Skateback

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Product Pitch

According to Autoinsurance, **77%** of Americans drive to work every day and accordingly to Edmund, just **6.8%** of cars in the US are electric. This creates a massive carbon footprint simply for getting to and from work. In addition, many drivers also have to endure traffic and congestion especially when traveling during peak commuter hours.

To solve both of these problems, we introduce Skateback, a portable electric skateboard that is capable of traveling **8+ miles** on a single charge and reaching speeds of up to **20 mph**. Skateback is controlled entirely from an **ios app**, eliminating the hassle of buying, operating, and storing a remote control.

Skateback also improves the user experience when learning or riding. If the user is separated from the board, users can press a button on the app to begin the "return-to-me" flow in which the board will autonomously path back to the user at up to **80m.**

Skateback can traverse over a variety of different terrains, climb slopes, and can be fully recharged in around **4 hours.**

System Architecture

Our system consists of two primary systems, the physical board architecture and the app architecture

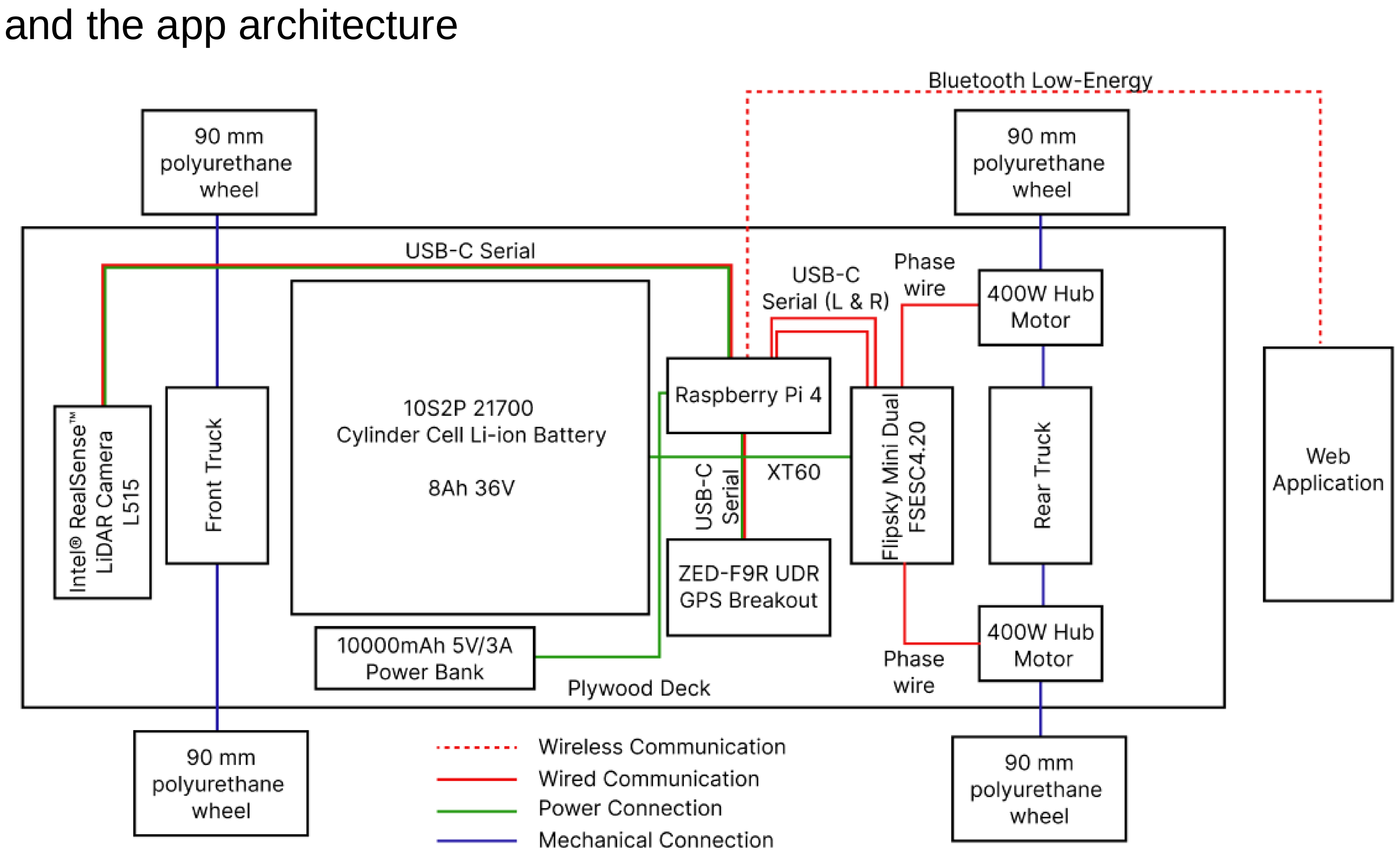


Diagram 1: Hardware and Raspberry Pi integration. Everything enclosed in the outer black box resides in an enclosure underneath the skateboard

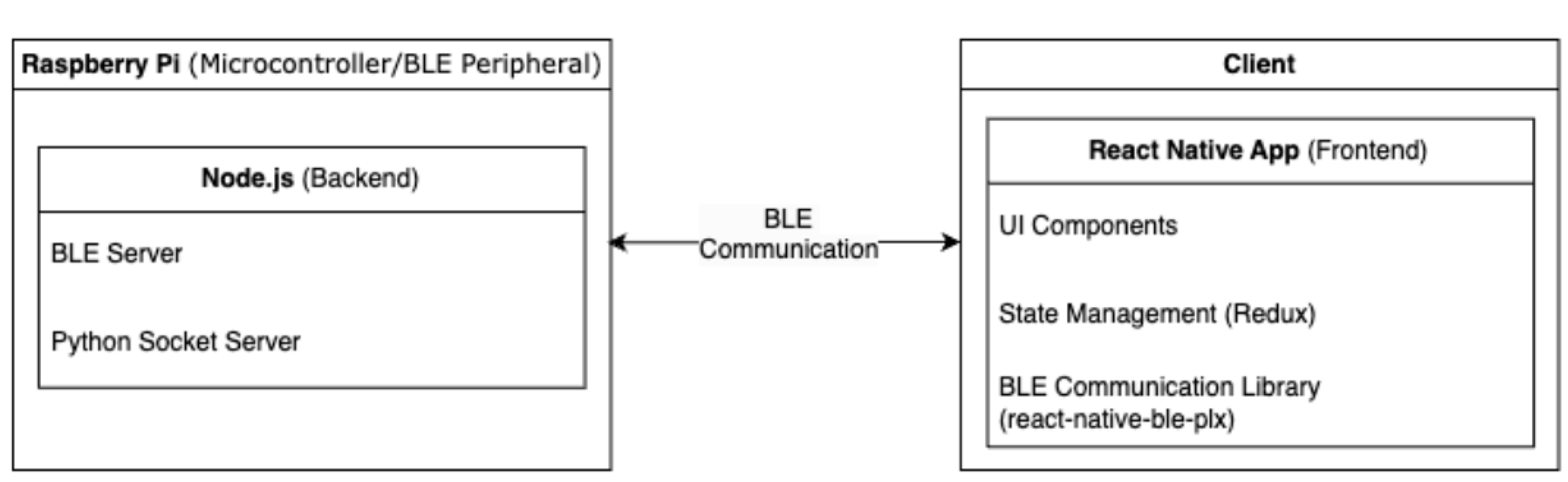
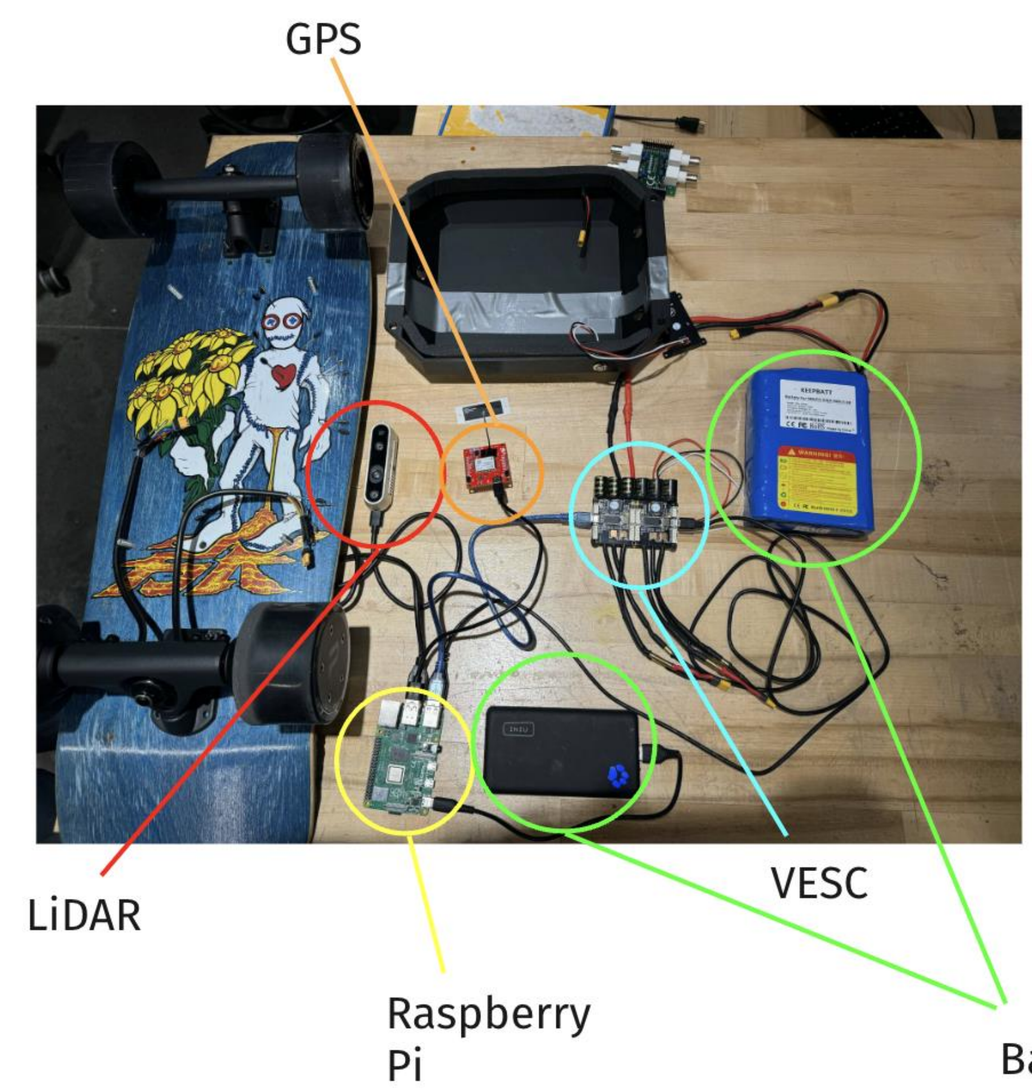


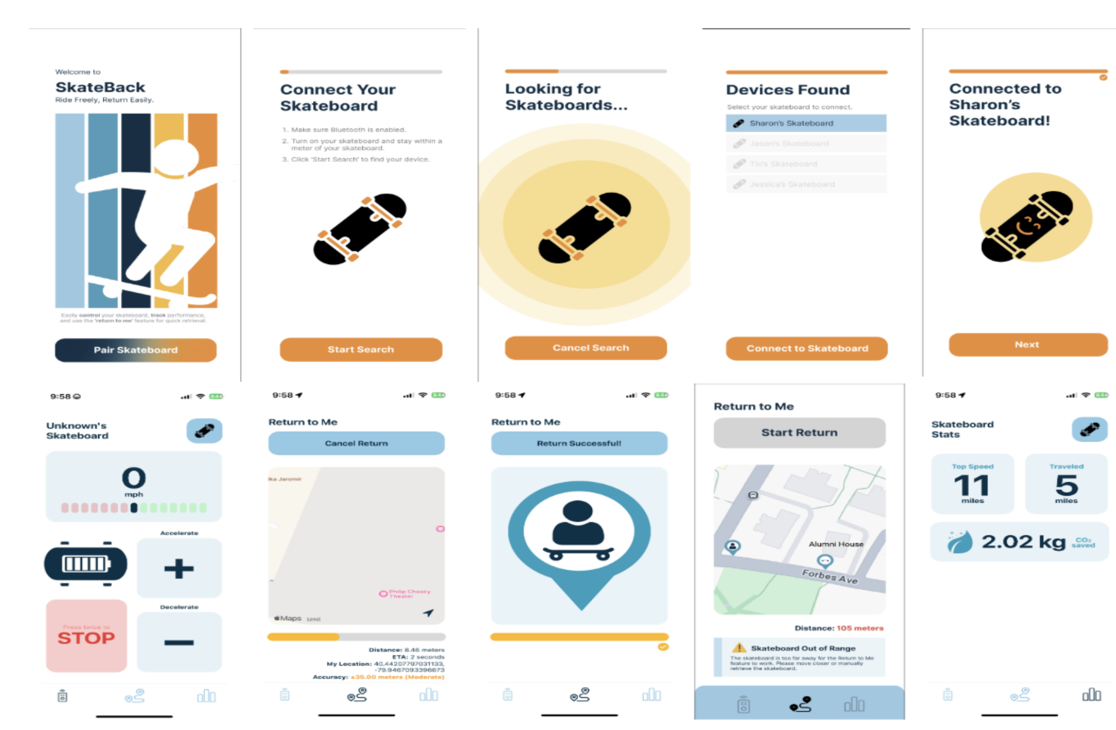
Diagram 2: IOS app architecture. The app runs on the users phone and sends/ receives data from the Raspberry Pi onboard

System Description



The first system connects the VESC (Vedder Electronic Speed Controller) to the Raspberry Pi as well as the battery and the power switch. The Raspberry Pi also connects to the GPS, LiDAR, as well as its own power source, an external 5v battery. All of these components are housed in the black enclosure (top) and bolted to the bolt via mounting holes and hardware

This is a flow of our second system, the IOS app. Users first pair with the skateboard via a Bluetooth low energy server, and send acceleration or deceleration commands while riding. They can also initiate the return to me process and see their location as well as other relevant data such as speed.



System Evaluation

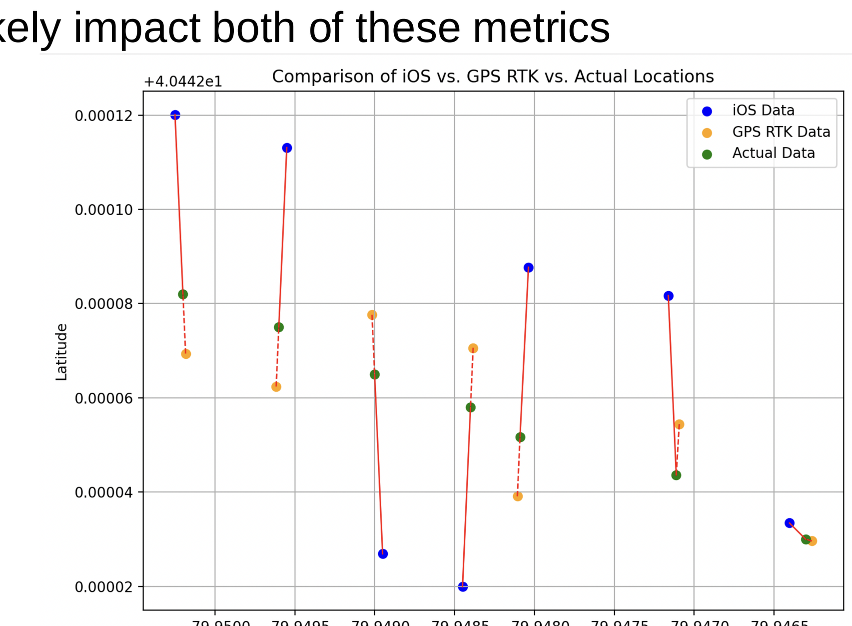
Our testing strategy consisted of testing part individually, then grouping parts into our subsystems and testing, then finally bringing all components together and testing as a whole. We wanted to ensure each subsystem performed up to our standards to allow us to make any adjustments or pivots early on in the process and make the final integration process easy.

Metric Comparisons:

Metric	Target	Actual
Range	≥ 5 Miles	≥ 8 miles
Top Speed	≥ 15mph	≥ 20 mph
Return Accuracy	≥ 80%	75% without obstacles
Load Capacity	220lbs	220+lbs
Command Latency	<100ms	Average of 80ms

*Range and Top Speed are tested on flat surfaces with minimal road debris. Traveling across hills, frequent braking, or on difficult terrain will likely impact both of these metrics

To the right is a visualization of 5 data points we collected to test the accuracy of our IOS app gps as well as the RTK GPS chip on our board. The GPS chip is expected to be accurate to less than a meter and the IOS is expected to be accurate to around 5m. As it turns out, these numbers are closer to 3m and 10m.



Tradeoffs:

	Turning Capability	Stability	Ease of Riding
Short Deck Length	Significantly less force required	Much stronger deck and can support mounted hardware better	More awkward foot placement for taller riders
Long Deck Length	Much larger turning radius	Flimsy feel, deck integrity becomes a concern at higher weights	More comfortable and natural ride feel and can appeal to a larger variety of riding styles

Conclusions & Additional Information

Scan the QR code to the here to learn more about the functionality and development of Skateback!

Conclusions: This project was an incredible undertaking that presented a refreshing and impactful challenge for each of us. Working throughout the semester tested not only our knowledge of the content taught in our courses, but also our ability to proactively seek answers and knowledge to fill the gaps. Each of us considerably advanced in our technical abilities as well as in our ability to work in group environments, deliver a product end to end, communicate with stakeholders, and present about engineering work. By preserving several very significant setbacks, we learned valuable lessons in compromise, adaptability, and resilience. Future work will include LiDAR integration and better detection of user/board separation