

# DEVELOPMENT OF AN OPEN HARDWARE WEATHER BALLOON PACKAGE

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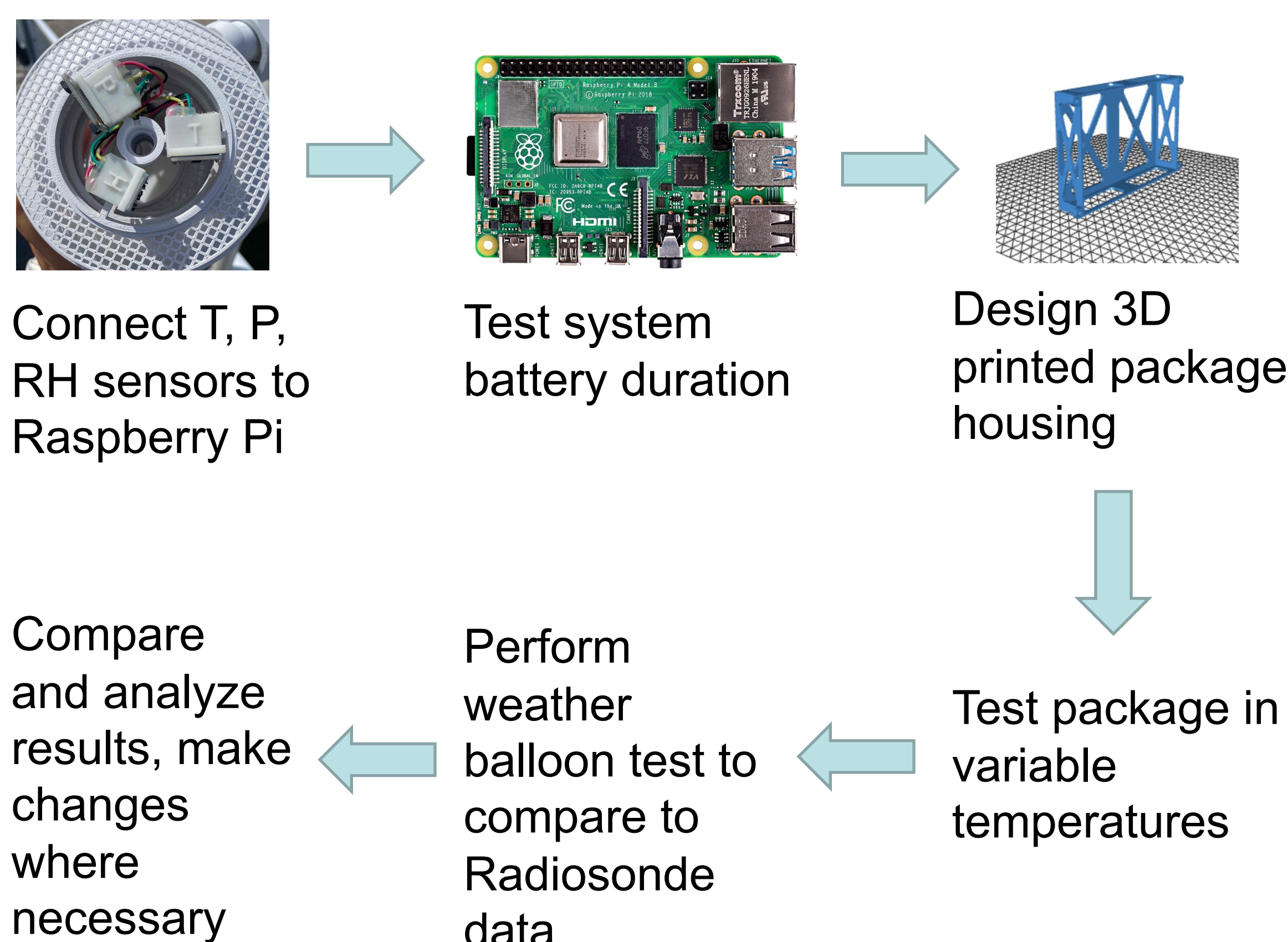
## OBJECTIVES

- Develop a deployable balloon package using open hardware and open software.
- By using open source plans, the balloon package can be adapted for use in educational settings.

## BACKGROUND

- Atmospheric weather balloons carry balloon packages that record a profile of the atmosphere.
- Balloon packages can include a variety of instrumentation to monitor different atmospheric characteristics such as temperature, pressure, and relative humidity.
- This project developed a weather balloon package by adapting elements of an open source 3D printed atmospheric weather station (3D-PAWS) to weather balloon deployment.

## MATERIALS AND METHODS



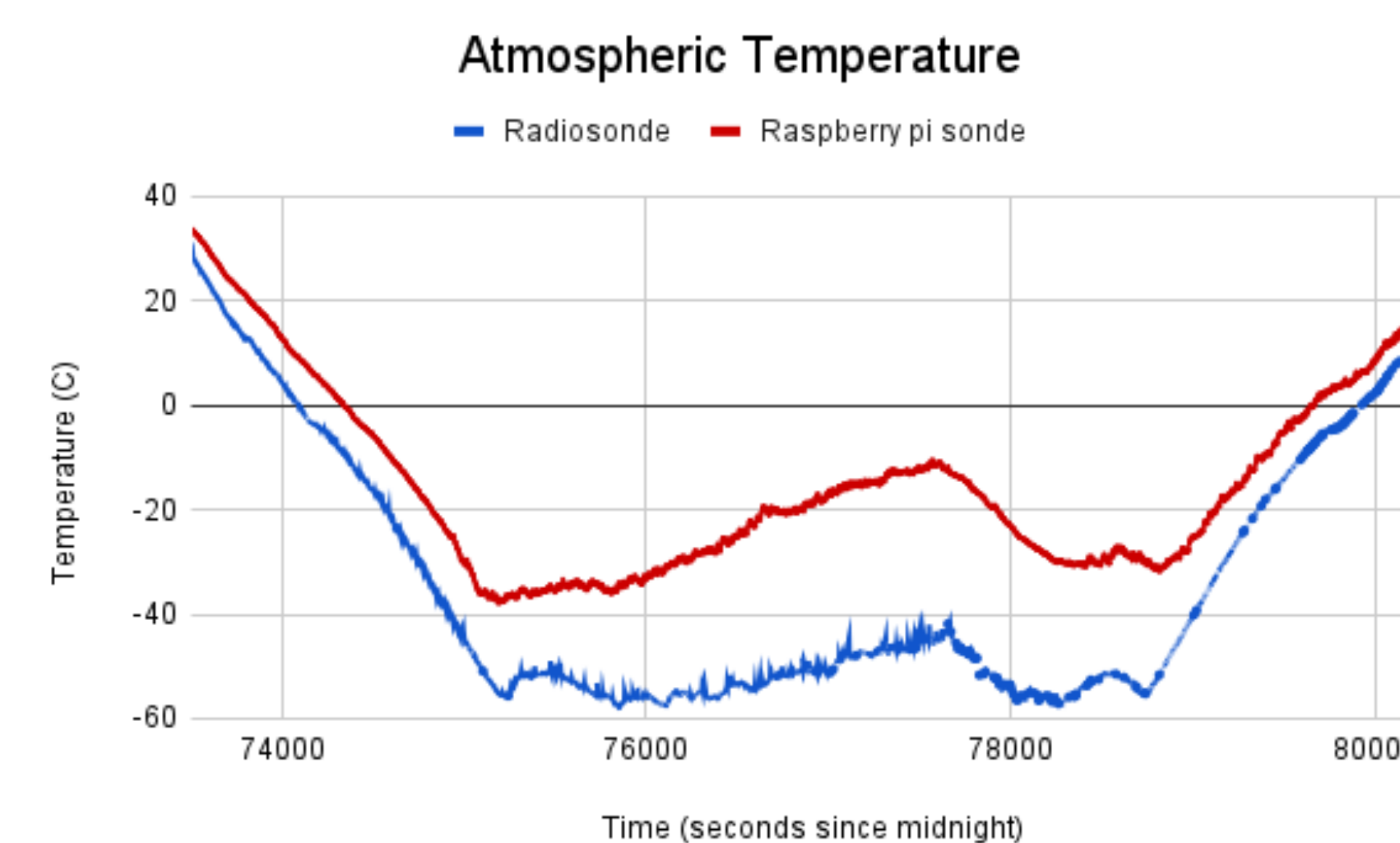
## RESULTS

### Battery Test Results



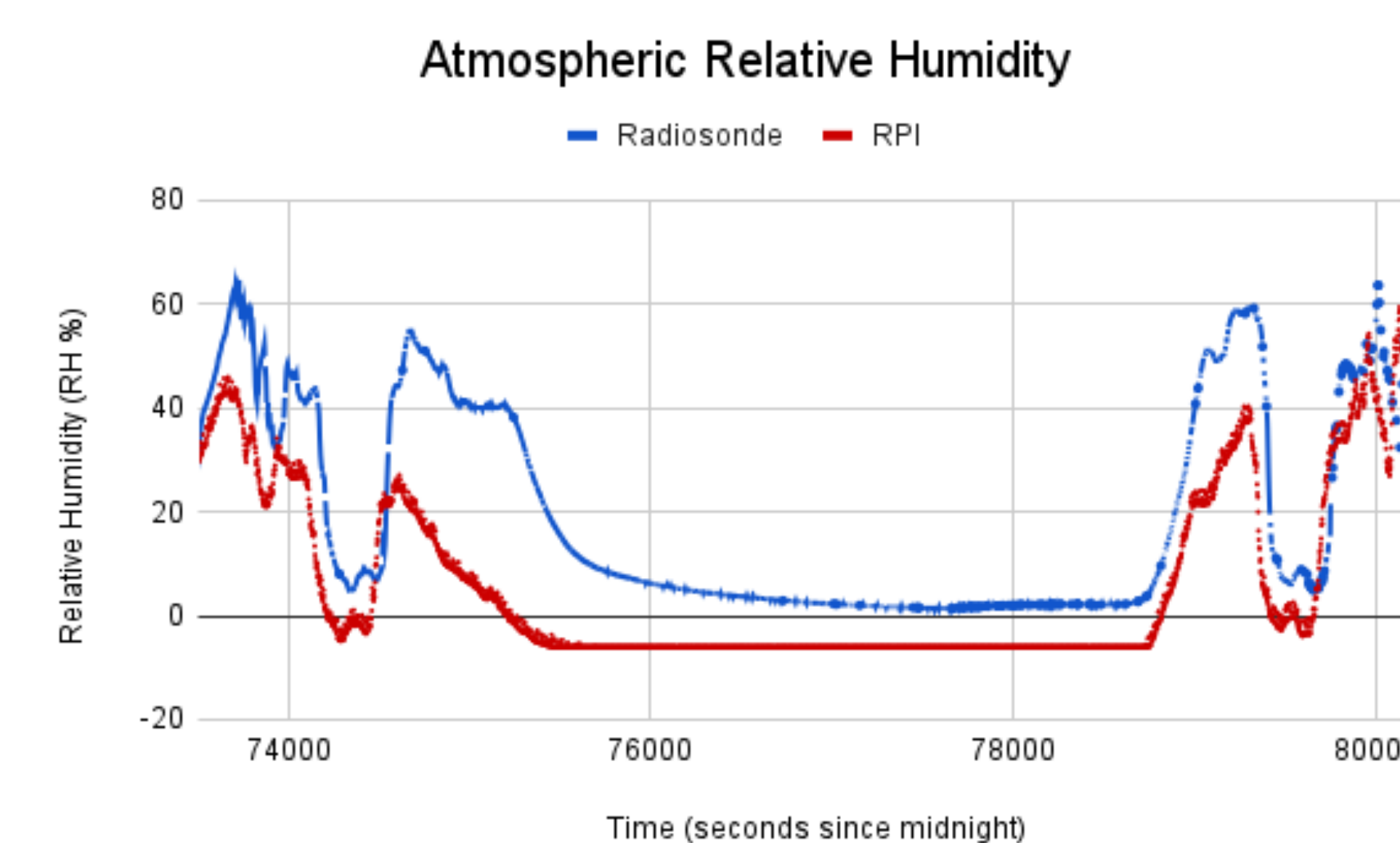
- 4 hours with all peripherals running =  $\frac{3}{4}$  battery drainage
- Full battery capacity estimated at 5h 15m
- 10,000mAh battery is sufficient for the duration of a balloon flight

### Balloon Flight Results



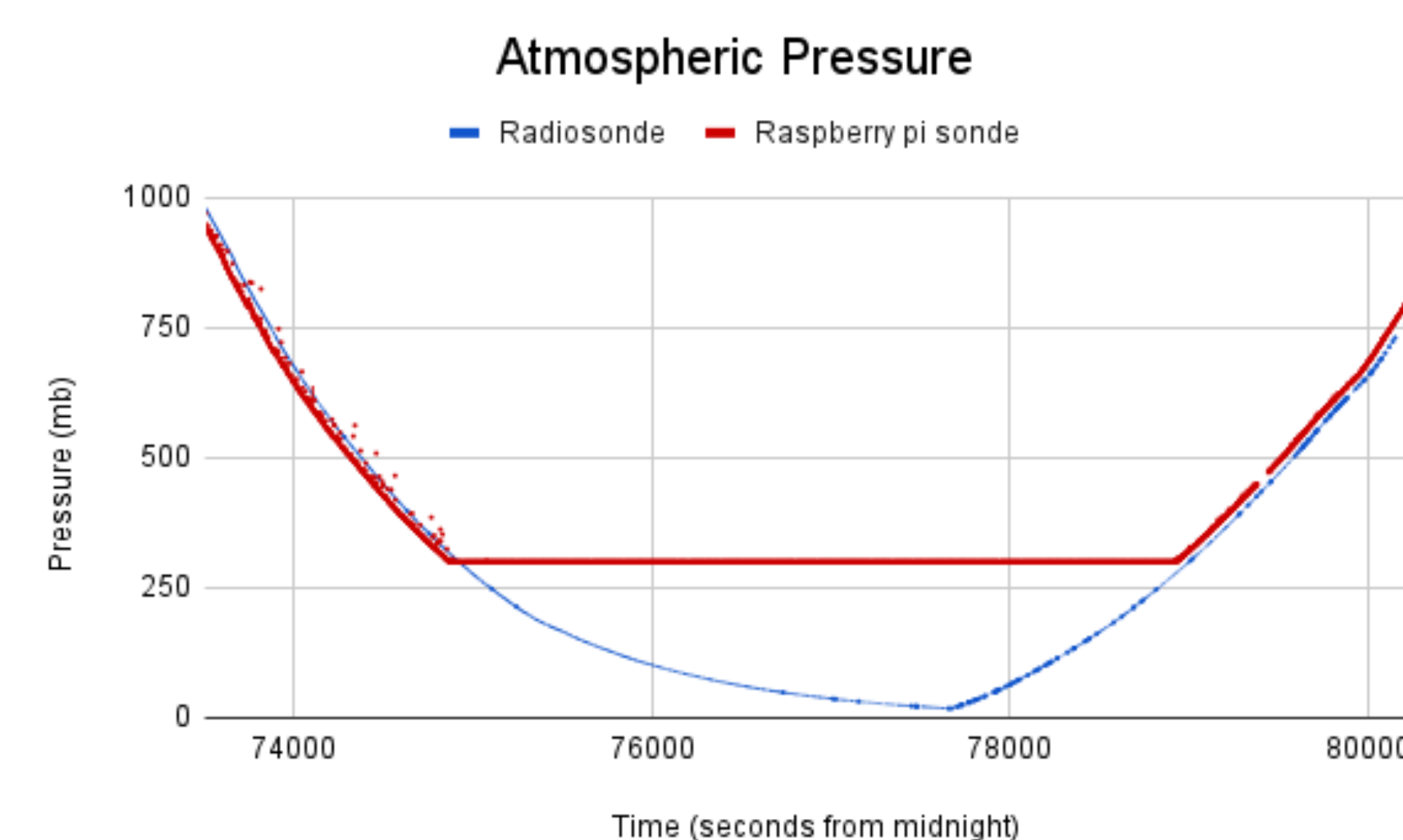
A flight was conducted carrying both the raspberry pi sonde and radiosonde packages to compare sensor efficacy.

A comparison between temperature measurements from the radiosonde and the raspberry pi sonde indicate the raspberry pi sonde has a smaller temperature operating range than the radiosonde.



Under freezing temperatures, the humidity sensor on the raspberry pi sonde recorded negative readings.

This may suggest that during the balloon package's ascent, the sensor was exposed to conditions outside of its operating range.



Readings from the pressure sensor attached to the raspberry pi sonde show a similar pattern to those from the humidity sensor.

At low temperatures, both sensors fail to perform and record accurate data

## CONCLUSIONS

- The open hardware raspberry pi sonde was launched on an atmospheric weather balloon and retrieved with no damage and viable data.
- The package test flight indicates that the sensors on the package lack accuracy and precision across the wide temperature range they are exposed to during the flight.

## FUTURE WORK

- Developing a lesson plan targeted towards secondary-school students focusing on ballooning
- Adapting a 3D printed housing for the balloon package
- Additional sensor testing and the addition of GPS and data downlink capabilities

## ACKNOWLEDGEMENTS

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