CornellEngineering
Electrical and Computer Engineering

Cart-E: Indoor Tracking Device

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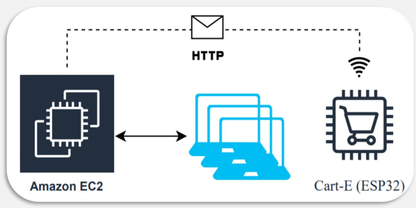
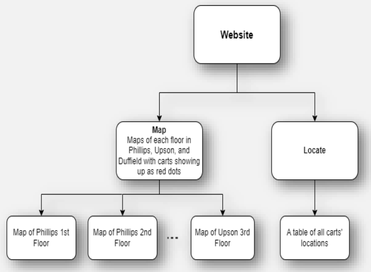
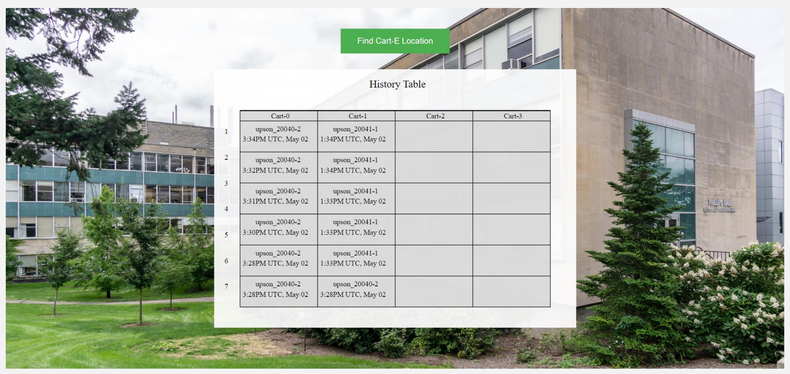
AWS EC2 SERVER

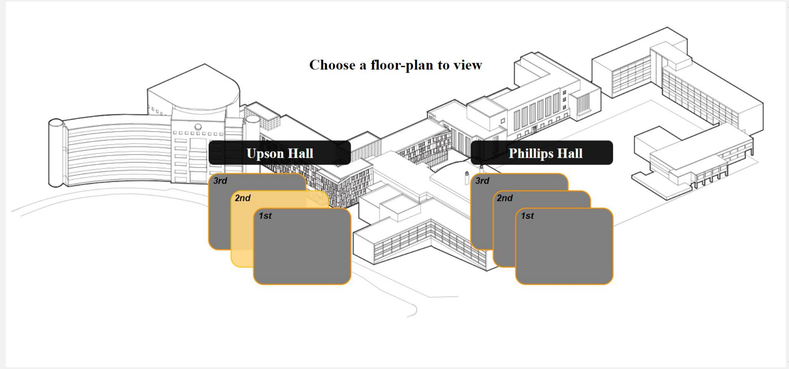
The server hosts our website and collects information about the location of the Cart. Collected WIFI signals from different carts will be stored on the server and analyzed by Python script.

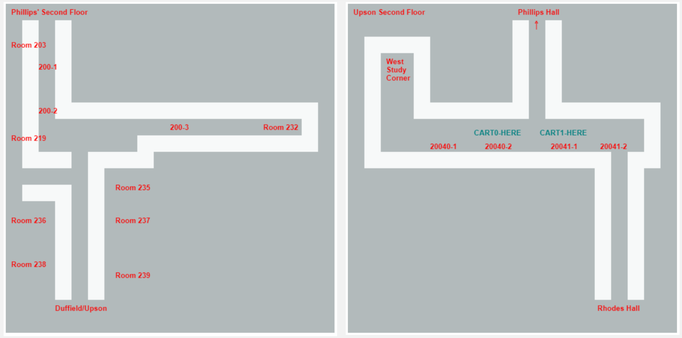




Our website has two features: it displays a table of all carts' locations and has a 2D floor plan for the user to look at in case they are not familiar with the building.
The history table contains information about different cart's location and time in the past.
The floorplan example on the bottom right corner shows that two carts are currently in Upson second floor.



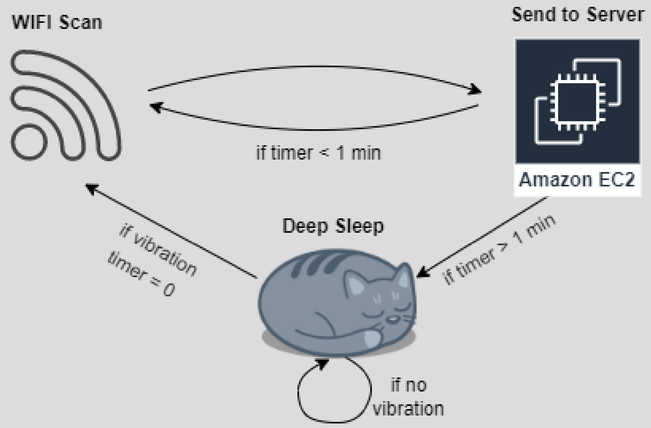




CART MISSING? TRY CART-E!

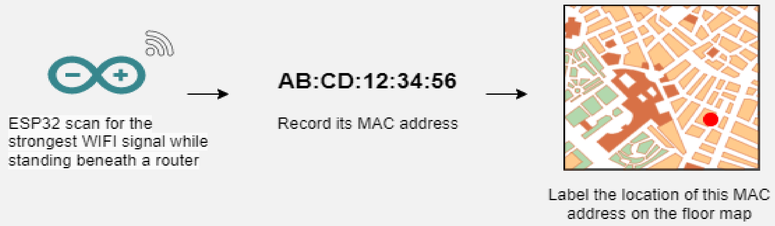
Look, Xiangyi can not find her cart! She searched all Phillips Hall but had no luck! Luckily, Alga is around, and we attached Cart-E to the cart to prevent situation like this from happening.

To help the ECE department locate the missing carts in Phillips Hall, we designed and implemented an indoor tracking device -- Cart-E.



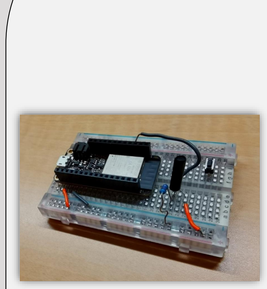
WIFI ADDRESS MAPPING

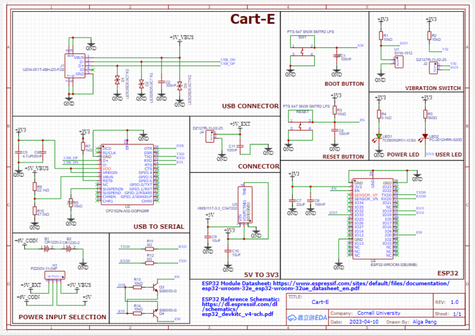
The essence of our locating functionality lies in Cart-E recognizing nearby WIFI router signals with known locations and determining its location based on the strength of these signals. Therefore, we want to map the physical locations of the routers with their identifications scannable from the ESP32.



We noticed that the WIFI library of ESP32 has a function to scan the MAC addresses of each router. We were expecting the list of MAC addresses that the CIT has would match the ones, but they proved to be different. Therefore, we had to do the mapping manually by standing beneath a router with an ESP32, recording the MAC address of the strongest signal scanned by the ESP32, and labeling the location of this router on the floor map on our website. We performed this manual mapping for the routers in Phillips, Duffield Altrium, and Upson Hall 1st-3rd floor.

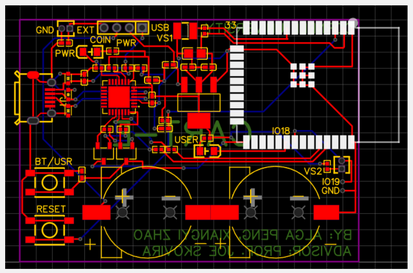
PCB DESIGN

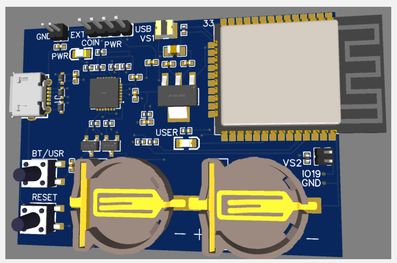




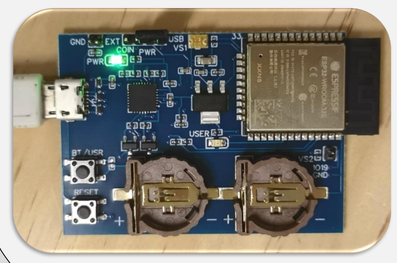
Cart-E's PCB contains the following components:

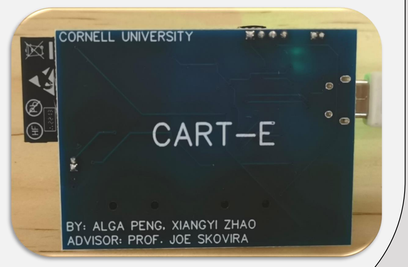
- ESP32-WROOM-32E-N8 module
- USB-to-Serial converter
- USB connector
- Power input selector (External 5V, USB 5V, Battery 6V)
- Two vibration switches (A mounted one and a backup option for plugin)
- Two 3V 12mm coin-batteries
- 5V-to-3.3V convertor





Cart-E's PCB design is less expensive than the prototype which uses ESP32 Feather ($21) and the Lithium-Ion Polymer Battery ($7). It will cost around $6 dollars if we order 3000 pieces together.





ACKNOWLEDGEMENTS & REFERENCES

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Thanks to Owen Deng, a Cornell ECE alumni from the class of 2023, for generously loaning his AWS EC2 server to us to host our website.

[1] How to Make Custom ESP32 Board in 3 Hours | Full Tutorial. wwwyoutubecom. [accessed 2023 Apr 20]. https://www.youtube.com/watch?v=S_p0YV-JlfU.
[2] ESP32WROOM32E & ESP32WROOM32UE Datasheet. https://www.espressif.com/sites/default/files/documentation/esp32-wroom-32e_esp32-wroom-32ue_datasheet_en.pdf.
[3] https://dl.espressif.com/dl/schematics/esp32_devkitc_v4-sch.pdf