# Climbers Ligament Injury Mitigation Band

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## Product Pitch

CLIMB is a system capable of monitoring, analyzing, and visualizing forces applied by the hand over time. In the form of a glove-like wearable device, **CLIMB aims to improve the state of training and rehabilitation in rock-climbing** by providing climbers with an unobtrusive, injury-preventative training device paired with the immersive CLIMB app which helps users track, analyze, and share their workout data. As a result, climbers using CLIMB will avoid overloading their pulley-joints during their workouts and will identify areas of improvement in their rehabilitation and training.

CLIMB can accurately measure **up to 60lbs per pulley** with **3% error**.
CLIMB can be used **at any distance** from the paired device.
CLIMB can visualize data from a workout in **8 seconds**.

"Yeah I'd use that as long as my fingertips and palm are free, **it'd definitely save people from getting pulleys**."
~ fellow climber at ICB Climbing Gym

## System Architecture
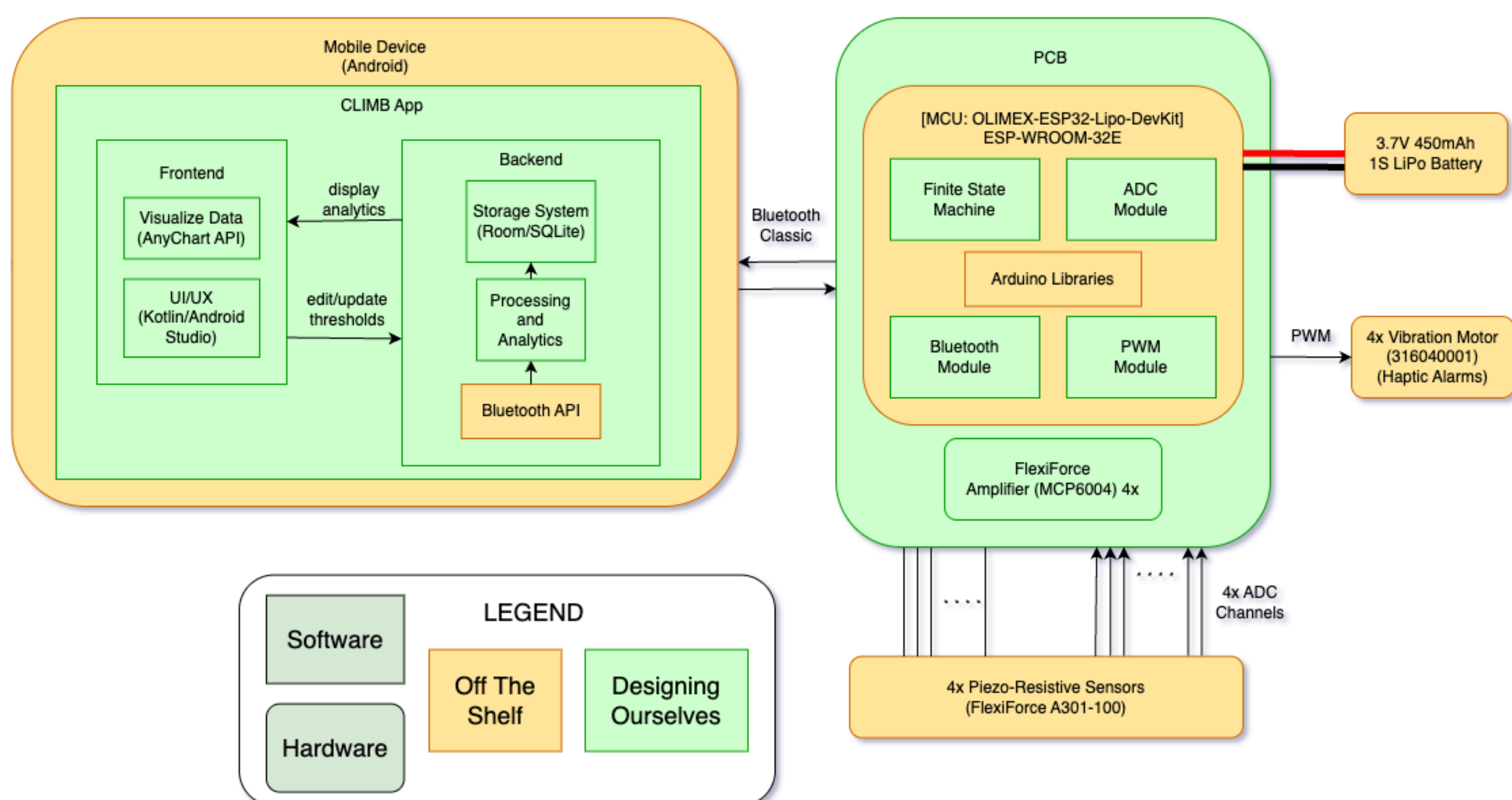


## Conclusions & Additional Information

### What worked
CLIMB offers a durable, unobtrusive system of assistive features for rehab/training of climbers: real-time pulley monitoring, pulley-risk indication via haptics, wireless, battery-powered use, and workout tracking/analysis via a robust, intuitive user interface (CLIMB app).

### Lessons Learned
(1) Design modularization and task assignment via skill-maturity is vital in achieving parallelization, managing progress effectively, and improving collaboration.
(2) Users are unpredictable! Identifying risk and implementing safe states and redundancy in our system to avoid catastrophe was critical.

### Room for Improvement
Account for sharper rocks via an environment specification feature on app.
Add positional sensors to account for pose.
Adding suggestive and social app features.

https://course.ece.cmu.edu/~ece500/projects/f24-teamc1/
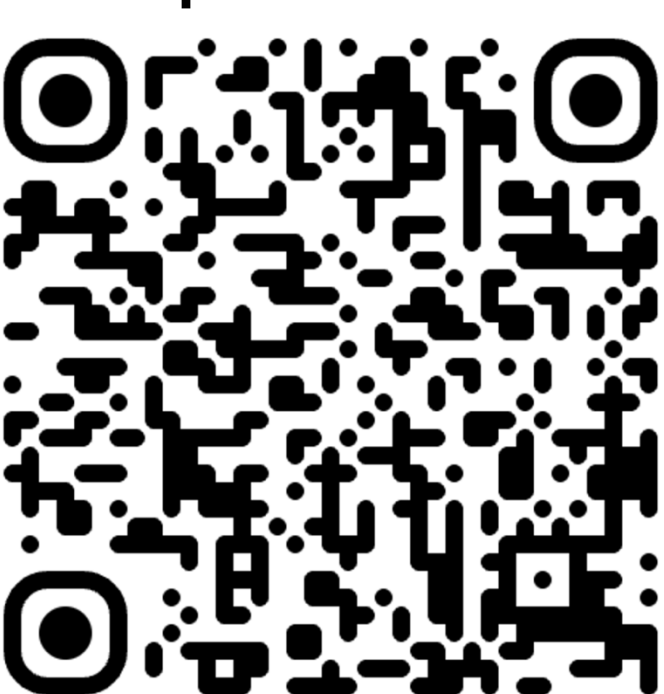
## System Description

### CLIMB Glove
This component acts mainly as the data-collection layer of the design by procuring force readings over an interval of time and shipping them to the processing layer. The secondary operation of this component is to drive a haptic alarm upon the encroachment of *dangerous* force-reading levels on a particular pulley.

### User Interface
The mobile application describes the obtained force readings analytically. Users can set pulley force thresholds, begin a workout, and analyze previous workout sessions.

### Tracking Data
A lightweight, reliable database management system, SQLite, is used to store and query user data.
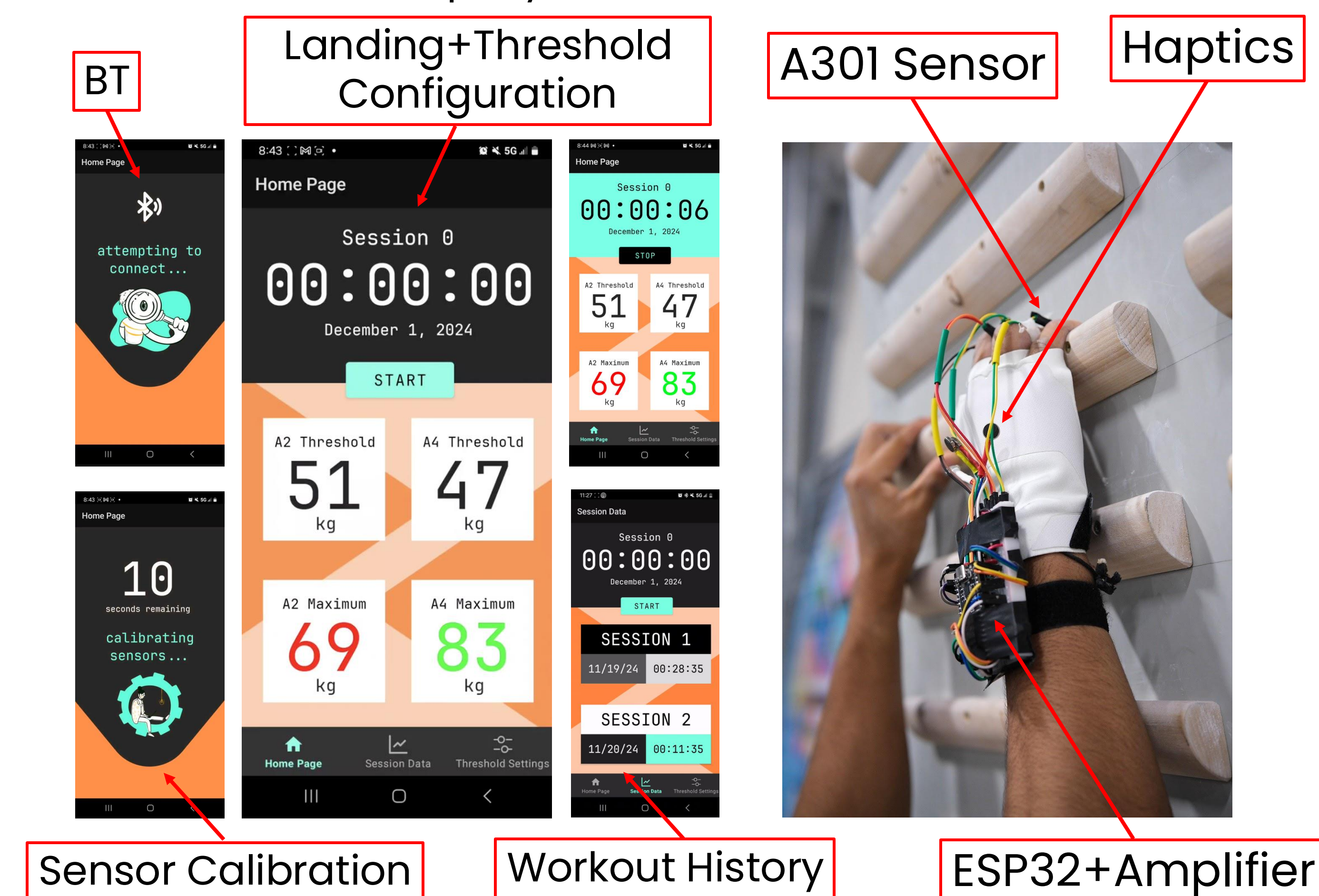


## System Evaluation

### Use-Case Requirements:

| Metric | Target | Actual |
|---|---|---|
| Surface Coverage | < 30% | 24.5% |
| Alarm Fire | ≤ 200ms | 100ms |
| Measurement Accuracy | > 95% | 97% |
| Workout Visualization | < 10s | 8s |

### Design Requirements:

| Metric | Target | Actual |
|---|---|---|
| Battery Life | ≥ 3 hours | 3 hours |
| Reading Consistency | < 5% error | 3% error |
| Data Shipment | < 5s | 3s |
| Usage Distance | > 10ft | Inf. |

### Embedded Design Tradeoff Factors:
- BT Support
- Performance
- Size & Weight
- Peripherals

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