# LyftSync

## Lift Harder, Not Smarter

Omar Nayfeh

# Introduction

**Goal**

Design an IOT system that allows the user to select weightlifting goals and send live haptic feedback to allow the user to keep track of rep and count, rest time, and rep speed to optimize performance.

**Motivation Behind the Project**

- Whether new to the gym or a veteran, it is extremely helpful to be reminded of proper form, rep/set frequency and rest time.
- Smartwatches such as fitbits are great for post-analysis, but don't give any live feedback.
- The use of haptic feedback could benefit those with impairments, especially in noisy public environments

**Task Breakdown**

- Identify and acquire needed sensor(s)
- Write an arduino code on the Feather that can output accelerometer data that can be read by the Pi
- Create a flask API that allows the user to communicate with the Pi
- Write a python code on the Pi that takes in the user API data, collects the arduino data from the Feather, logs rep/set count and sends back a signal to the feather to buzz the motor
- Prototype a wrist band to carry the battery, feather, accelerometer, etc.

**Hardware**

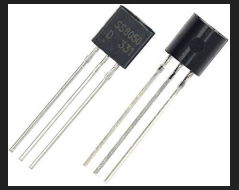
Raspberry Pi 4
Model B

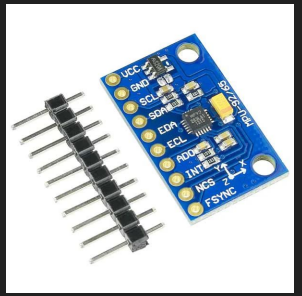
Adafruit Feather nRF52 Bluefruit LE
Model: Adafruit 3406

InvenSense MPU
Model: 9250

DIANN Mini Vibration Motor

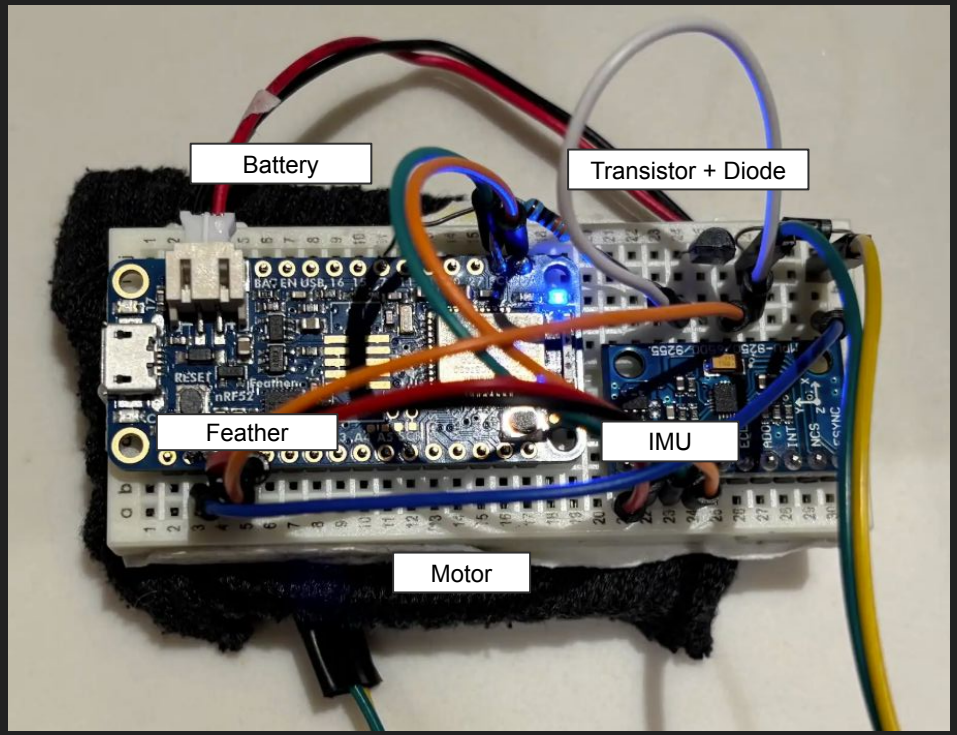
NPN Transistor
Model: S8050



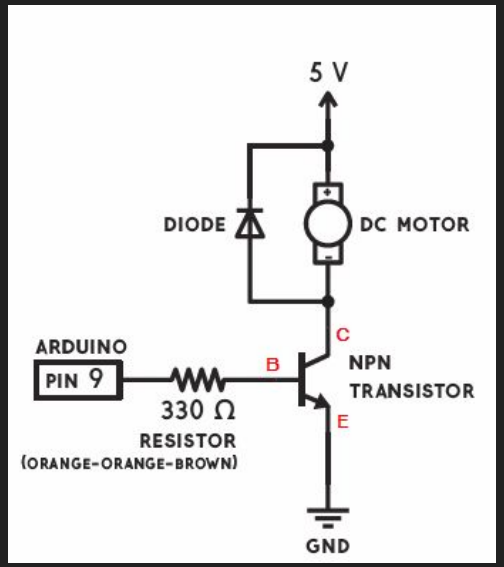



# Design

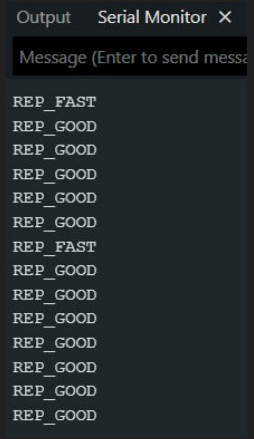
Prototype Wristband



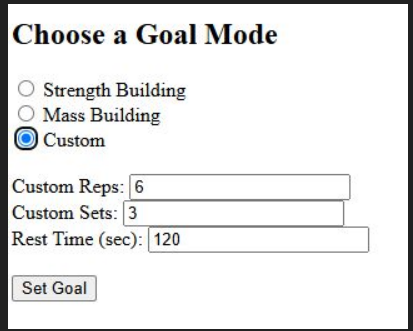

Transistor Wiring

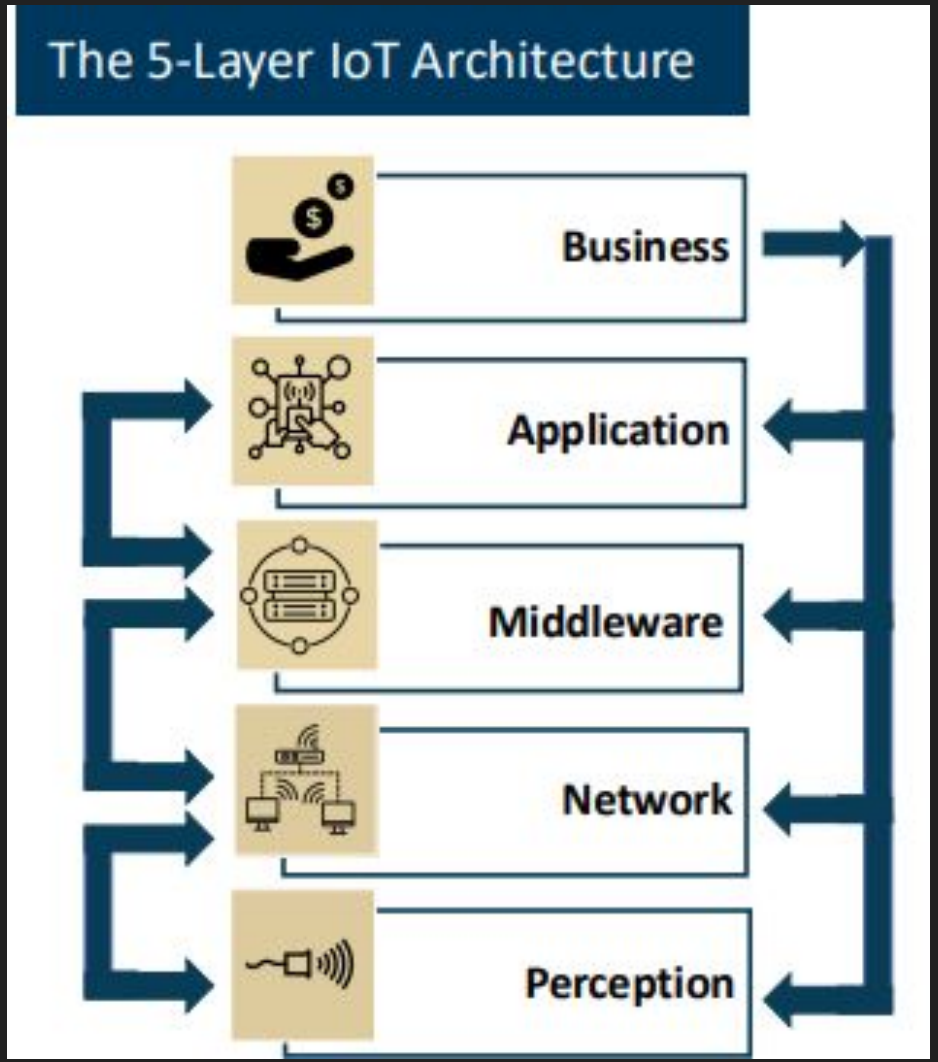



Feather Arduino Output




Flask API






**5.** Product could keep track of user goals/performance. Enable sharing of goals/results, allow for subscription features for more elaborate coaching/routines

**4.** Flask API allows for user input through configuring set count, rep count, rest time (or selecting preconfigured settings

**3.** Pi processes incoming data from Feather and stores data to track reps, sets, and rest time

**2.** Rep data (count and speed) is transferred from Feather to Pi via bluetooth

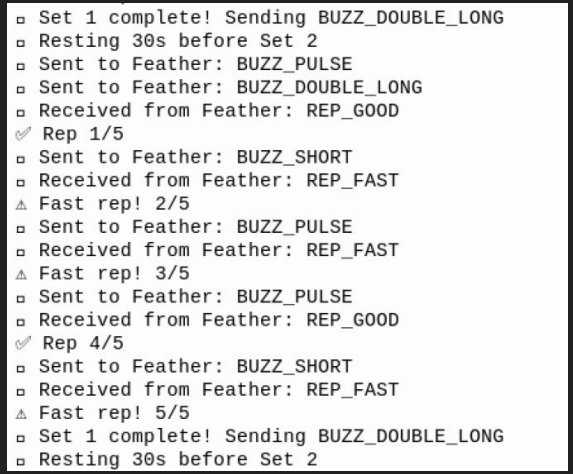
**1.** MPU-9250 IMU detects acceleration from physical movement, motor gives haptic feedback

# Results and Conclusions

The edgecompute was primarily implemented  on feather, which was connected to the IMU. It utilized an arduino code to detect and decipher accelerometer data specific to the actual lift (in this case, is a basic curl motion). All that is needed to be sent to the Pi is “REP_GOOD” or “REP FAST”.

On the other side, the Pi works to keep track of the reps, organizing them into sets, then sending the Feather feedback on vibration frequency based on the counters and timers implemented in the python code.

The system worked flawlessly- from inputting the user information all the way to the live haptic feedback. As expected, the accelerometer data tended to jump a small amount, but not enough to be particularly noticeable. There was surprisingly little lag given bluetooth and the back and forth data transfer




References

**[1]** K. Bulusu, *MAE 6291: Internet of Things for Engineers – Week 6 Lecture Notes*, Mechanical and Aerospace Engineering Department, The George Washington University, Washington, D.C., Feb. 26, 2025. [Online].
**[2]** B. Huang, “Driving Motors with Arduino,” SparkFun Electronics, 2025. [Online]. Available: https://learn.sparkfun.com/tutorials/driving-motors-with-arduino/all
**[3]** Outwork Nutrition, “Dumbbells vs Barbells for Building Muscle and Strength,” *Outwork Nutrition Blog*, 2025. [Online]. Available: https://outworknutrition.com/blogs/learn/dumbbells-vs-barbells-for-building-muscle-and-strength

# Demo