Rain Collection and Environmental Sensor Package

Joseph Johnson, Dr. Austin Downey

Abstract

The goal of this research is to produce a sensor package that is capable of measuring rainfall using a drop-counting mechanism as opposed to traditional graduated cylinder, tipping bucket, or weighing gauge methods. The results from the drop-counting method are expected to closely match reported rainfall amounts.

Introduction

Rain gauges, or pluviometers, have been used for centuries to determine amount of rainfall in an area. The standard rain gauge involves an 8-inch funnel, and the goal of this project is to create a smaller rain gauge using the aforementioned drop-collection method. This operates as follows:

- The drop-counting mechanism consists of using a funnel to create a standardized drop size that then passes through two probes of an open circuit.
- The droplet passing through the probes completes the circuit and the number of instances that this occurs is recorded.

Additional sensors will be included in the overall prototype including temperature, pressure, and humidity to monitor environmental conditions.

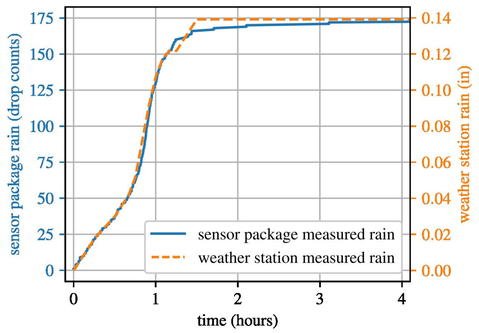
Materials

The rain gauge and environmental sensor package was constructed from the following materials (pictured below in this order except for the analog moisture sensor):

- BME/BMP280 Environmental Sensor Module
- Arduino Nano Microcontroller
- DS3231 Real-Time Clock Module
- Micro-SD Card Reader Module
- Analog Moisture Sensor
- Lithium Polymer Battery

Results

Based on the average raindrop that the printed funnel produces, the rain gauge is able to translate a drop count into a rainfall rate and an overall rainfall amount for a given period of time.



Conclusions

Based on the results of the experiment, the drop-counting method agrees well with reported rainfall amounts. However, more testing must be done in a variety of scenarios including high-wind conditions and heavy rainfall to determine whether the sensor package continues to accurately match actual rainfall values.

Future Work

From this research, further sensors and wireless capabilities can be added to the overall sensor package. This will allow development of a compact and cost-effective weather sensor that can be deployed to remote locations and wirelessly transmit data, improving weather mapping of local regions.

Acknowledgements

I would like to acknowledge the contributions of the Adaptive Real-Time Systems Laboratory, Sydney Morris, David Wamai, and the National Science Foundation to the ongoing progress of this project.

This work is supported by the National Science Foundation, United States Grant Numbers 2152896 and 2344357. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.