



Base Station for Social Distancing Sensor

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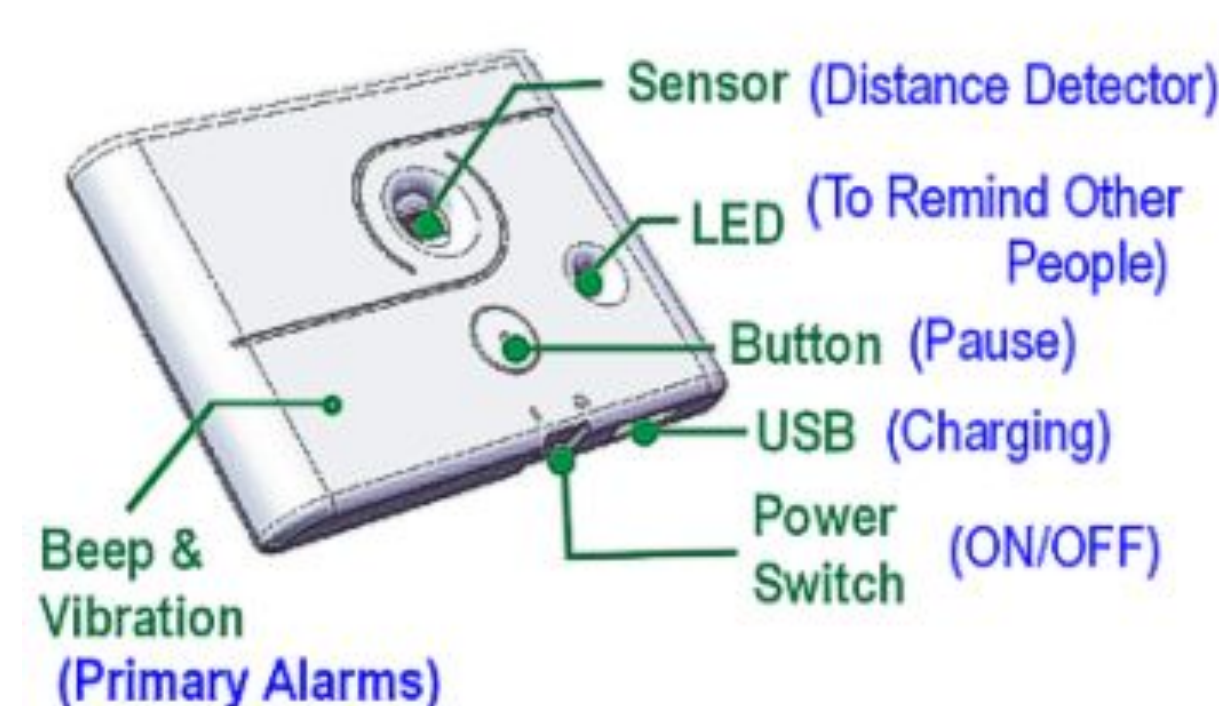
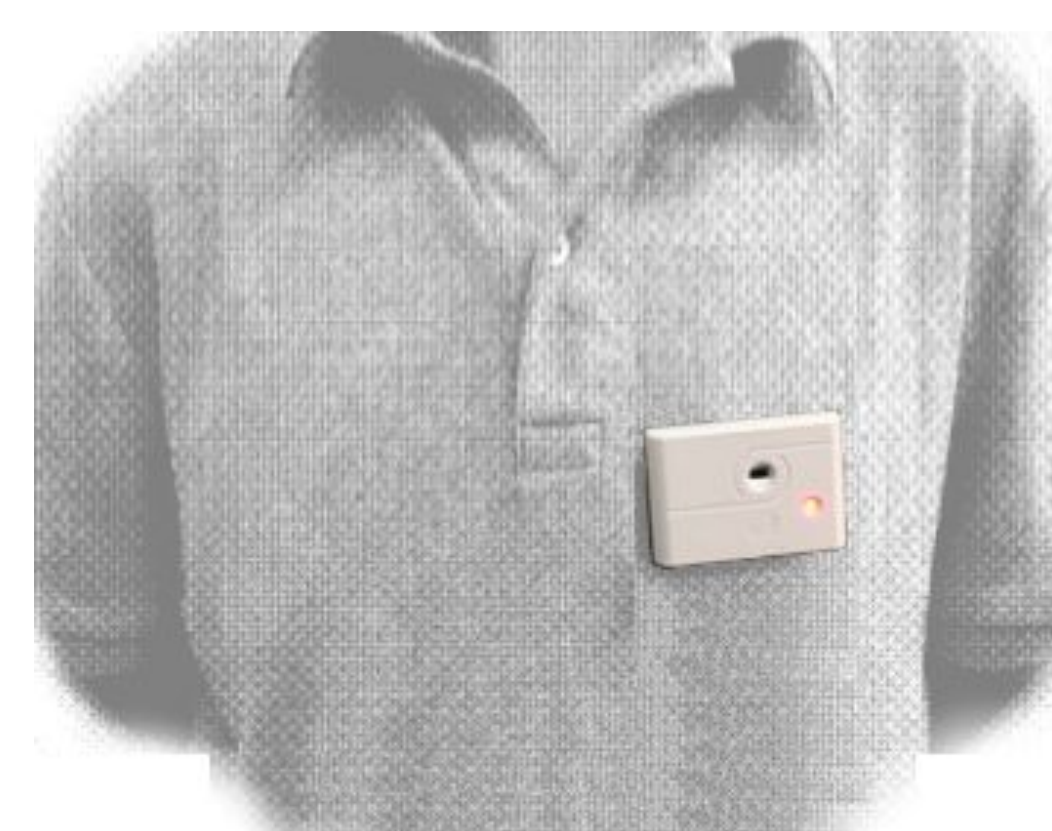


Project Introduction

- Design a base station which will hold the sensor and charging circuit.
- Address the limitations of current social distancing sensors, which are not easily integrated into living spaces, have weak battery life, and cannot function independently and develop a base station to eliminate those limitations.
- Final design should be polished enough to be considered production and consumer level - we want it to be as accessible as possible.

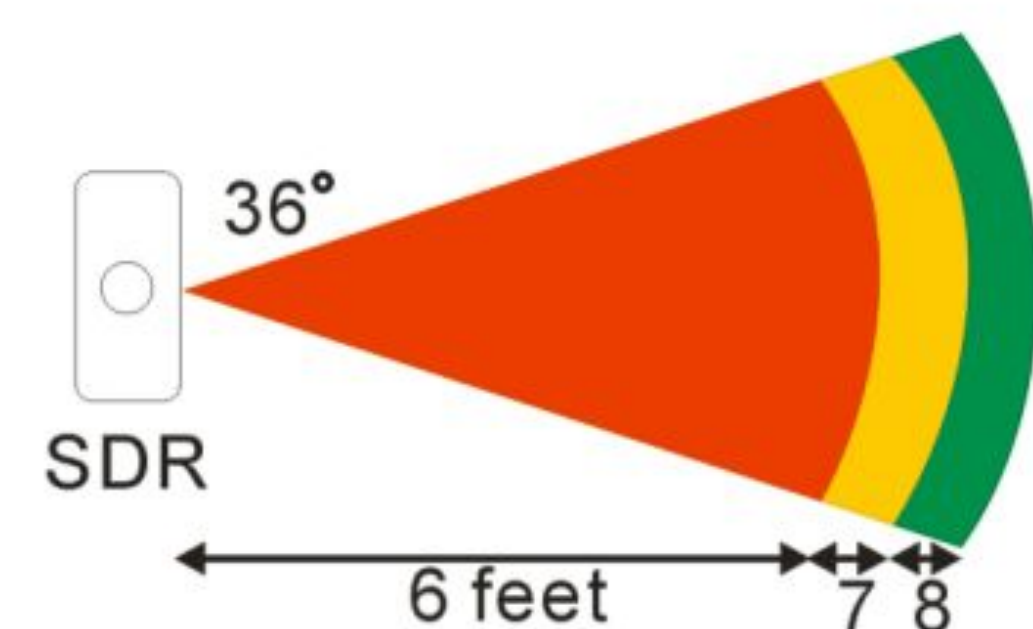
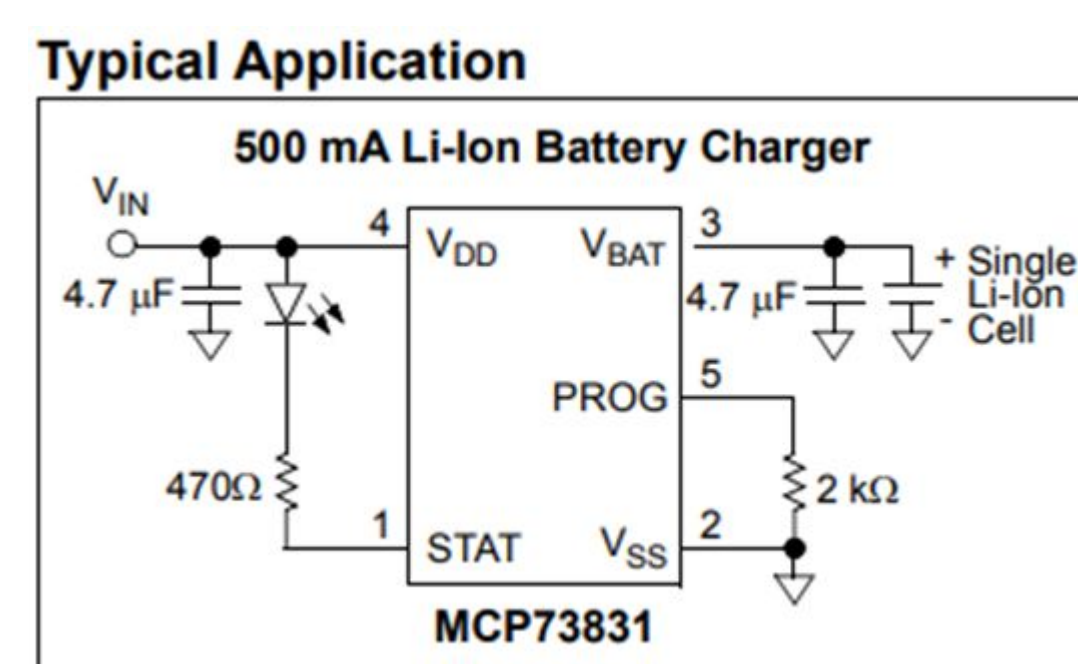
Social Distancing Sensor

- Pre-existing Social Distancing Reminder (SDR) is designed for general purpose indoor social distancing reminding.
- It detects the distance between two people or objects and remind users in different ways.
- With the help of different alarm modes (sound, light and vibration) it ensures to remind not only to user but also to other people to safely distance.



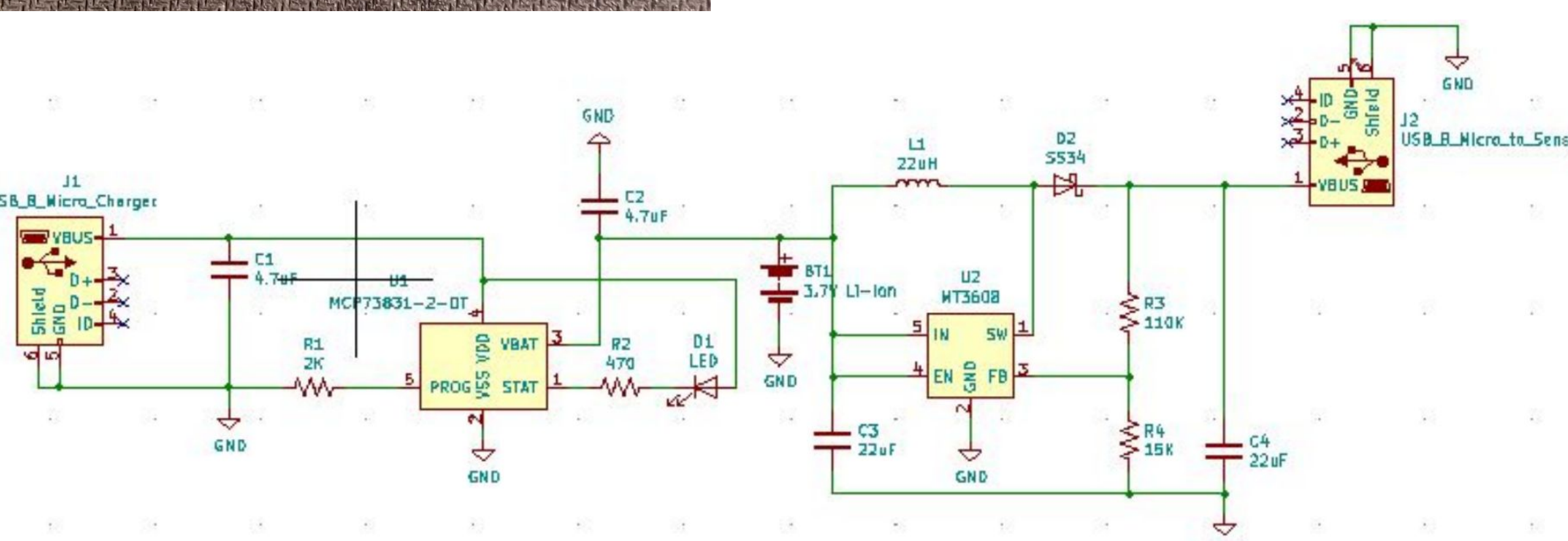
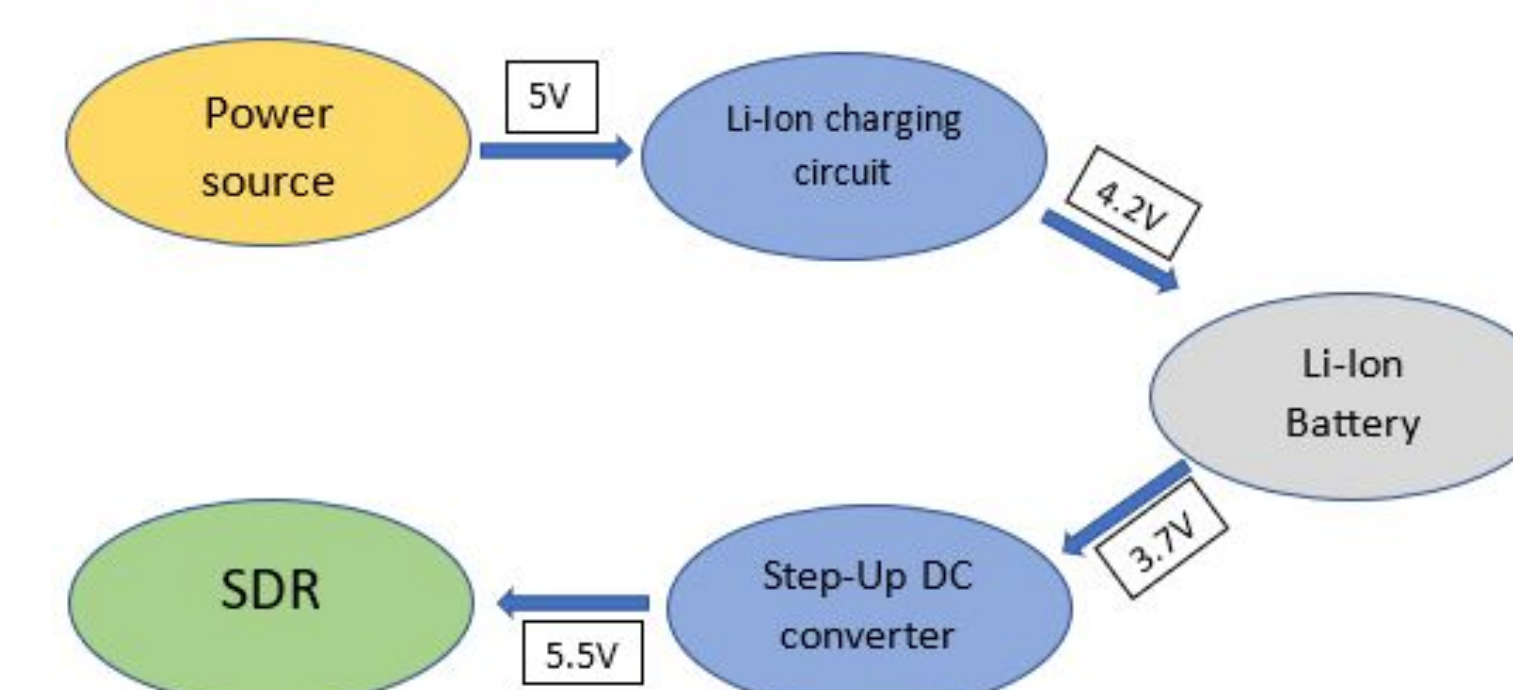
Technical Requirements

- The base station should function as an external power bank which would allow sensor to run longer time without needing to be charged.
- It should be able to be charged using a 5V source.
- The circuit should convert 3.7V from a Li-Ion battery to 5.25V +/- 0.25V to charge the sensor.
- The user should be able to replace the power circuit with an off the shelf power bank unit.
- There should be a place for a user to place their business cards.
- The SDR should be able to detect objects from up to 11 feet away and within a 36 degree arc.



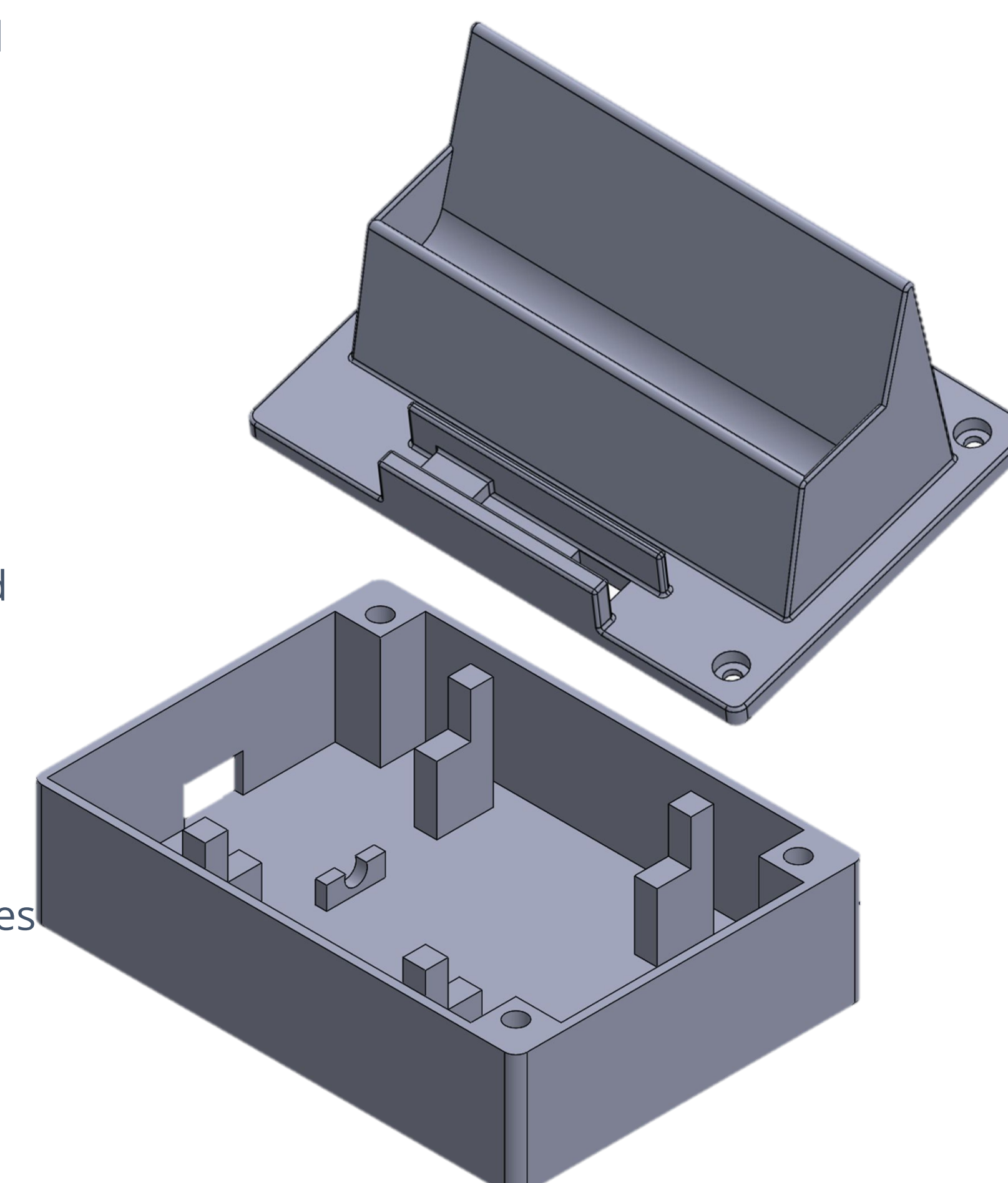
Charging Circuit

- The design allows the sensor to charge 50% faster than its current configuration and the battery lasts 2 times longer than the sensor's own battery.
- We measured ~4.2V output when charging the circuit's battery and ~5.5V output when charging the sensor itself.
- Our circuit charges the sensor's internal battery with 1.8 - 2.0A charging current.



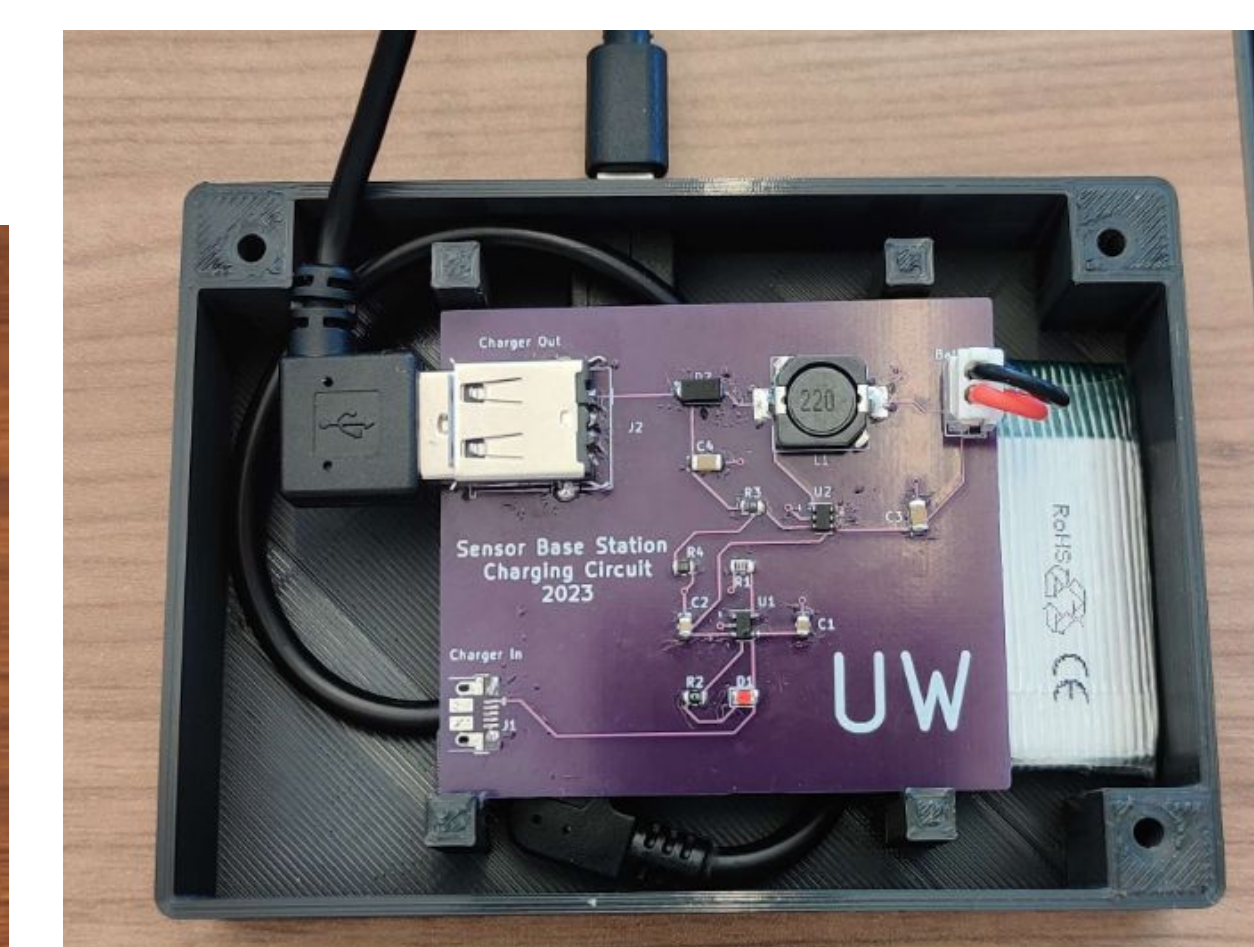
Base Station Design

- Dimensions chosen based off spec sheets and measurements taken using a digital caliper
- Parts modeled in Solidworks and sliced using UltiMaker Cura
- Utilized Creality material extrusion printers to 3D print our parts
 - Material used: polylactic acid (PLA)
- Base station split into two separate parts:
 - Top part locates and holds onto SDR, also features a business card holder
 - Bottom section houses charging circuit and associated cabling
- Cable connectors held in place using interference fits
- Bottom and top piece held together using M3x0.5mm hardware
 - Threaded heat inserts placed in corner holes on bottom part
 - Socket head cap screws kept flush using counterbores on top part



Current Progress

- Completed multiple fully functioning 3D printed prototypes with multiple rounds of design evaluation and improvements
- Sensor housing is compatible with both an off-the-shelf external power bank, as well as our custom charging circuit
- Implemented customizability of the sensor base station using a business card holder and a space for stickers/logos
- Successfully completed durability testing of threaded insert fasteners and internal locating features



Conclusion and Future Work

Our work here has shown:

- We developed several versions of fully operational prototypes that are compatible with standard cables and power banks, in addition to incorporating a customized charging circuit to enhance efficiency.
- Next steps for this project include:
- Design for manufacturing - parts need to be modeled to allow injection molding or other mass manufacturing method.
 - Variable angle feature needs to be added to tilt the sensor in the vertical direction.
 - Wireless charging can be implemented to replace the need for excess cabling.

References

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- [2] "MCP73831/2 Features." Available: https://www1.microchip.com/downloads/en/DeviceDoc/MCP73831-Family-Data-Sheet-DS20001984_H.pdf (accessed May 22, 2023).
- [3] "MT3608 Features." Available: <https://www.olimex.com/Products/Breadboarding/BB-PWR-3608/resources/MT3608.pdf> (accessed May 22, 2023).