Racket Sport Training Device

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Introduction

Racket sports, such as tennis and pickleball, have become increasingly popular in recent years. Many amateurs want ways to **improve their skills**, but existing options are expensive. We developed a **cost-effective** system that monitors a user's swing data and provides relevant feedback that helps the user make note of mistakes and sharpen their mechanics. The straightforward layout of the app makes for a **user-friendly** experience.
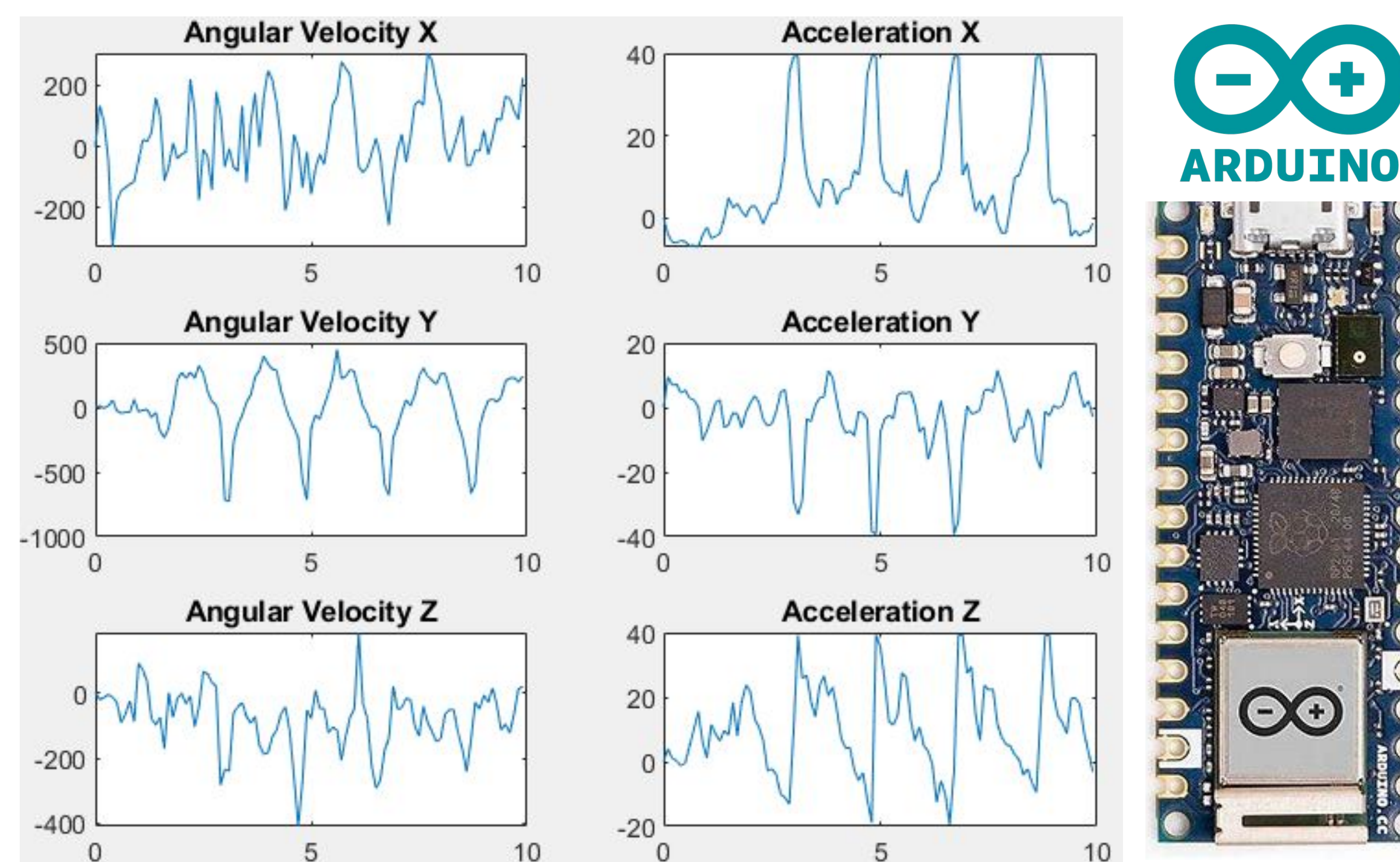
Data Managing

Data is saved if the acceleration at that instant exceeds 30 m/s^2. If two instances of data occur within one second of each other, they are registered as the same swing.
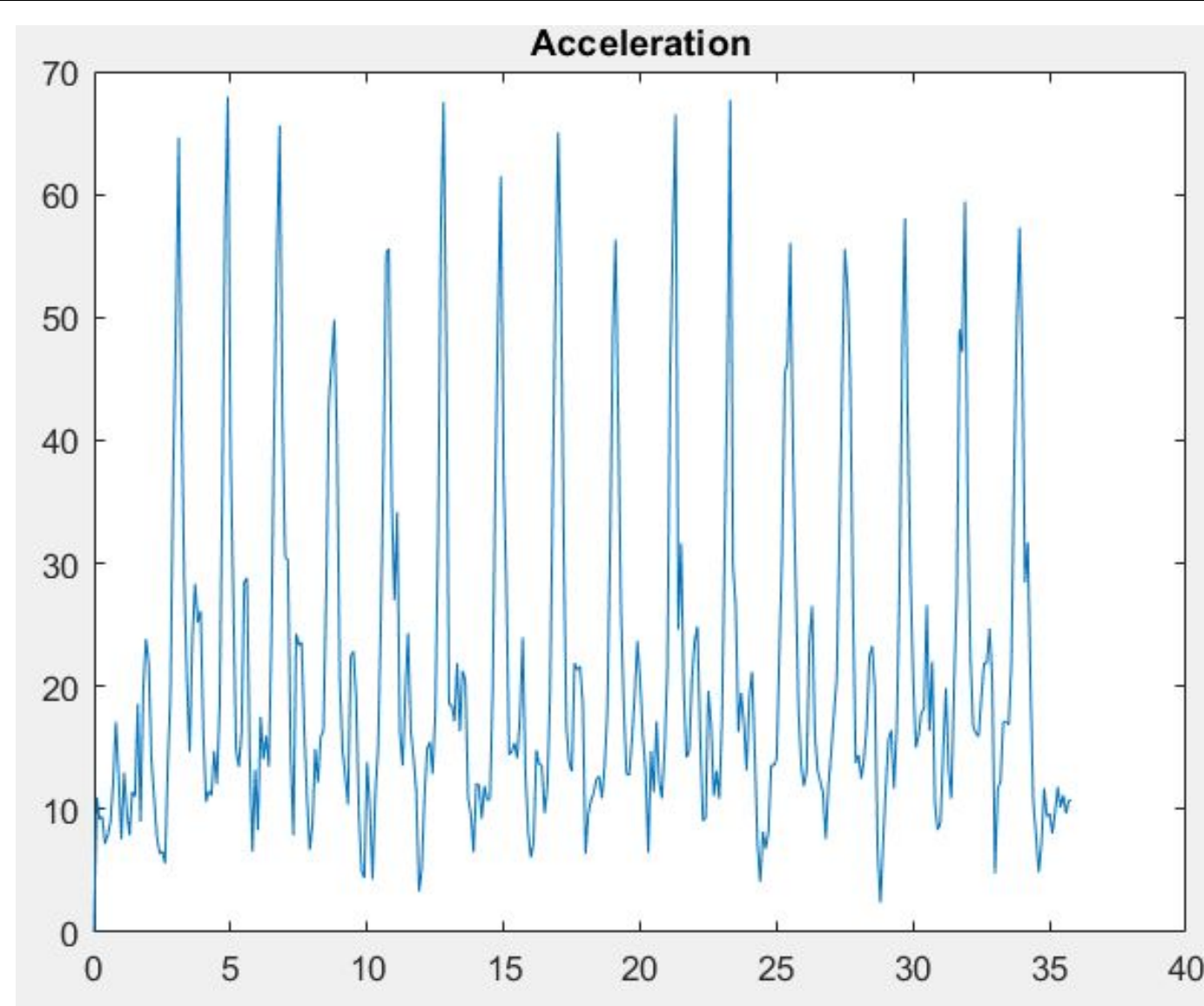
Acceleration

Hardware Overview

- Arduino Nano RP2040 Connect
  - LSM6DSOX Inertial Measurement Unit
    - Reads acceleration and angular velocity values of the board in the x, y, and z directions
  - Nina W102 Wi-Fi/Bluetooth Module
- 21700 Rechargeable Li-ion Battery – 3.6V, 5000mAh
- MH-CD42 Charge and Discharge Module
  - 5V Input/Output, 2.4A charging, 3.5A discharging

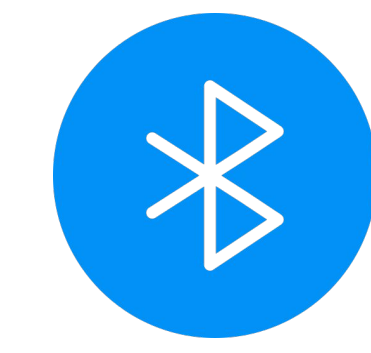Angular Velocity X, Acceleration X, Angular Velocity Y, Acceleration Y, Angular Velocity Z, Acceleration Z

Software Overview

Arduino – C/C++
- Initialize IMU and BLE module
- Read IMU data and send via BLE every 100ms
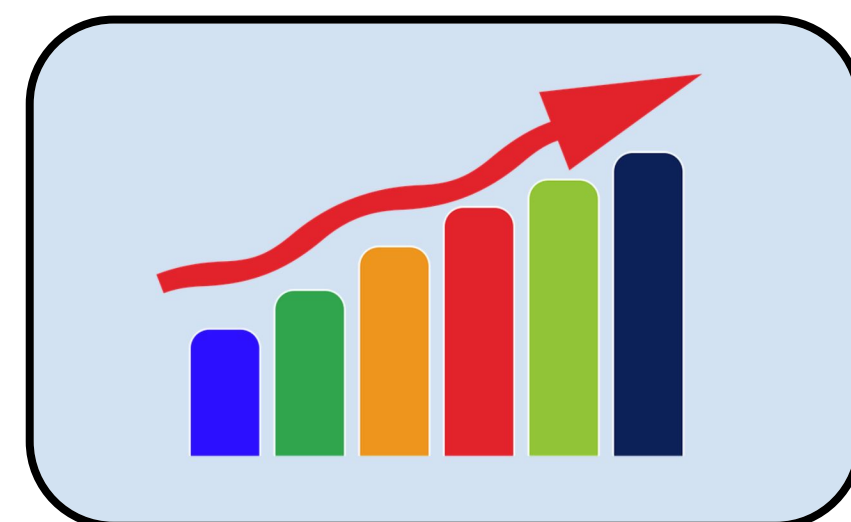
Android – Kotlin
- Bluetooth Manager
  - Automatically connect to Arduino
  - Read packages from BLE GATT Server
- Data Managing and Algorithms
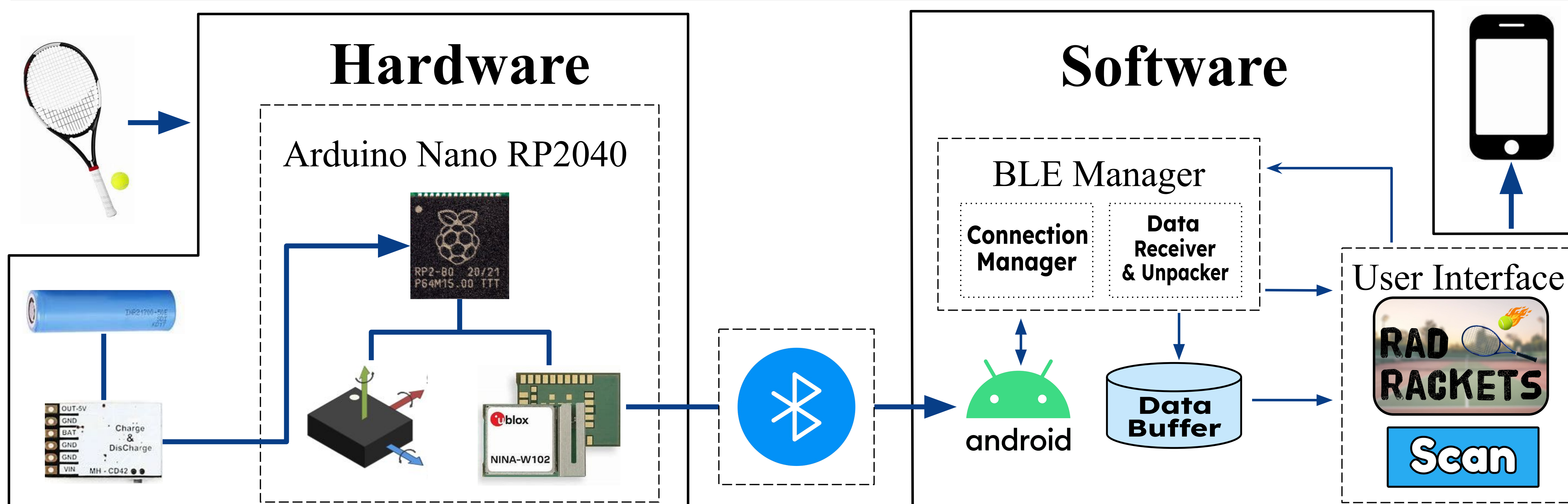- User Interface

Results

App is able to show user:
- Avg. acceleration
- Avg. angular velocity
- Avg. linear velocity
- Maximum linear velocity
- Linear position change
- Avg. angular acceleration
- Swing advice

View Data

Future Improvements

- Implementation of method deriving orientation
- Addition of more detailed advice by comparing user's swing to sample of ideal swings
- Detection of swing types (serve, backhand, etc.)

Acknowledgements

System Architecture

Hardware

Arduino Nano RP2040

Software

BLE Manager

Connection Manager | Data Receiver & Unpacker

User Interface

RAD RACKETS
Scan

Data Buffer

android