

Improvement of the MaRTiny: A low cost thermal sensing device

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Introduction

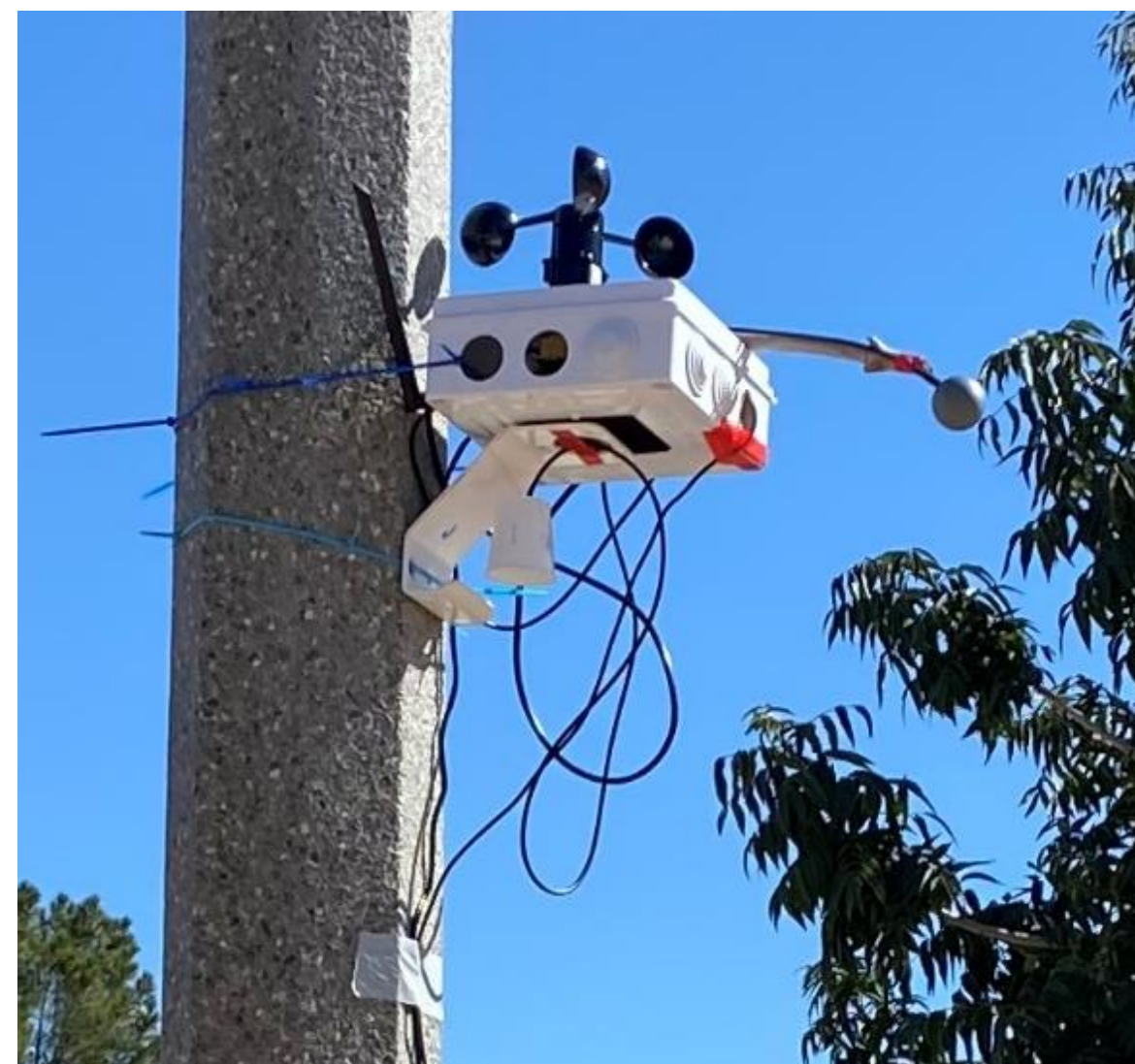
Future trends of climate change coupled with urban population growth indicate the need for reducing human exposure to extreme weather and heat [1]. Extreme heat strains human health and people's ability to work, travel, and enjoy time outdoors.

Objective

This project develops a low-cost Internet of Things (IOT) device called MaRTiny that collects meteorological data and concurrently counts the number of people in the shade and sun [2]. It can determine a relationship between how people use public outdoor spaces and the mean radiant temperature (MRT). This FURI project specifically aims to improve the energy supply of the system using solar panels and improve the system mount through a 3D printed design to minimize sensing errors.

Old Design

Fig 1: Old setup to the MaRTiny
Utilized zip ties to attach the device to the pole. Hanging wires and sensors. The sensors being so close to the pole, interfere with accurate measurements. [3]



Experimental Design

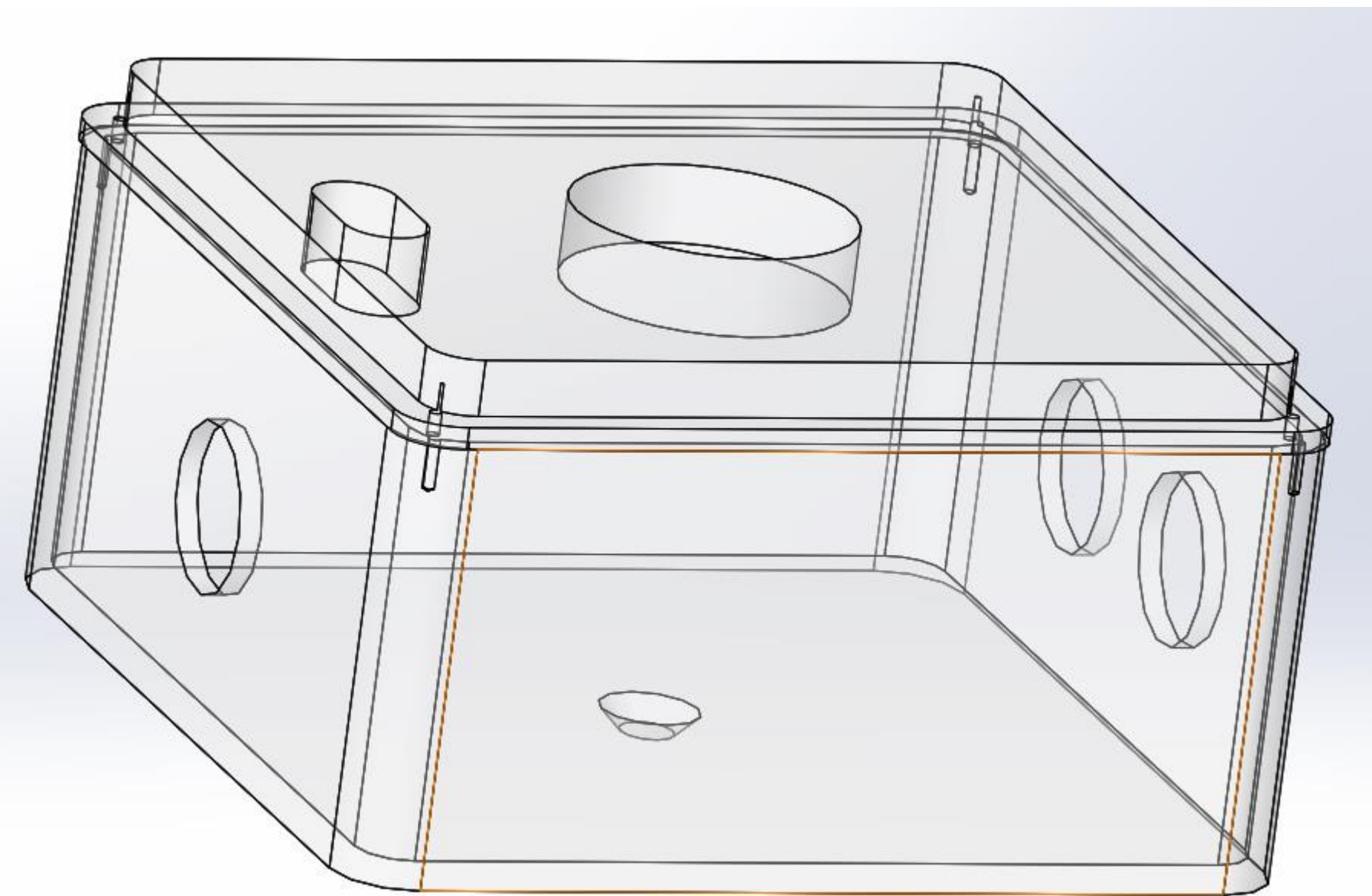


Fig 2: SOLIDWORKS model of new hardware design to minimize sensing errors and optimize airflows to hardware and sensors

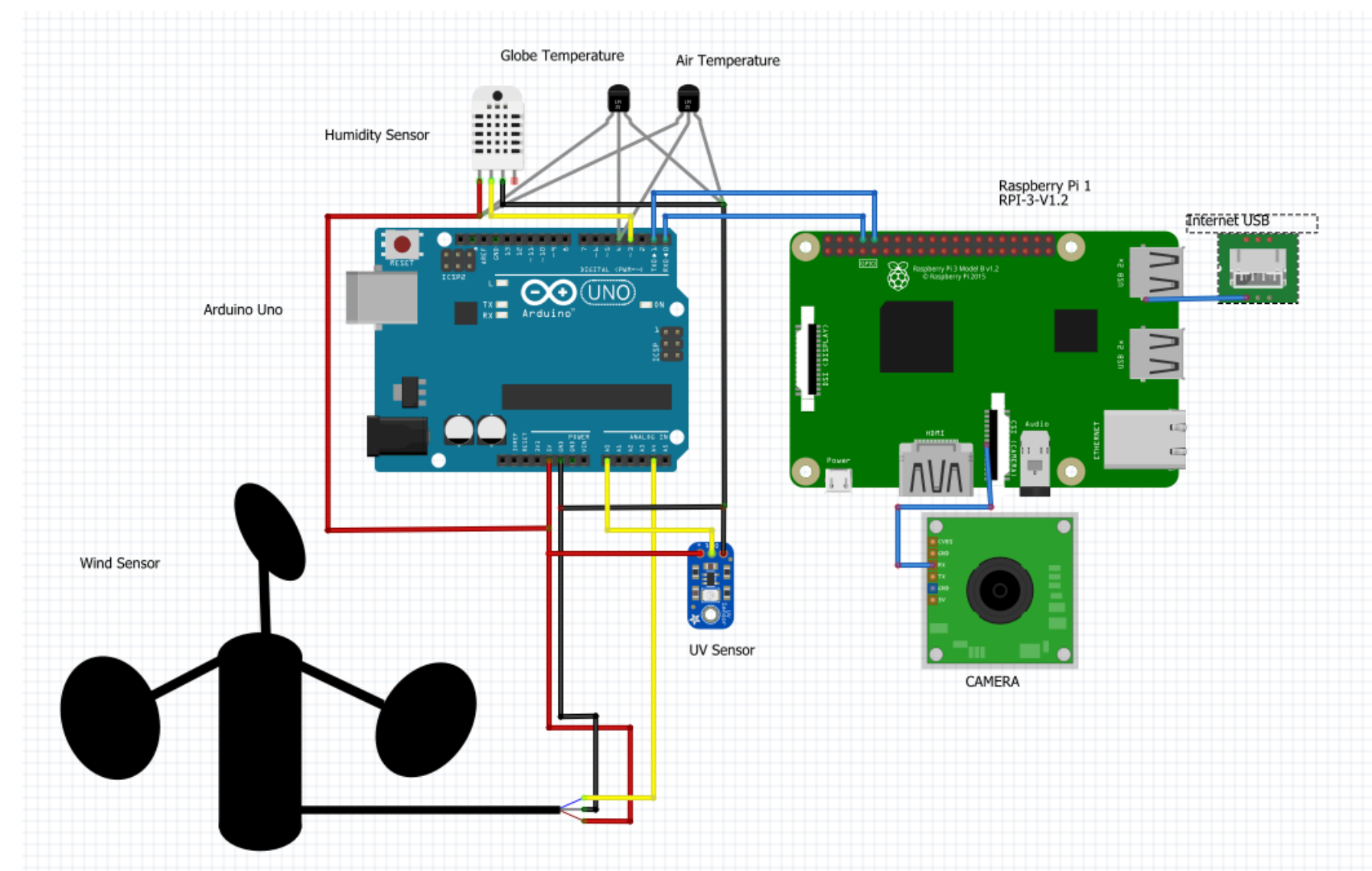


Fig 3: Block Diagram of MaRTiny setup along with communication protocols. Five sensors are configured to Arduino Uno and the collected data is transmitted to a Raspberry Pi which sends the data to a local server in the lab.

Machine Learning



Fig 4: People Counter detecting people (left); counting number of people in shade (right).

References

- [1] NOAA National Centers for Environmental Information, State of the Climate: Global Climate Report for Annual 2020, published online January 2021, retrieved on October 20, 2021 from <https://www.ncdc.noaa.gov/sotc/global/202013>.
- [2] A. Middel and E. Krayenhoff, "Micrometeorological determinants of pedestrian thermal exposure during record-breaking heat in tempe, arizona: Introducing the marty observational platform," *The Science of the total environment*, vol. 687, pp. 137–151, 10 2019.
- [3] Karthik Kashinath Kulkarni, Florian A. Schneider, Tejaswi Gowda, Suren Jayasuriya, Ariane Middel. (in review). MaRTiny – A low cost thermal sensing device, *Frontiers in Environmental Science*.

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