

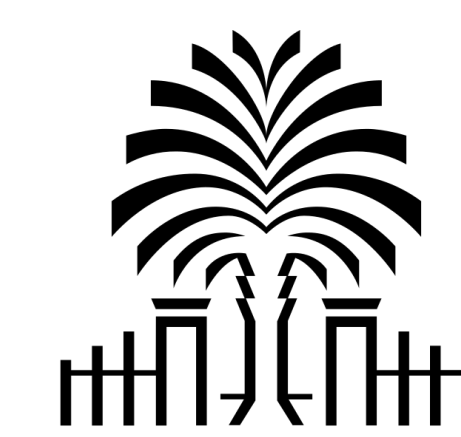
# Measuring Precipitation through Raindrop Conductivity

Christopher Heaps<sup>1</sup>, Jasim Imran<sup>2</sup>, and Austin R.J. Downey<sup>2,3</sup>

<sup>1</sup>Department of Aerospace Engineering, University of South Carolina, Columbia SC

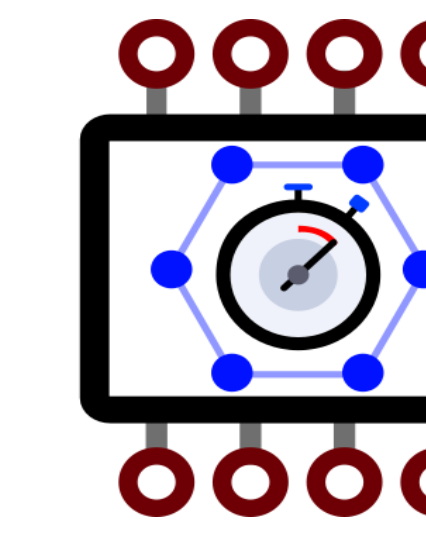
<sup>2</sup>Department of Civil and Environmental Engineering, University of South Carolina, Columbia SC

<sup>3</sup>Department of Mechanical Engineering, University of South Carolina, Columbia SC



UNIVERSITY OF

South Carolina



ARTS-Lab

Adaptive Real-Time Systems Laboratory

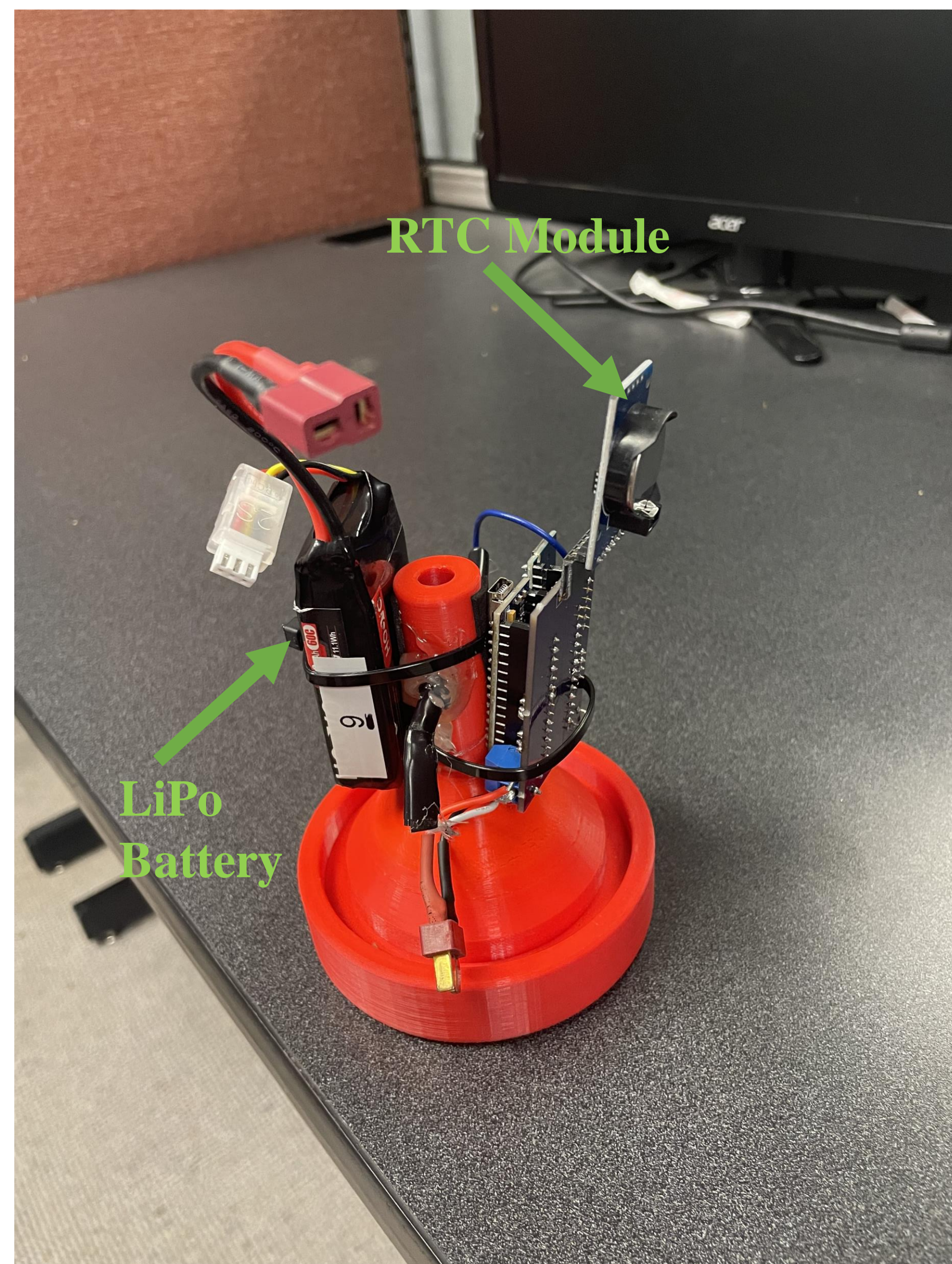
## Introduction

### Measuring the Rain

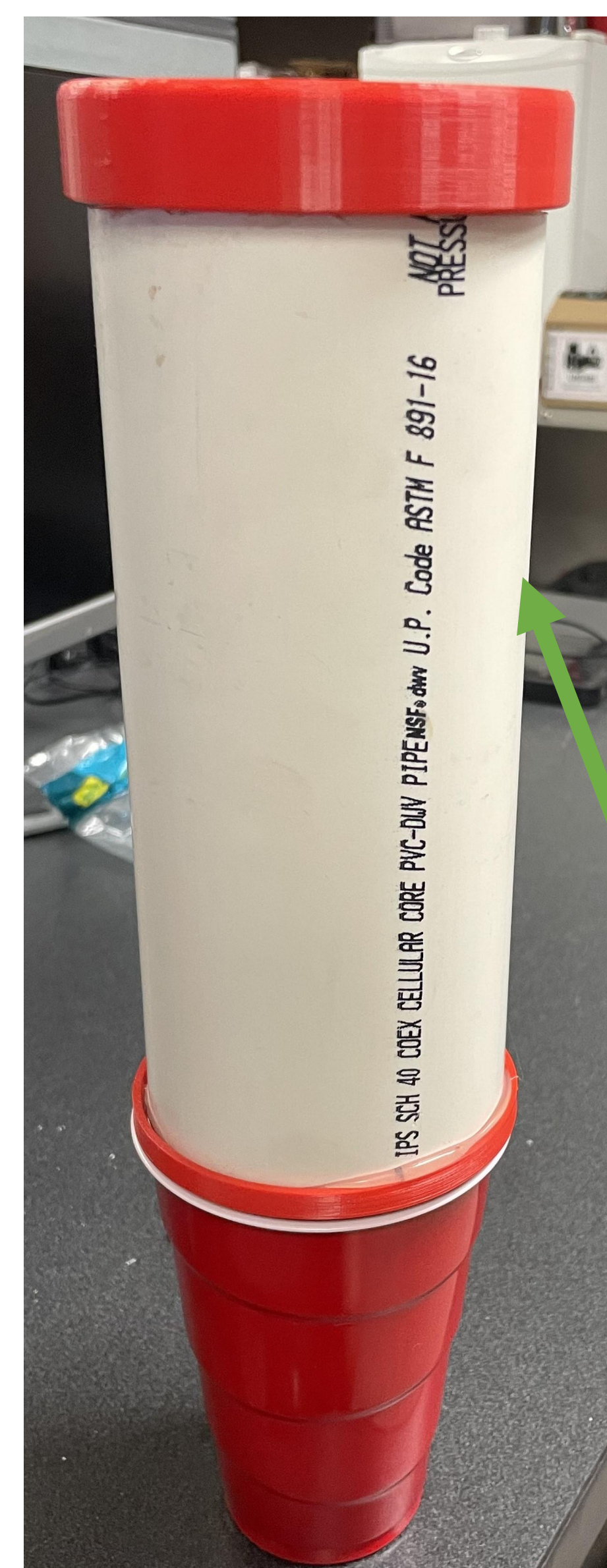
- Primary objective is to create a sensor package capable of accurately measuring precipitation by counting raindrops
- Data will be logged into a .csv (Excel) file
- Python can be used to interpret data, such as precipitation rate and identifying times of greatest rainfall

### Conserving Power

- Sensor package is meant to be deployed for weeks at a time
- Package is powered by a 7.4V Lithium-Polymer battery
- A sleep function is used to power down the Arduino, and a Real-Time Clock (RTC) module sends a wake-up signal to power the system back up



Pictured above: funnel and nozzle assembly (left) and sensor package with cup to drain into (right)



Drops drain down into cup

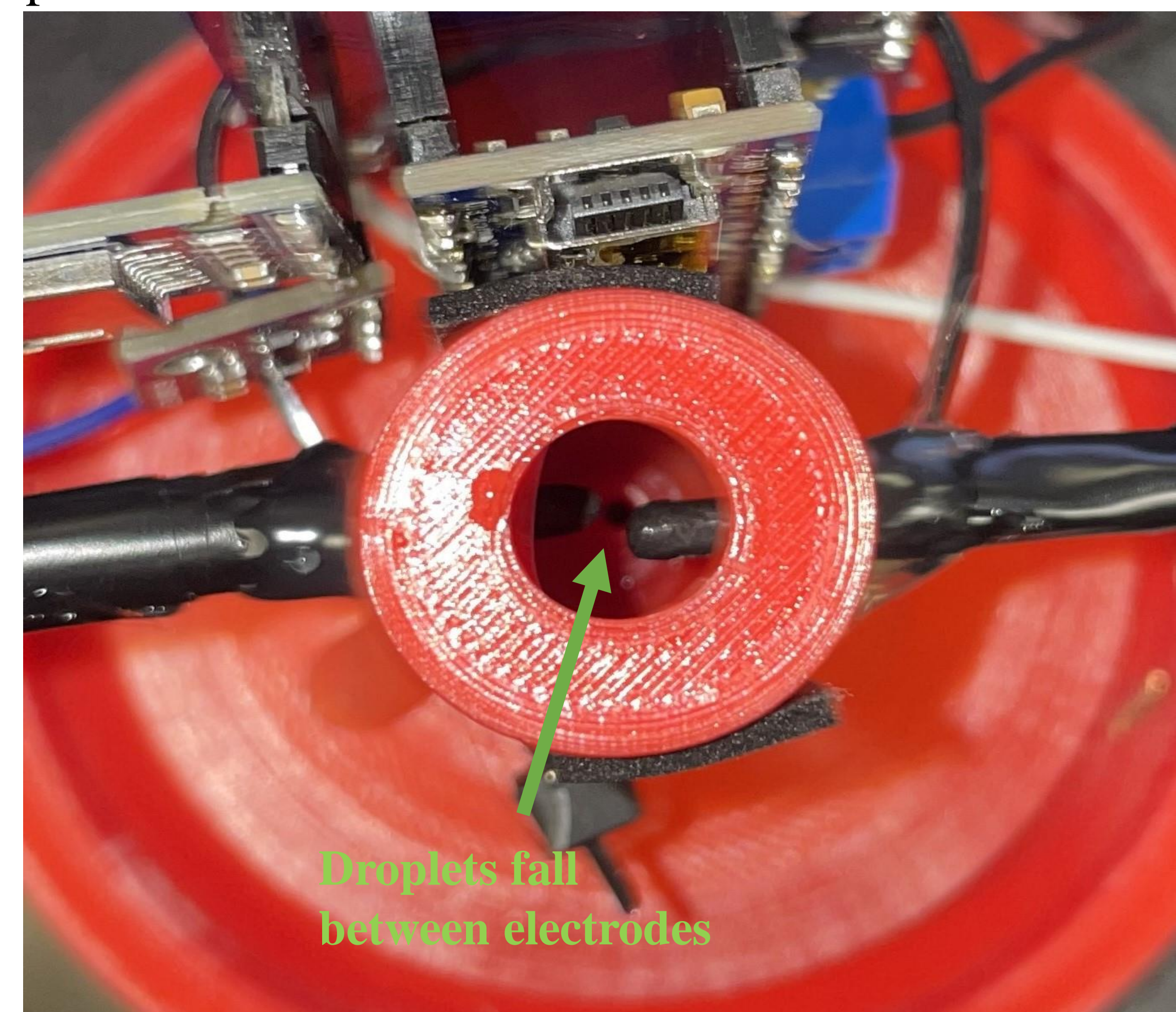
## Methods

### Nozzle and Funnel

- Funnel is used to collect rainwater from storms and drip through nozzle
- Nozzle ensures water droplets have consistent size

### Electrodes

- Principal concept is to allow droplets to fall through and send a charge through them
- Conductivity data goes back to Arduino and is counted
- This is then logged to a .csv file through MicroSD card
- Electrodes have had many designs, current one is using graphite rods



Pictured above: Graphite electrodes in funnel

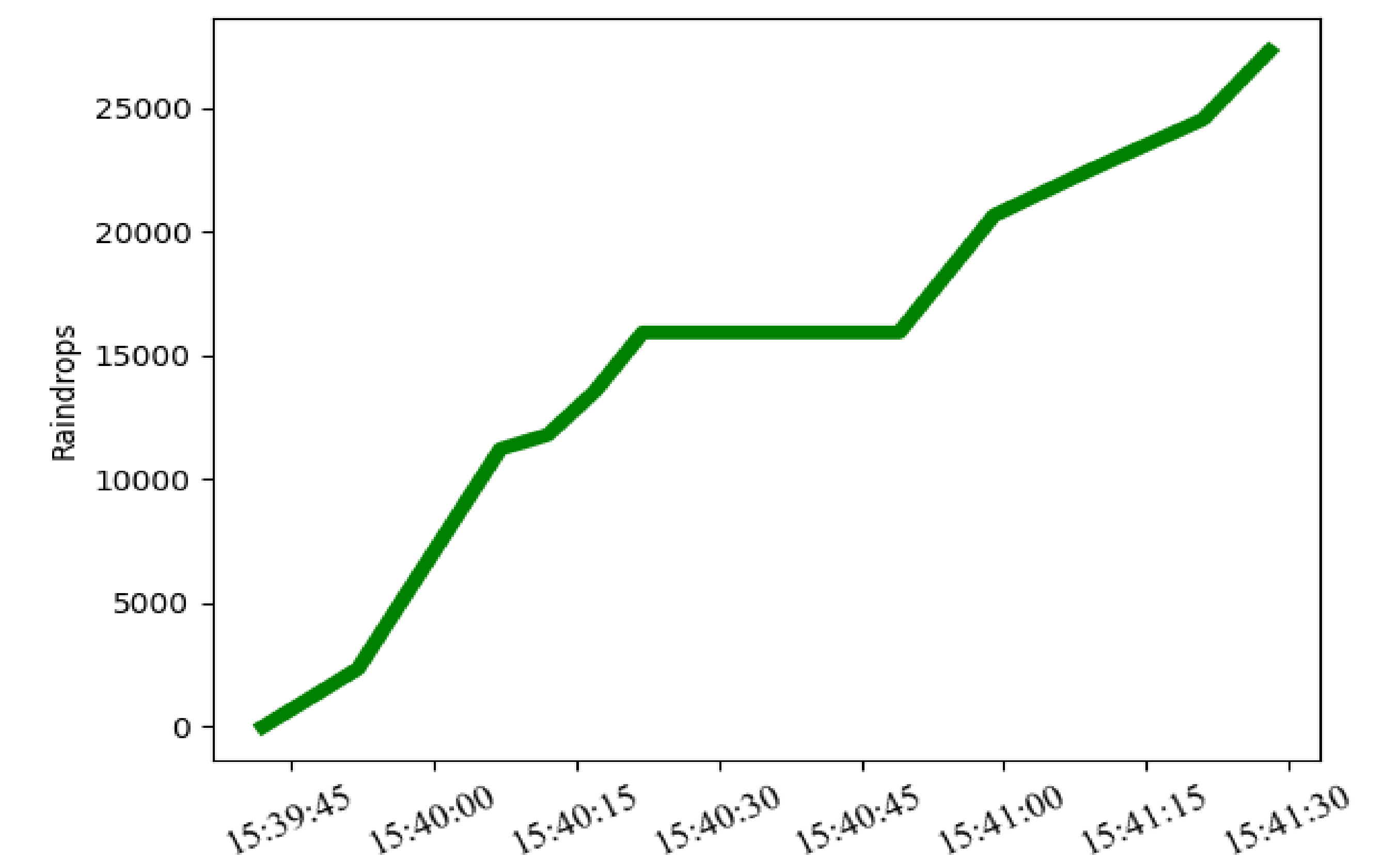
Droplets fall between electrodes

### Humidity and RTC

- Sensor package has a BME280 temperature and humidity sensor to keep track of humidity
- The humidity level will act as a sleep/wake interrupt for the sensor package
- RTC module logs time of conductivity readings and wake up the Arduino to check humidity on certain intervals

## Results

- The sensor package can accurately count raindrops over time and log them, generating data that can be analyzed
- Sensor package wakes and sleeps as it should, can change wake interrupt interval, power is conserved as desired
- Electrodes can count raindrops and handle conductivity as desired, however they are difficult to get into position to properly count raindrops without the droplets clinging to the rods



Pictured above: sample data depicting water droplets being logged by the sensor package over time

## Acknowledgements and References

Special thanks to the McNair Junior Fellows program for guidance and funding on this project, as well as the USC ASPIRE I grant #80004440

### References

- [1] Github: Heaps, C., Brown, R., Smith, C., & Downey, A. (2023). Rain-Gauge-Sensor-Package [Github Repository]. <https://github.com/ARTS-Laboratory/Rain-Gauge-Sensor-Package>

Feel free to check out the project Github repository! →

