TEAM C6: SKATEBACK

A SMART ELECTRIC SKATEBOARD

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USE CASE

Problem: Commuters, students, and beginners need a convenient, eco-friendly way to travel. Current electric skateboards are hard to retrieve and lack autonomous features.

SkateBack:

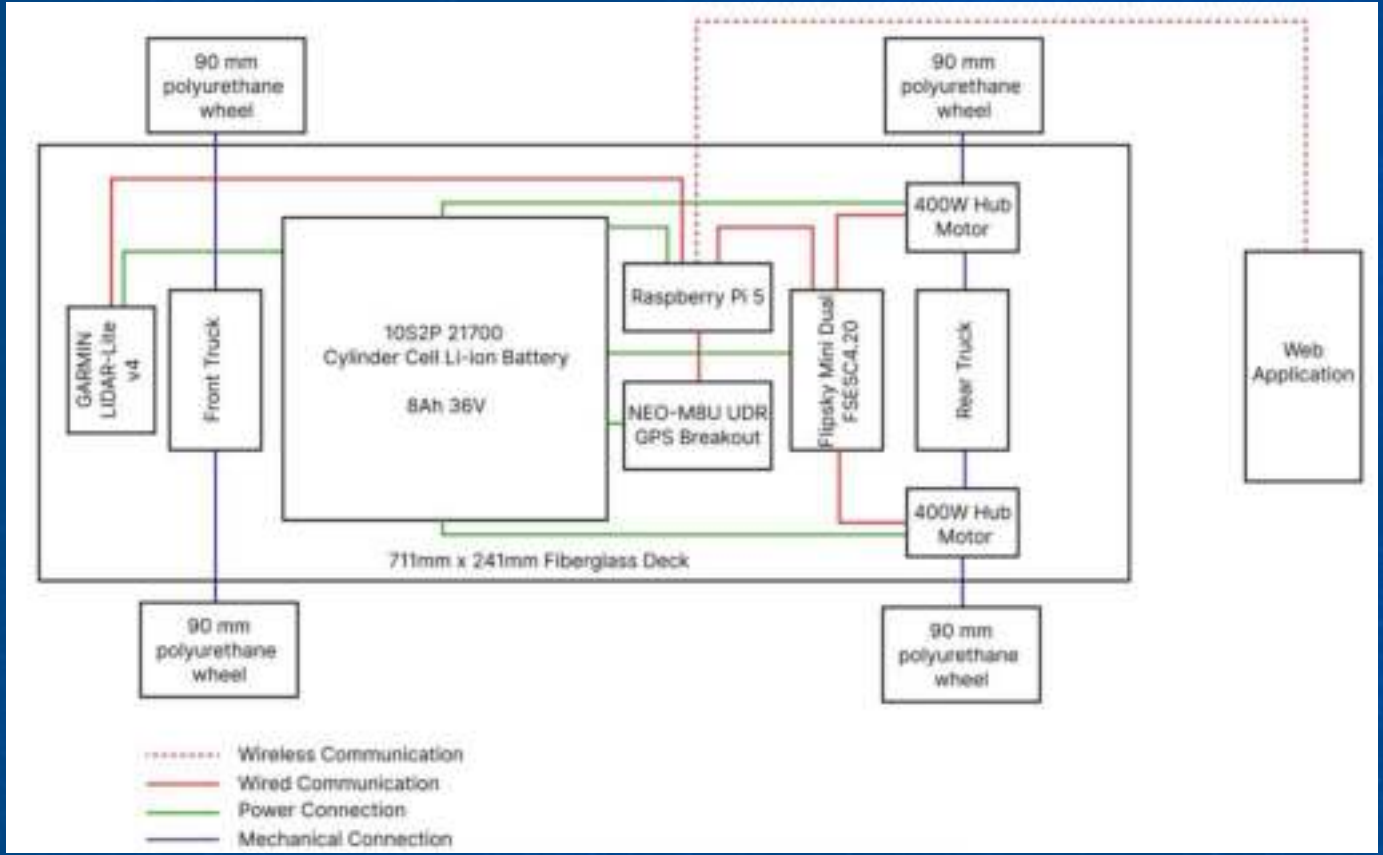
- Smart electric skateboard with "return to me" feature
- Controlled via a web app
- Displays real-time stats: speed, battery life, and environmental impact

ECE Areas: Hardware, Software Systems, Signals

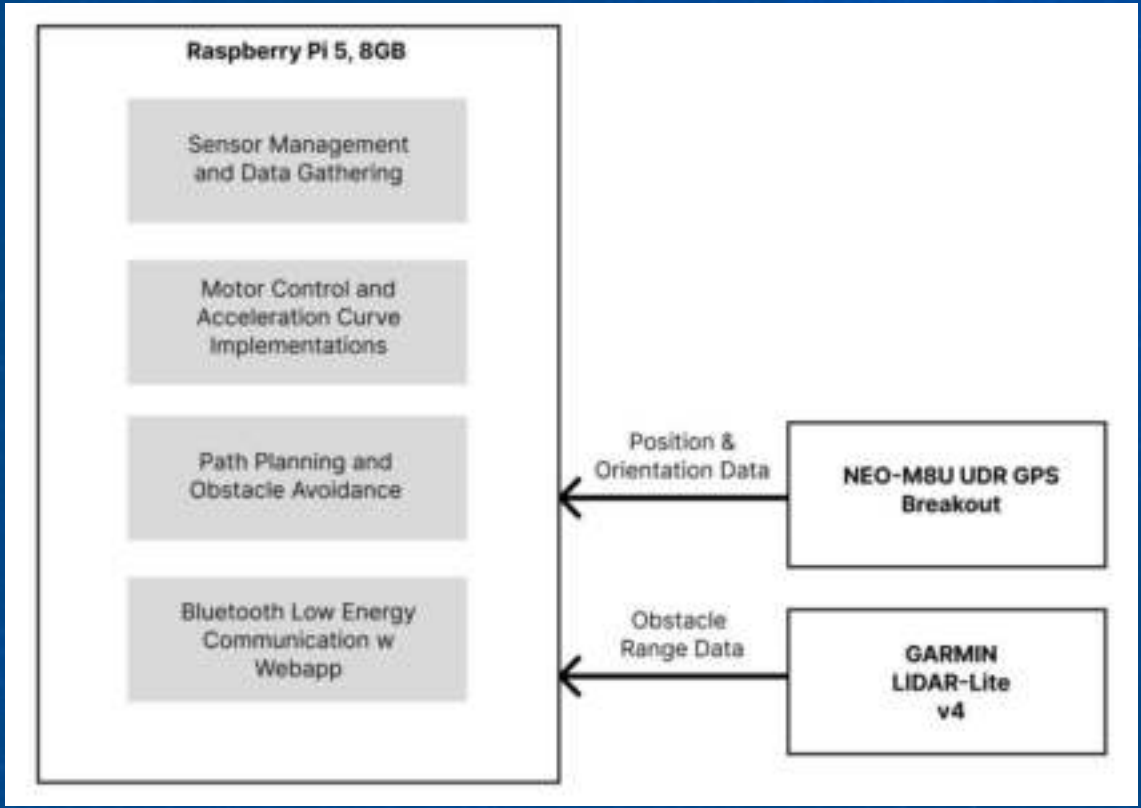
USE-CASE REQUIREMENTS

TOP SPEED	15 mph ± 1 mph
RANGE	5 miles ± 0.25 miles per charge
AUTONOMOUS RETURN ACCURACY	At least 80% successful retrieval within a 1-meter margin
OBSTACLE DETECTION	90% accuracy
SAFETY GUARANTEE	98% collision avoidance
LOAD CAPACITY	Skateboard must support up to 220 lbs while maintaining performance
LATENCY	Web app commands executed with ≤ 100 ms delay

SOLUTION APPROACH



IMPLEMENTATION PLAN

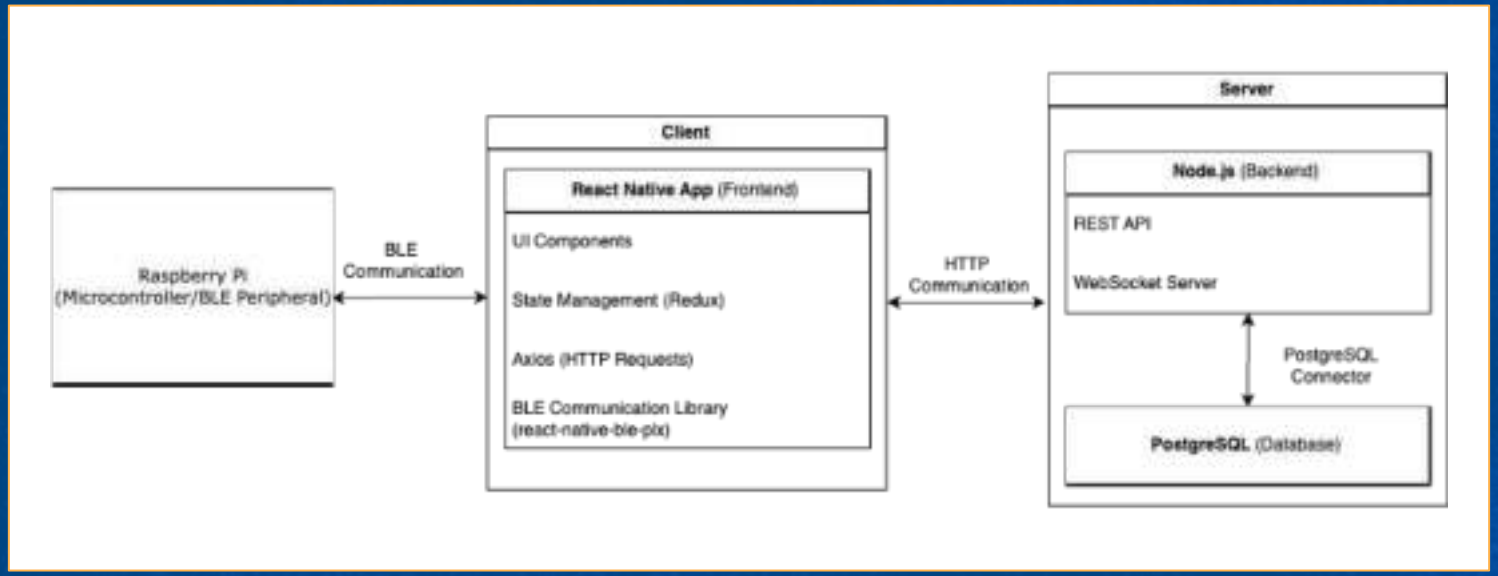


DESIGN TRADEOFFS

Camera	LiDAR
• Clearer Object View • Poorer depth perception • Less expensive • More effective in gauging object size	• Less computation on the board • More immune to different environments

Belt Motor	Hub Motor
• More Torque • More complex design and moving parts • Susceptible to jamming if items get into the belts	• Less overheating • More streamlined and clean design • Much quieter

WEB APP ARCHITECTURE



WEB APP UI MOCKUP

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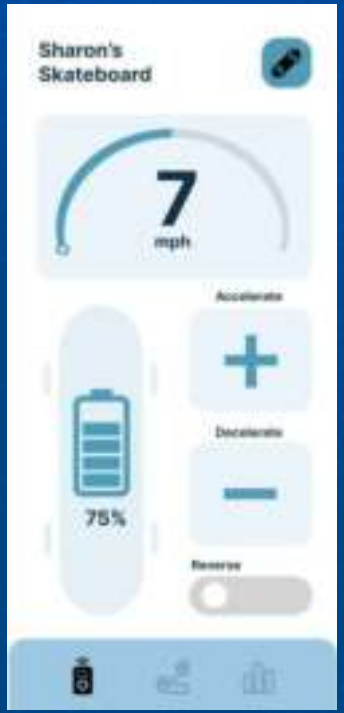

TESTING, VERIFICATION AND VALIDATION

Test	Measurement	Test Input	Test Output	Risks
Speed Test	15 mph ± 1 mph	Accelerate and decelerate on vary terrain (flat, inclined), rider weight, and motor load	Speed should remain within 14-16 mph	Failure to maintain a consistent speed and reach a top speed
Battery Efficiency & Range	5 miles ± 0.25 miles per charge	Continuous ride over varied terrain and rider loads (150-240 lbs)	Travel 5 miles on a single charge	Battery drains too quickly, insufficient power for "Return to Me" function
Return to Me Accuracy	80% success rate within 1-meter margin	Recall skateboard over varying distances (5m, 10m, 50m, etc) with/without obstacles	Skateboard returned to user and retrieved within 1-meter margin smoothly	Pathfinding issues due to GPS/IMU inaccuracies

TESTING, VERIFICATION AND VALIDATION

Test	Measurement	Test Input	Test Output	Risks
Obstacle Detection	Detect objects within 100ms, 90% accuracy	Set obstacle course with varied object sizes (rocks, trees, etc.)	Skateboard successfully avoids obstacles within design requirement	Slow or no detection at all, especially in fast-moving or small obstacles
Latency Test	Command response ≤ 100ms	Send commands from web app (accelerate, deccelerate, etc.)	Response time should be ≤ 100ms	Bluetooth disconnects, delayed execution of commands
End-to-End Integration	No interruptions in 2+ mile trip	Combine all features, ride continuously for 2 miles	System functions smoothly for the entire trip	Loss of connectivity or inconsistency between components

PROJECT MANAGEMENT

Tioluwani Ajani

Pathfinding/GPS Integration, and Core Performance

Jason Hoang

Board Assembly, Obstacle Avoidance, and Computer Vision

Sharon Li

Web Application, Software Development, and Board Manufacture