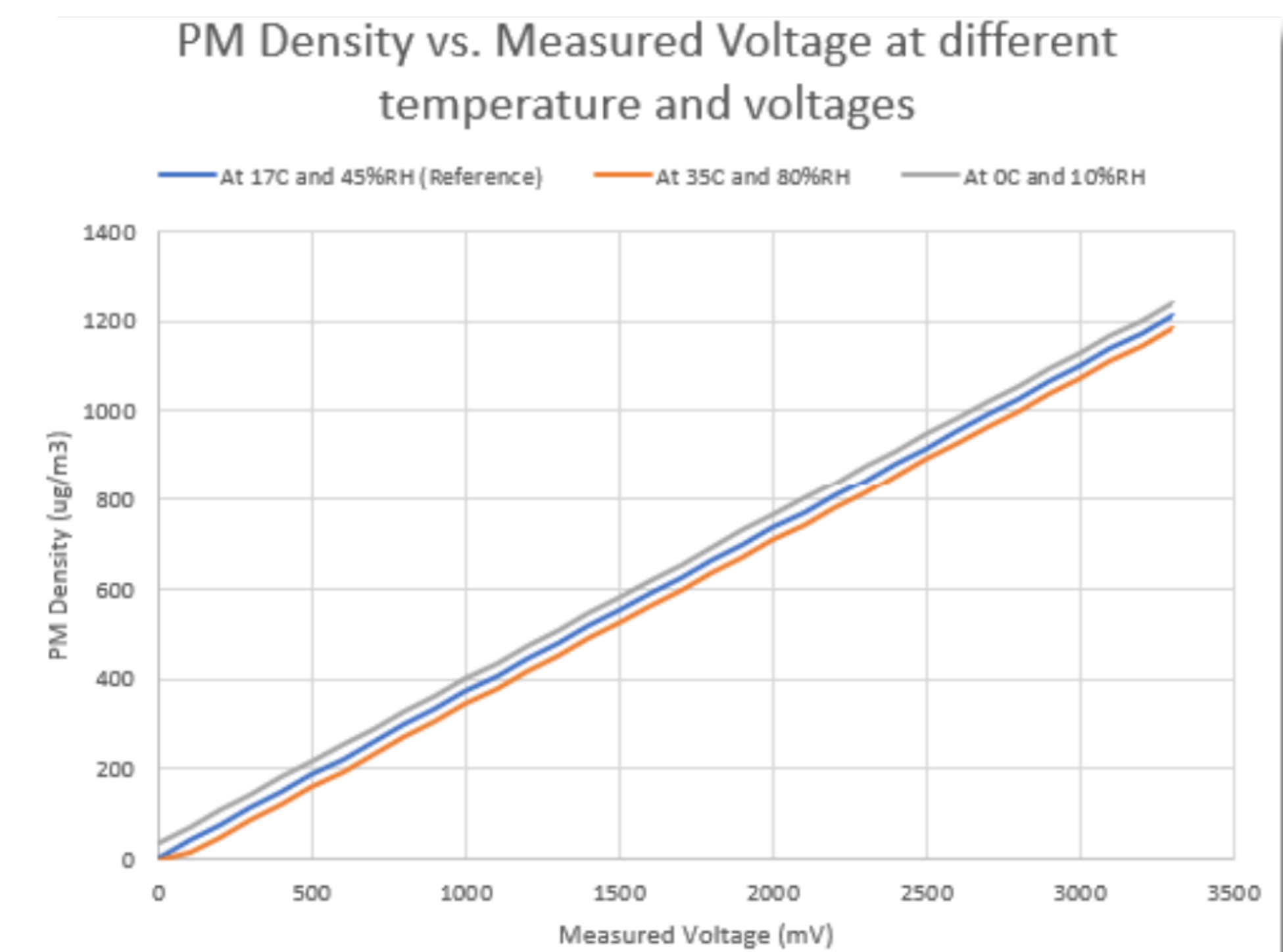
- App is functional and aesthetically pleasing.
- Bluetooth and SD card communication were successfully implemented.
- The sensor is anticipated to have a battery life over 1 month,
- Only 1 PM sensor instead of 3 is used due to the limited serial UART port on our Arduino MCU.