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# Spring Design Review

EMPRO

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# Problem Statement



EBIKES



\$

Expensive



Prone to  
Theft



Heavy and  
Bulky



DIY KITS



Tedious to  
Install



Unsafe



No  
Servicing

# Solution

An Electric Wheel That Transforms Any Bike to An Ebike

1



2



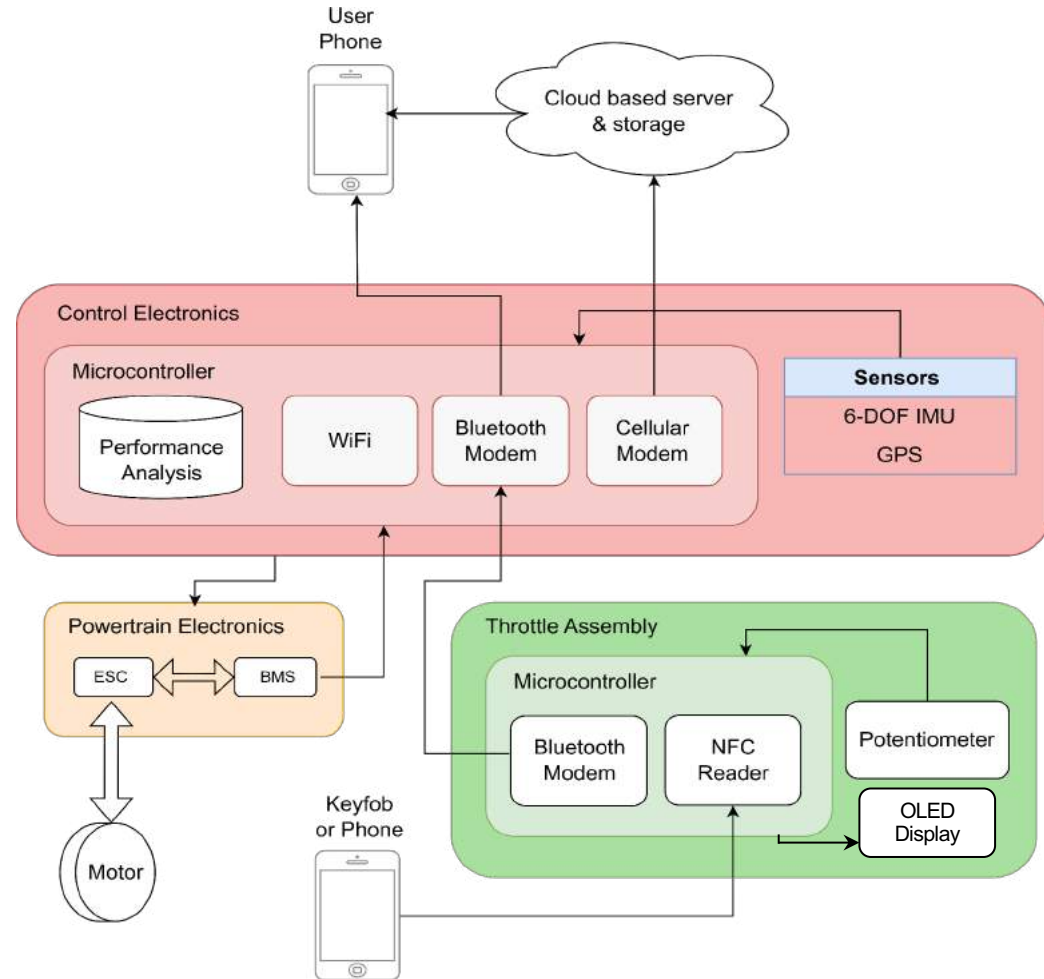
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# System Block Diagram

Five Primary Subsystems:

- Mechanical
- Throttle Assembly
- Powertrain Electronics
- Control Electronics
- Smartphone App

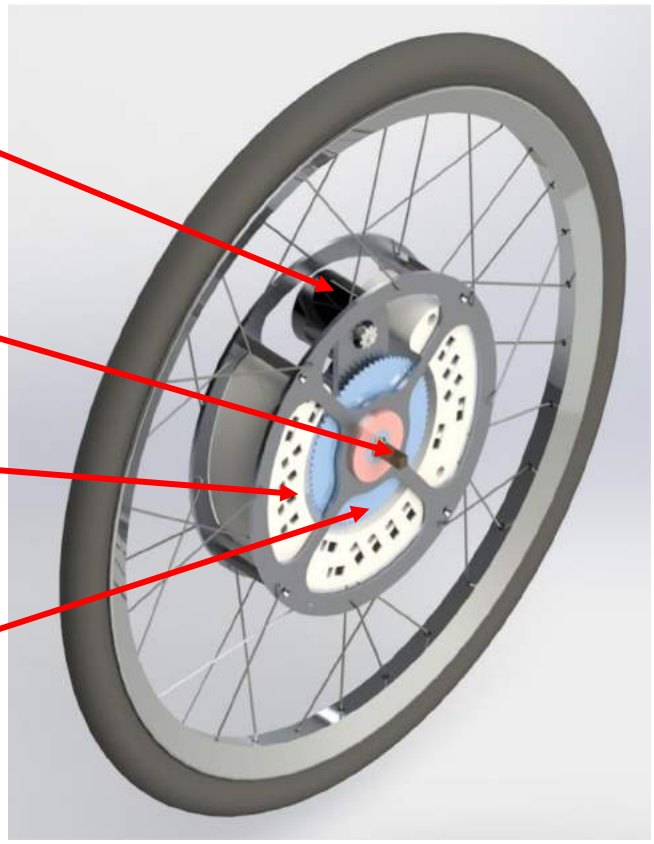


# Mechanical





- Motor
- Axle
- Batteries
- Electronics  
(*behind sprocket*)



# Throttle



# Throttle Housing

The throttle activates the wheel and controls its speed.

It encloses the throttle MCU, an NFC reader, and slots an OLED display.

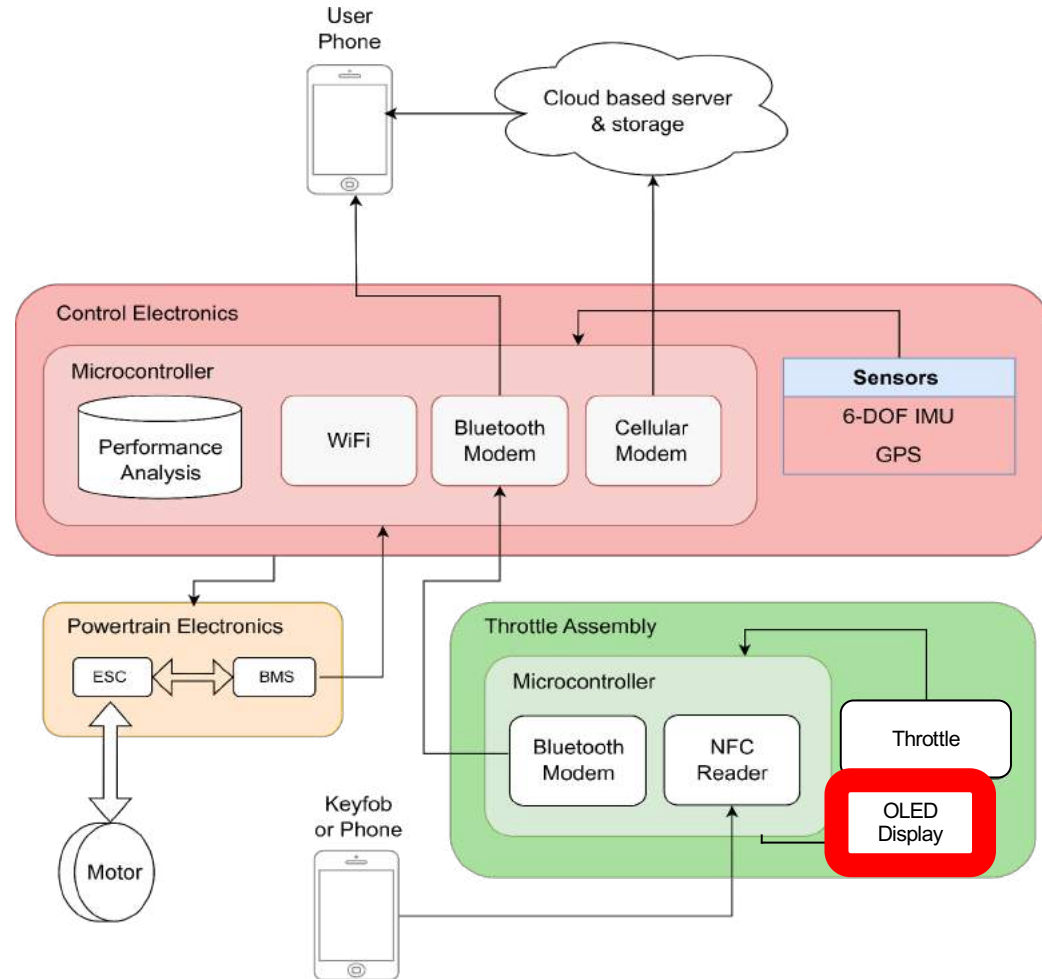


# Throttle Housing Demo



# Throttle - OLED Reader

The OLED display is used to display the power state and battery percentage of the wheel.



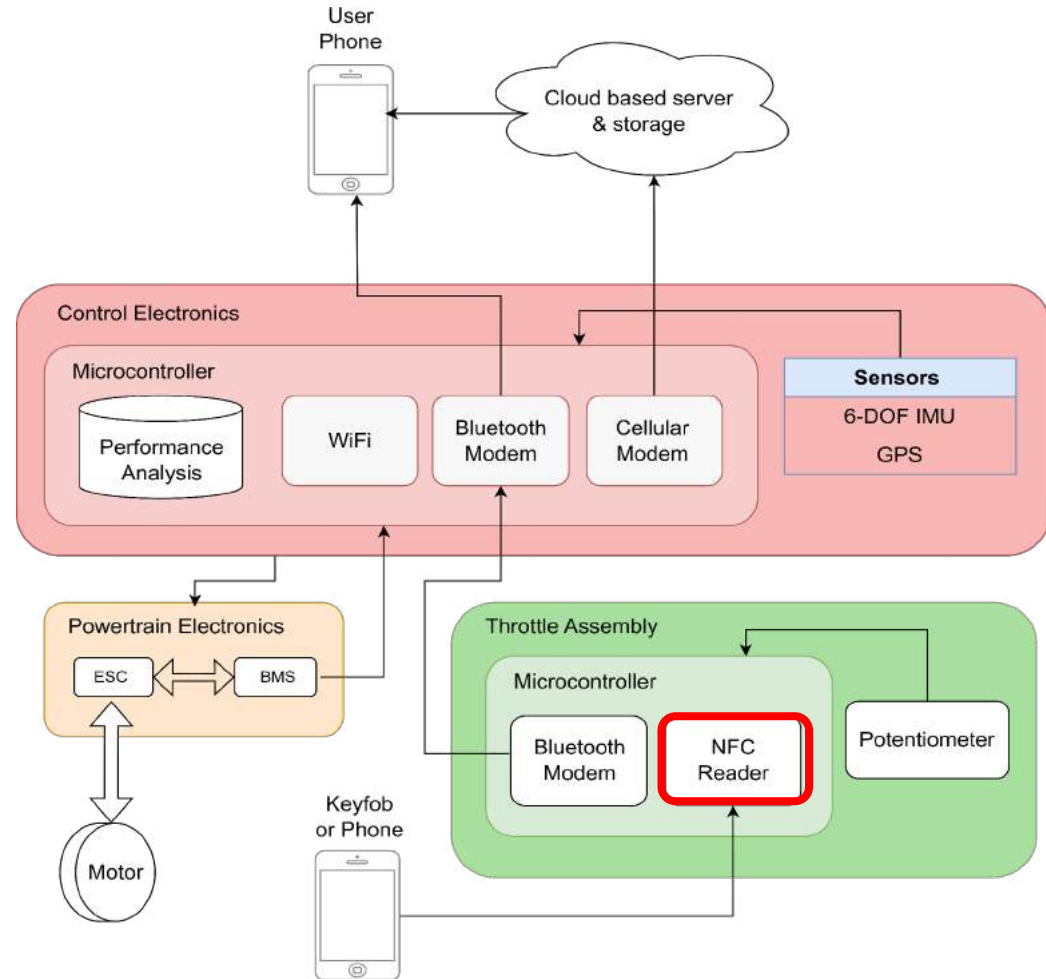
# Demo of OLED



# Throttle - NFC Reader

NFC Reader - NXP PN532

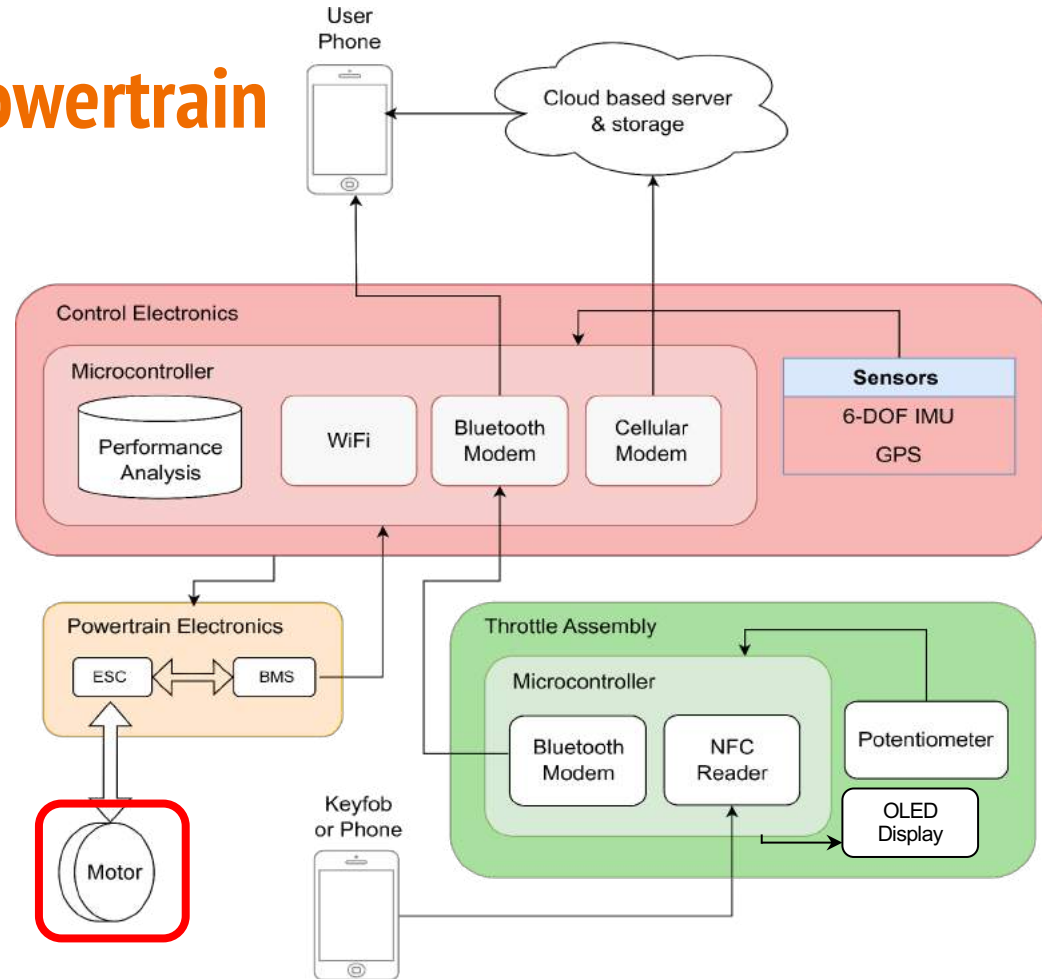
Authenticates user to wheel to improve security



# Powertrain

# Component Selection - Powertrain

Motor - Flipsky BLDC 2450W

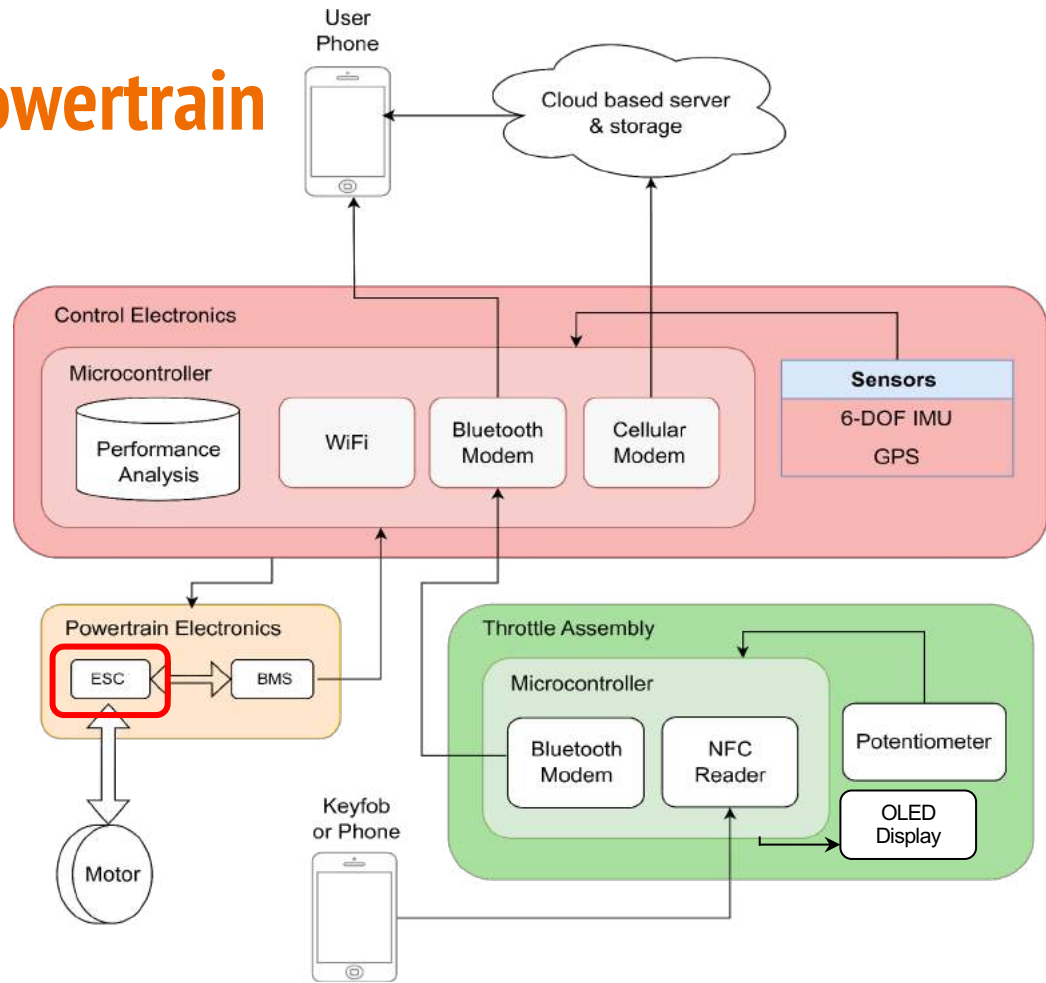




# Component Selection - Powertrain

ESC - Flipsky VESC 4.12

- 50A continuous, 150A burst
- UART serial port for command and telemetry

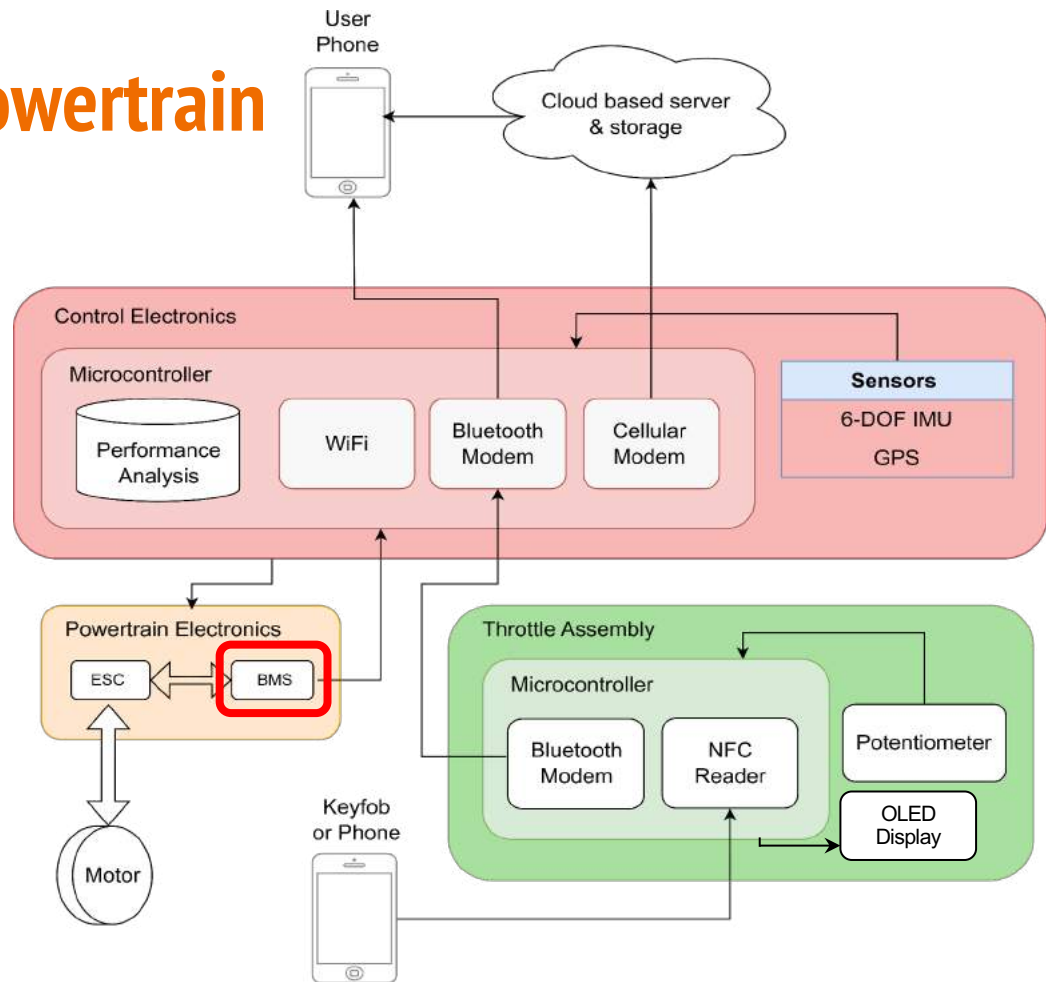




# Component Selection - Powertrain

## BMS - JBD Smart BMS

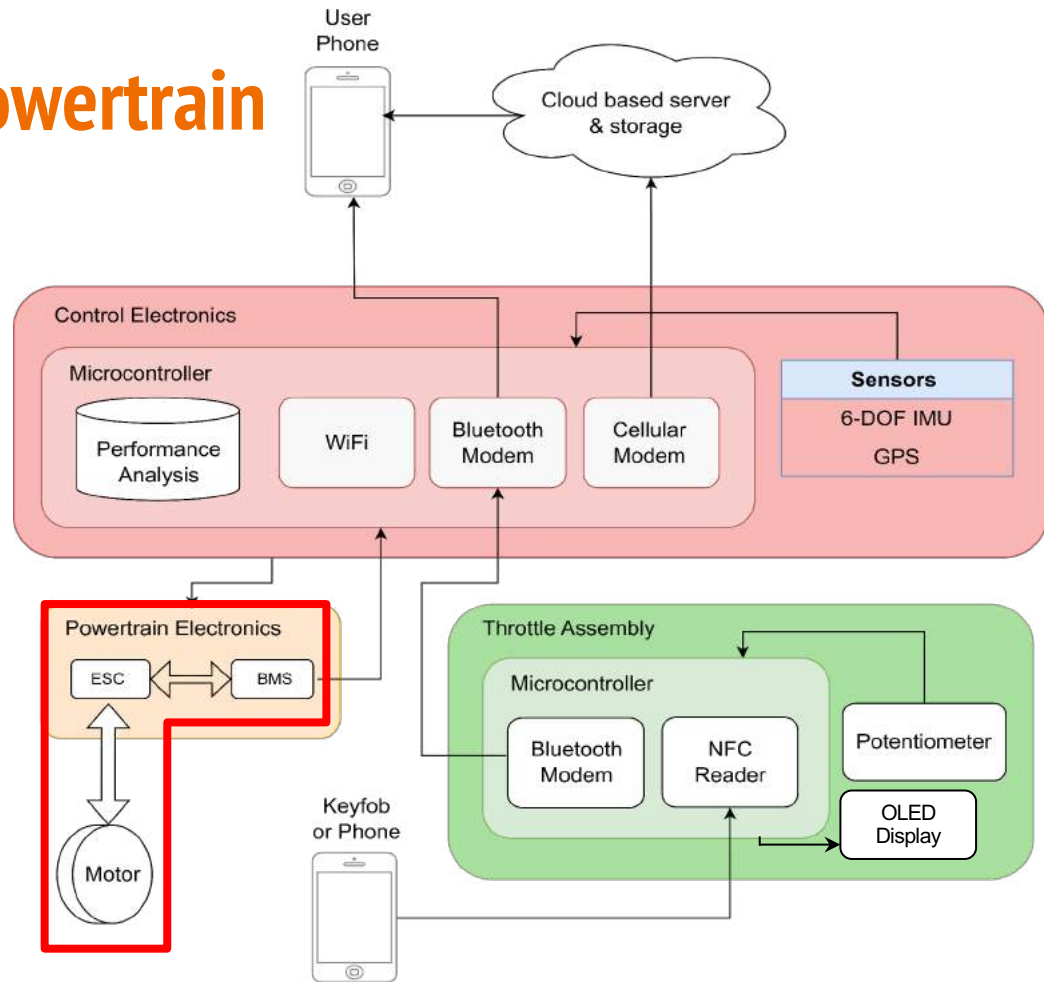
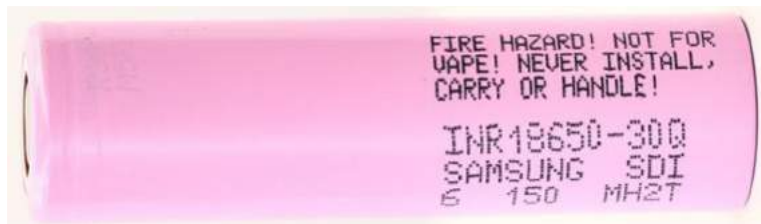
- 50A continuous
- UART serial port for telemetry



# Component Selection - Powertrain

Battery - 39x INR18650-30Q

- "13s3p" (9 Ah / 444 Wh)
- ~48V (nominal) or ~55V (full)

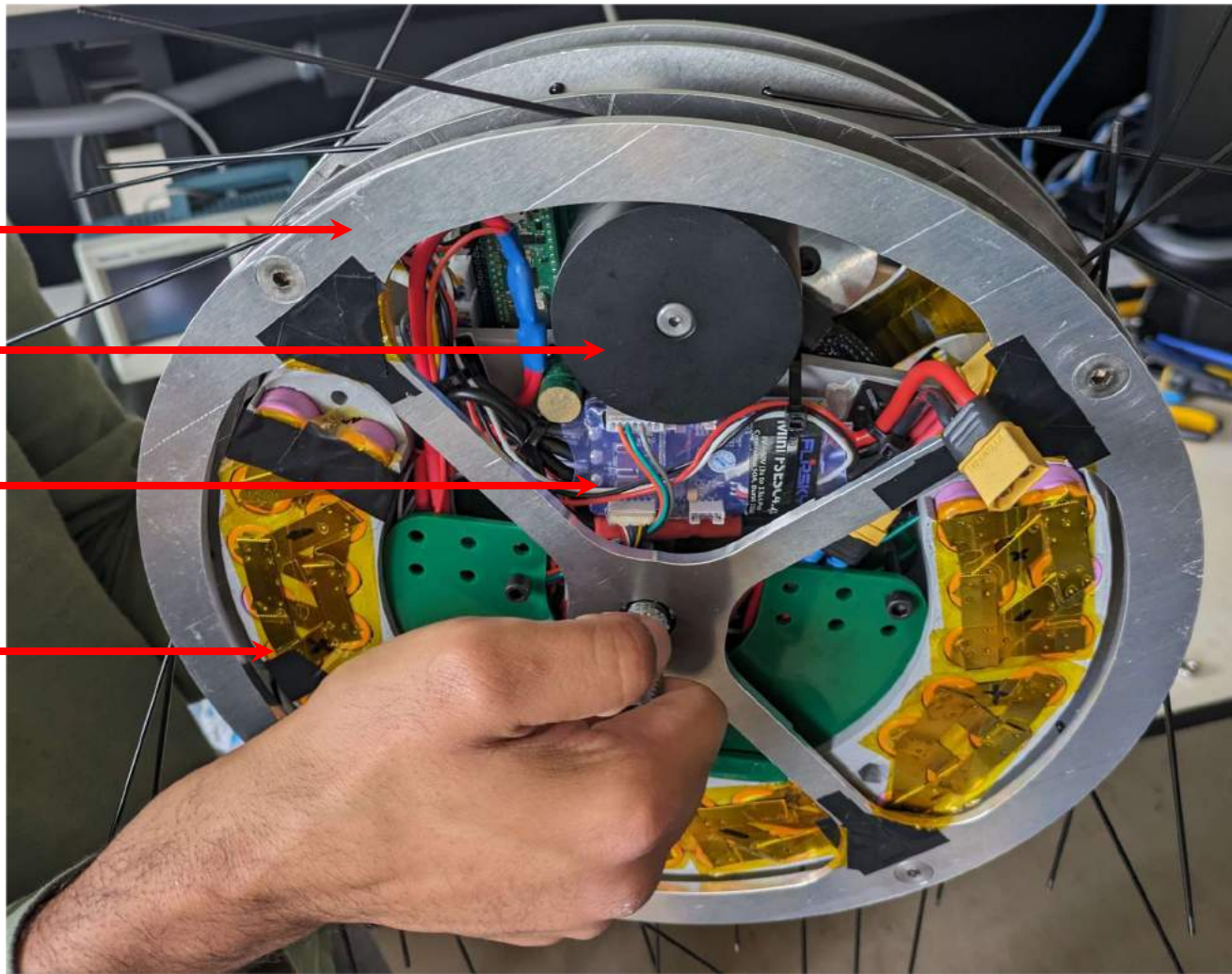


Housing

Motor

ESC

Battery

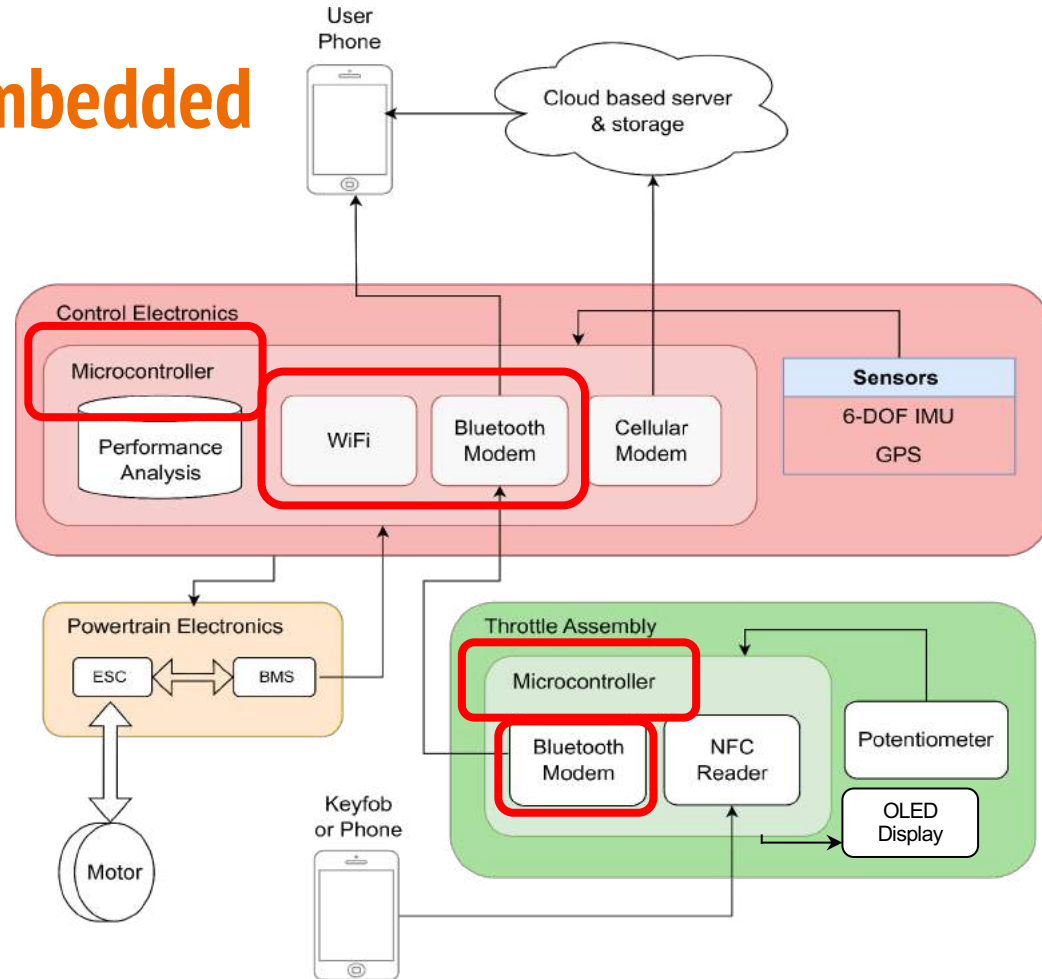


# Control Electronics

# Component Selection - Embedded

## Raspberry Pi Pico W

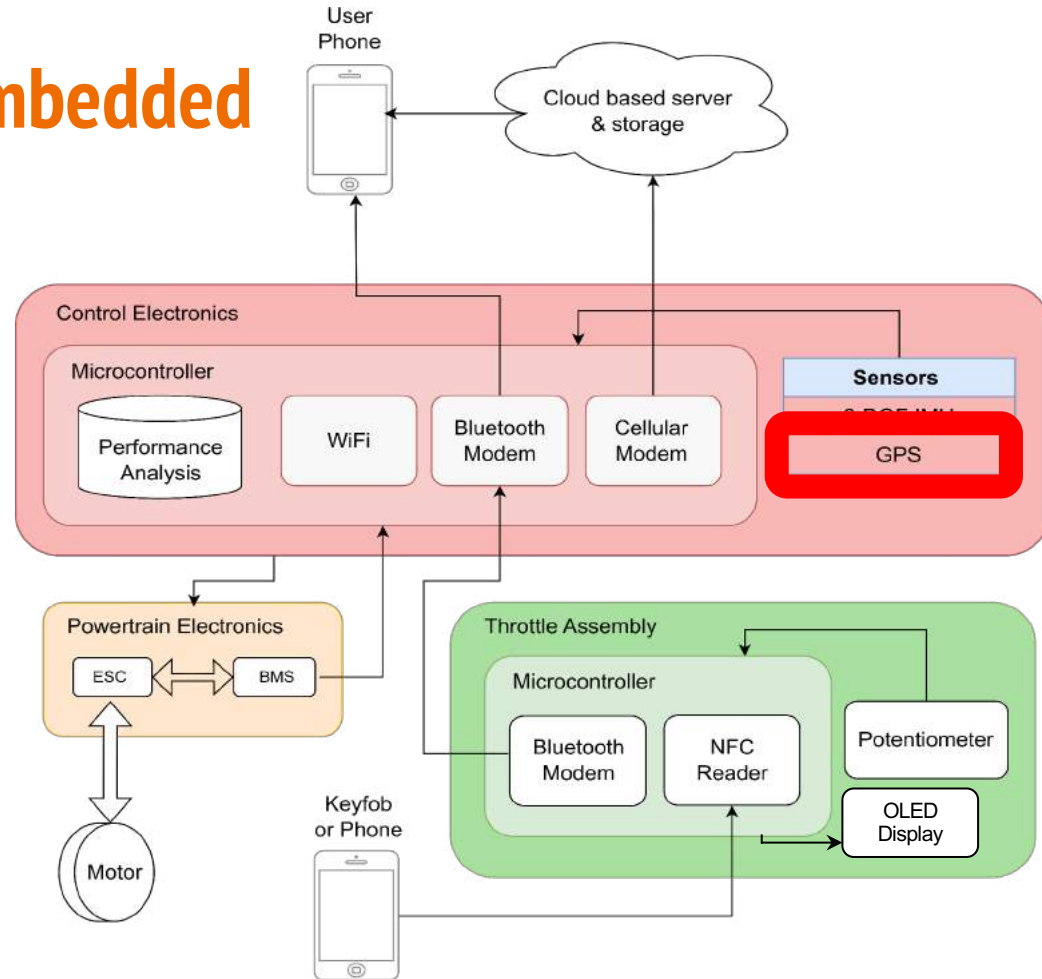
- ARM M0+ MCU
- Integrated BT(LE)/WiFi
- FreeRTOS middleware



# Component Selection - Embedded

GNSS - uBlox SAM-M10Q

- GNSS: all countries' GPS
- Low power receiver



# Phone Application

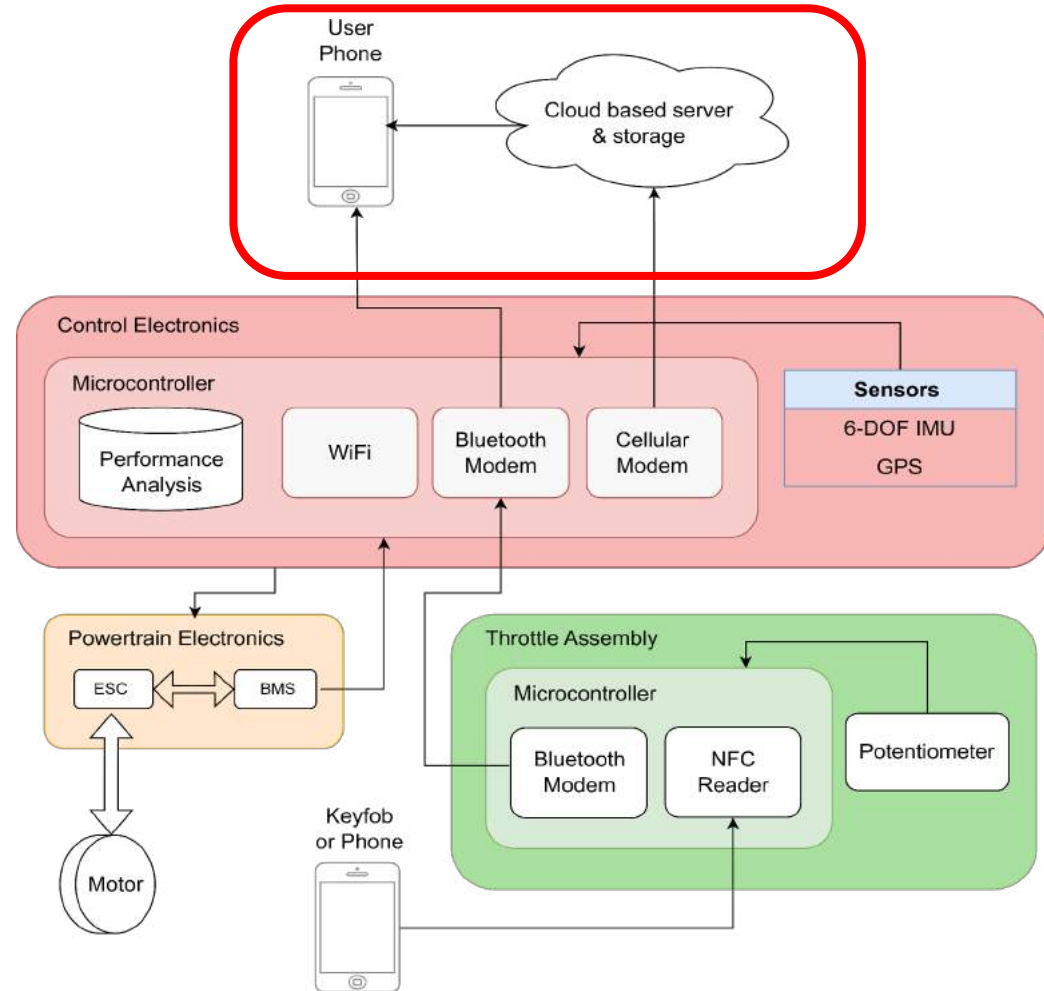


# Phone app - Demo

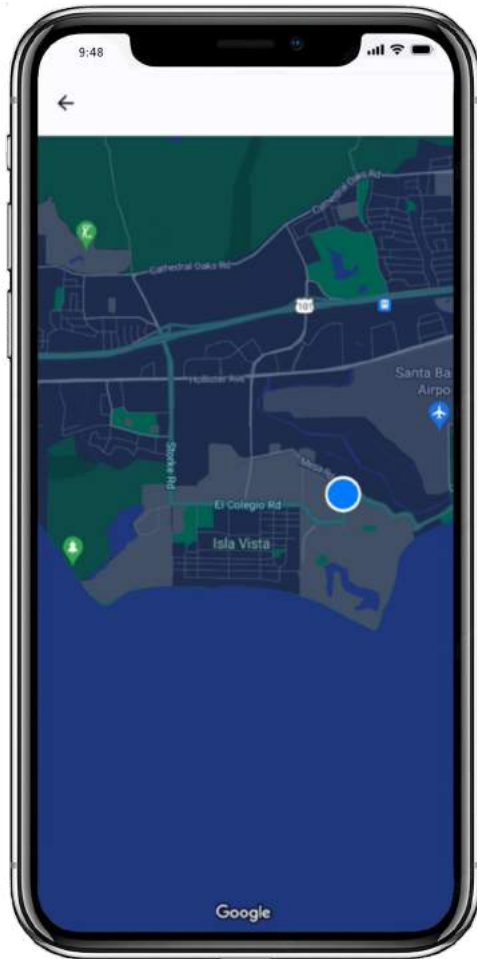
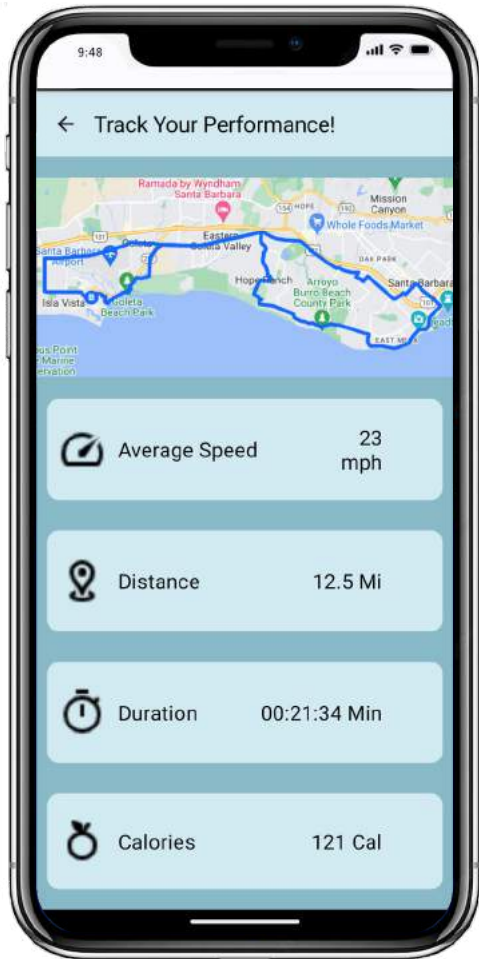
Tracks performance parameters

- Speed
- Total Distance
- Duration

Performs basic geolocation tracking

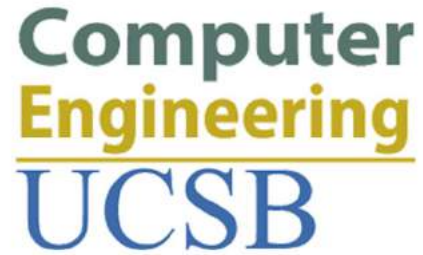








# Thanks to



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