# RiseVBT : F4 - Jamshed Panthaki, Jason Botros, **Meadow Webster**

For coaches & athletes looking to optimize training with objective data & analysis

**Automatically store distinct data on each rep in a set**

- Lifts: squat, deadlift, bench, overhead press
- Data: velocity, balance, bar path
- Recognize training patterns & growth

**Real-time evaluation with accurate, objective feedback**

- Post-lift graphs velocity in 3-axis and orientation
- Minimal sensor drift over time
- Synchronized footage displays bar path visual

**Easy setup**

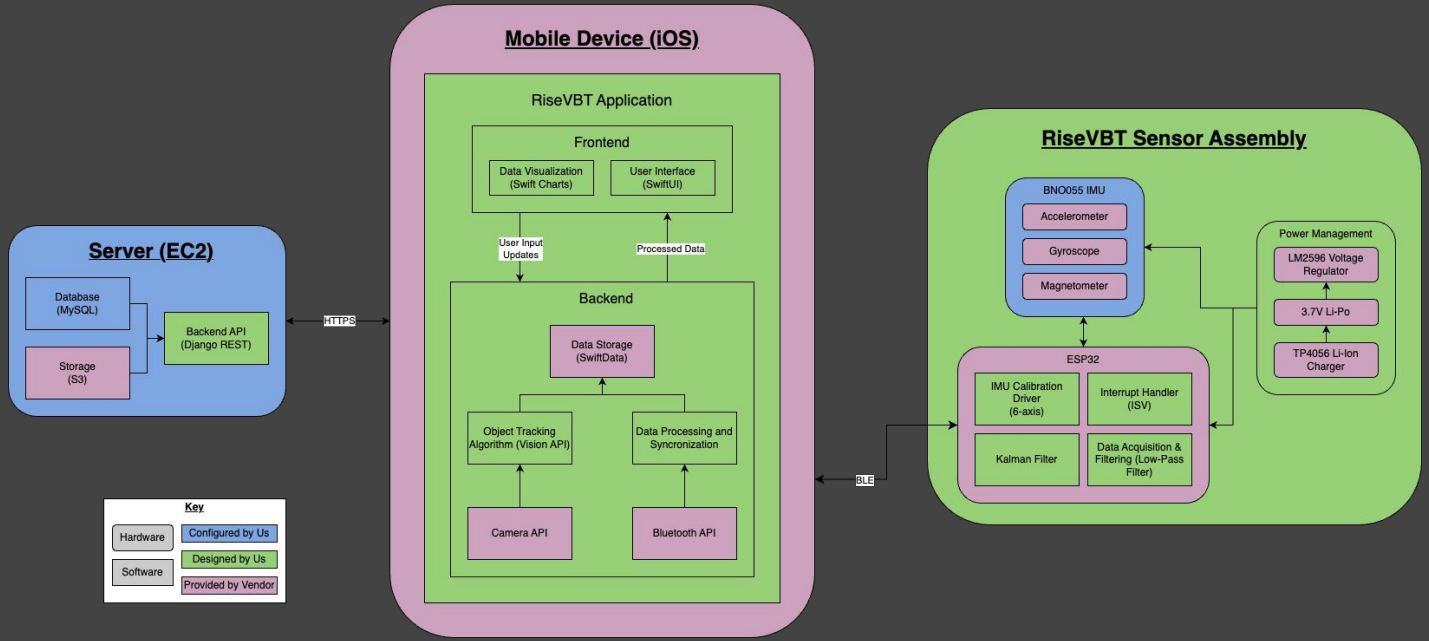
- Discrete, lightweight gear
- Compatible with commercial barbells

**Technical Reqs**

- Sensor/video analytics available within 30s
- Sensor data calibrated within 10% of ground truth
- Sensor system resistant against 2000N of force
- Video analysis accurate in 300-500 lux & angles ±15°

# Solution Approach (previously)





# Solution Approach (currently)

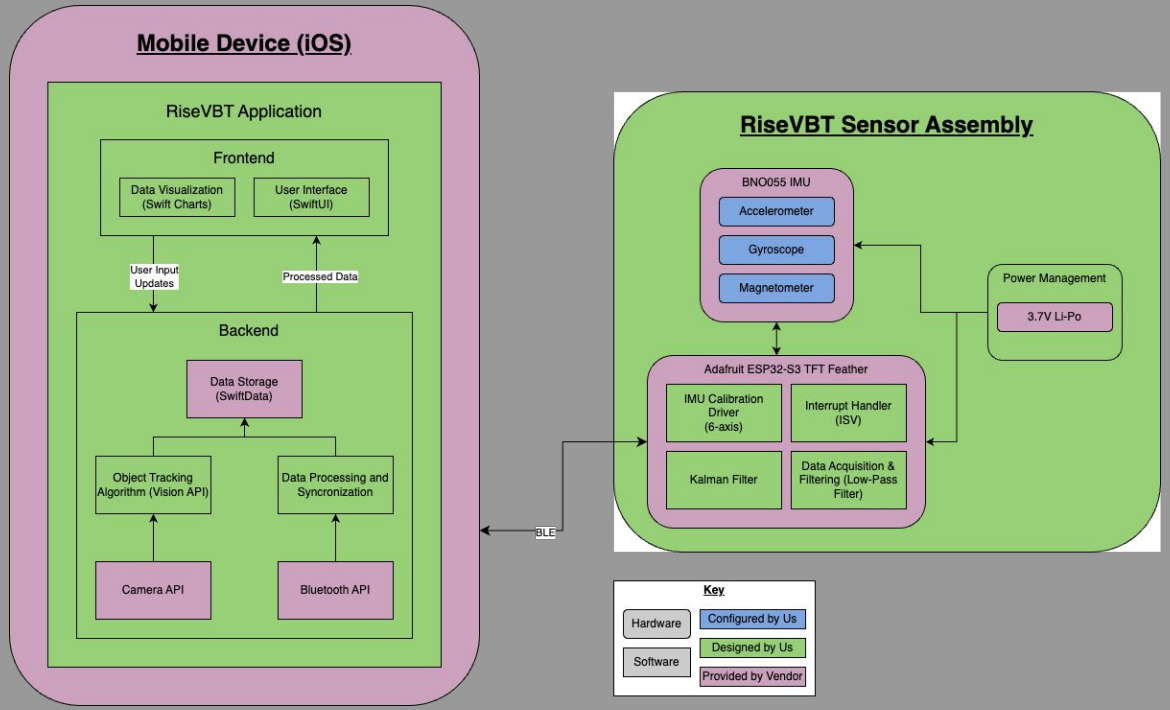


**Design Changes**

- 2 sensors —> 1 sensor
- Adafruit ESP32-S3 TFT Feather
- Cloud server unnecessary

**Safety, Health, and Social Influence**

- Indicators for good vs. bad
  - Green vs. red
  - Linked to rep
- Optional camera usage



# TESTING & VERIFICATION

## Data Visualization & Object Tracking

Mock IMU data —> Appropriate graphs

Mock camera footage —> Accurate bar path display

## Sensor Calibration & Power Integration

Known data —> Matching sensor readings

Battery powered sensor —> Data stream without loss

## Data Integrity over BLE

Sensor data —> Data transmission matches IMU generation

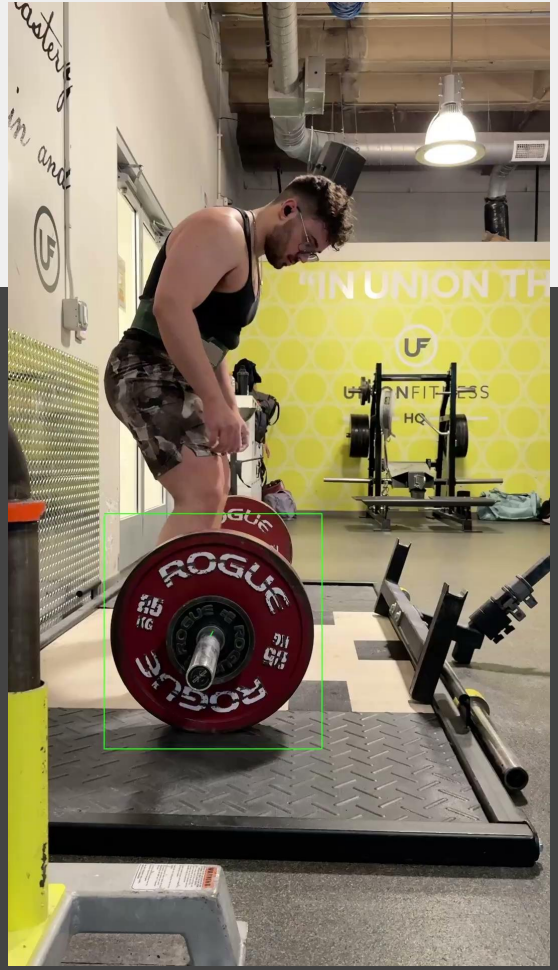
External Start/Stop Command Communication - > ESP32 Acknowledgement & Execution Accordingly in <1s

## App & System Integration

Sensor data —> App receives and plots data

Real camera  footage —> App displays correct bar path

# Data Visualization



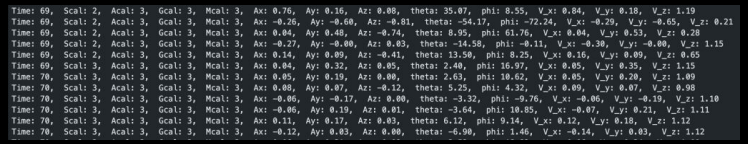

**Barbell Tracking Validation**

- YOLO v2 detection model performed 83% accuracy on test dataset
- Redetection performed during tracking based on calculated confidence levels
- Tested detection and tracking functionality with various aspect ratios, lighting conditions, and recording angles
- Met design requirements of accuracy in 300-500 lux, angles of ±15°

# Sensor Calibration & Power Integration

**Power**

- Validated sensor data stream to device with both USB-C and battery pack




**Calibration**

- Ground truth: move 1 ft (0.3m) in 0.5s
  - 0.6m/s velocity
  - 0.122g acceleration
  - Freefall: 0.9 m/s, 1g
- Most data within 10% of expectation
- Some data within approximately 15%

**Design Tradeoff**

- Adjust requirement to within 15%