Weather Box

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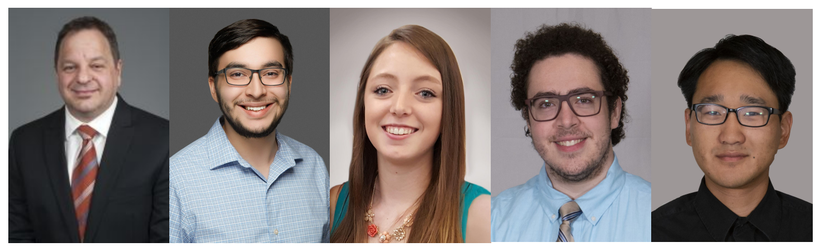
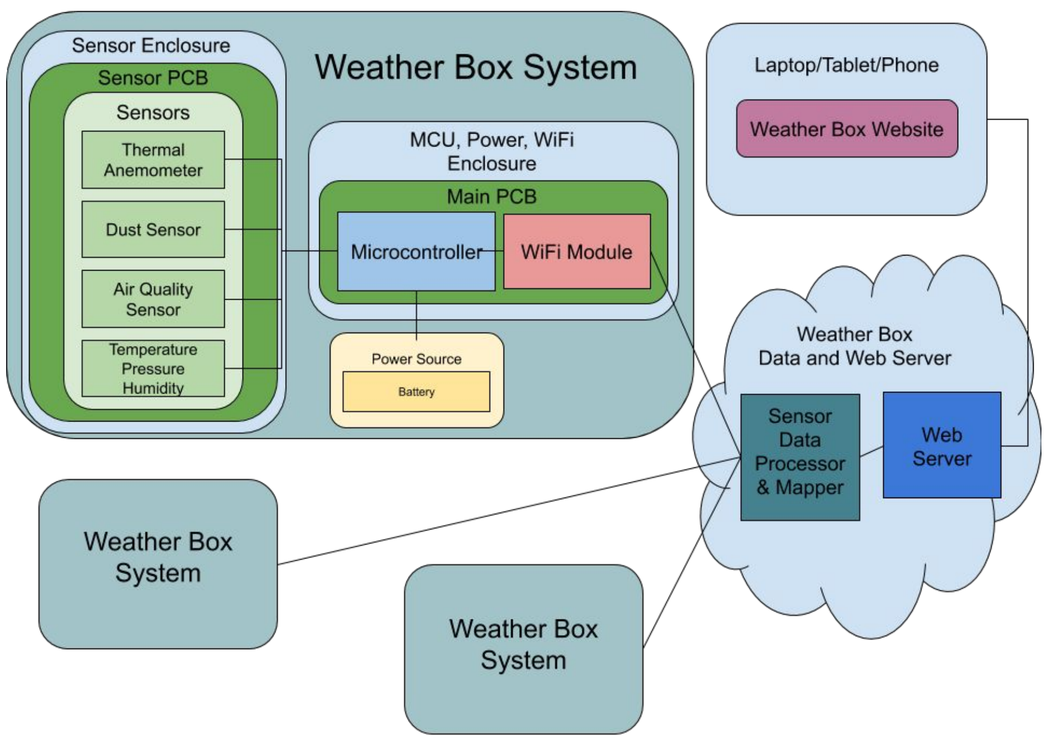


Abstract

Weather Box is a low-cost alternative for monitoring weather conditions in various applications. Weather Box also allows users to generate high-resolution maps of local climate information. This includes temperature, humidity, wind speed, pressure, dust, and air quality. This information would be available for viewing on the Weather Box website. The applications for Weather Box range from pollution monitoring in cities, pre-flight condition checking for drone operators, casual weather monitoring in the home, and more.

Block Diagram



Specifications

- Each sensor package will take measurements at its location
- The web server must create a map of at least 75 x 50 m2 based on data from sensor packages
- Each sensor package must be mountable and weigh less than one pound
- Each sensor package must measure wind, temperature, barometric pressure, humidity, dust, and air quality with 95% confidence
- Each sensor package must have a battery life of at least 24 hours
- Sensor package must be operable in the range of 20 degrees Fahrenheit to 100 degrees Fahrenheit
- Each sensor package should be able to transmit sensor data to a web server via Wi-Fi
- Each sensor package must be manufacturable for at most $120

System Overview

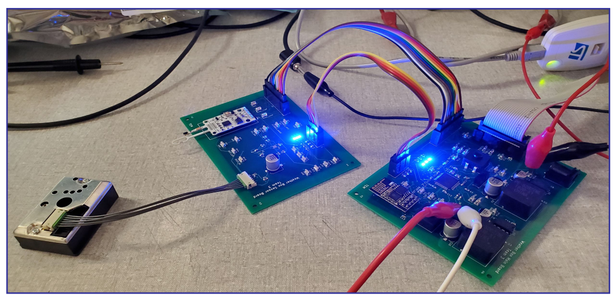
Each system contains a sensor suite comprised of a thermal anemometer, an air quality sensor, an optical dust sensor, and a combined temperature, humidity, and atmospheric pressure sensor. The system is powered by a AA battery stack. The main unit enclosure regulates power for all sensors and electronics. It also houses an STM32 microcontroller. The controller handles processing the raw sensor data, converting the data to a JSON message, and sending the message to the server via Wi-Fi.

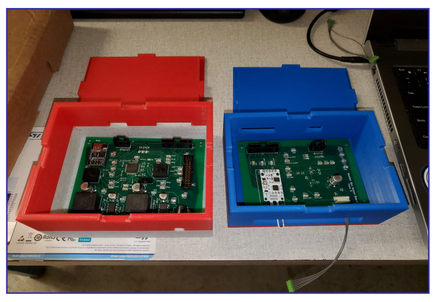
Once the server receives the message, it extracts the data and stores it into a SQL database. When the website requests the server for new data, the server queries the database, then sends it to the website. On the website, users select a measurement they want to have displayed as a heat map. Alternatively, users can display all measurements at once as discrete points.

Results

Team Weather Box created working sensor and main PCBs, enclosures for each board, and an easy to use website for data monitoring for CDR. For FPR, we needed to populate two more PCB systems and fine-tune the interpolation algorithm. The sensor board successfully captures and sends weather data to the microcontroller on the main PCB. Each PCB has its own 3D printed enclosure with openings for the power and data ribbon cables to connect the sensor PCB to the main PCB. The enclosure lid has mechanical joints on it to ensure a tight seal, thus securing the electronics.

On the main PCB, the Wi-Fi module sends data to a web server where it is viewable on the Weather Box website. Any user can choose what data to display on the map. With Google Sign-In, registered users can add or remove Weather Box systems from the map.





Acknowledgement

We would like to acknowledge and thank our advisor, Professor Zink, for his continued support and assistance throughout SDP. We would also like to acknowledge and thank our evaluators, Professor Tessier and Professor Pishro-Nik for their constructive criticism and feedback as well as Professor Holcomb for stepping in as an evaluator for CDR. We would like to acknowledge and thank the Provost office for aiding in the collection of additional funds as well as Apoorva Bajaj for assisting us in the initial research. Finally, we would like to acknowledge and thank our families and friends.