

Object Track Matrix

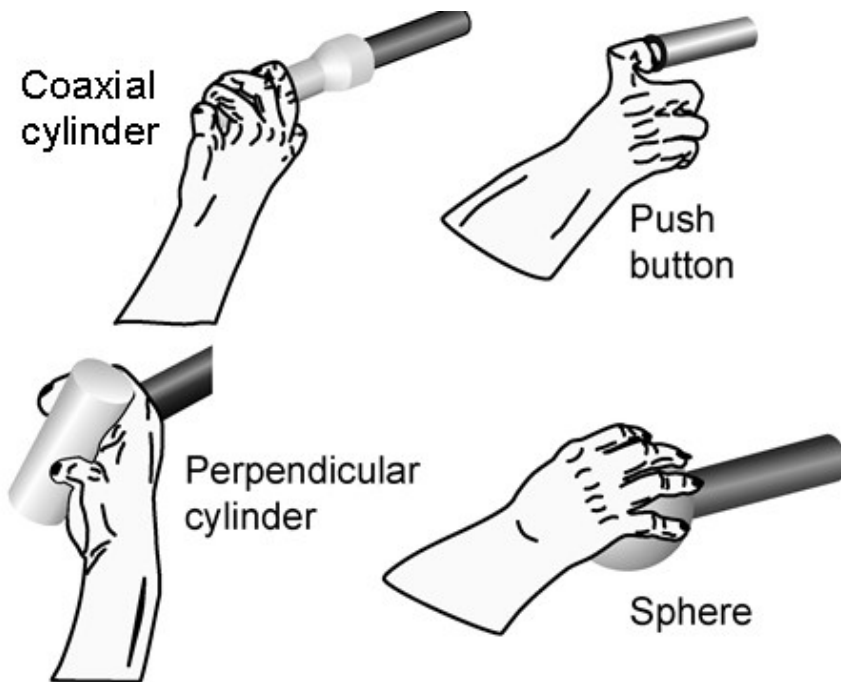
EPHSX 601
Spring 2023

KU

OVERVIEW

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Project Overview
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Back Ground



- ▶ **Dr. Adam Rouse:** Professor of Neurosurgery at the University of Kansas Medical Center
- ▶ Research Into Reaching & Grasping



Project Description: Object track matrix:

A puzzle with objects on it is set up for a monkey to play with.

Objects are held on rods and there is a light system that can light each object on.

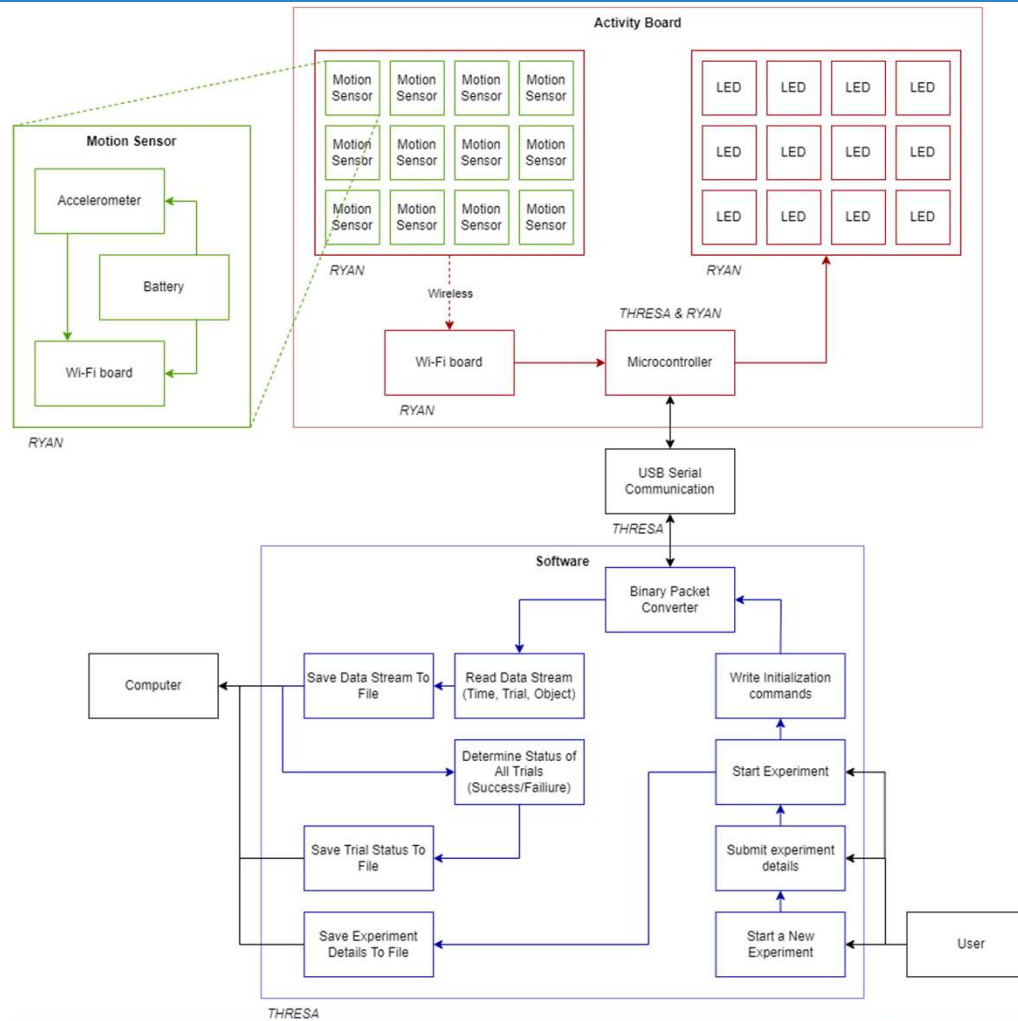
Motion Detection System

Interaction information must be stored so it can be compared with the neural information obtained from the monkey.

System Requirements



- ▶ Controllable Object Lighting
- ▶ 3 x 4 grid of 12 objects (in about an 18 x 12 inch workspace)
- ▶ Preferred to be used flat on a table top
- ▶ Flexibility to be able to vary the size and shape of the objects as well as potentially color, weight, and texture.
- ▶ The objects need to be anchored to a rod or support, so they stay at a fixed location.
 - ▶ Design should allow for future flexibility with freely movable objects.
- ▶ Should allow for easy cleaning.
- ▶ Creation of a task software to control what object is instructed and then determine if the correct object was manipulated.



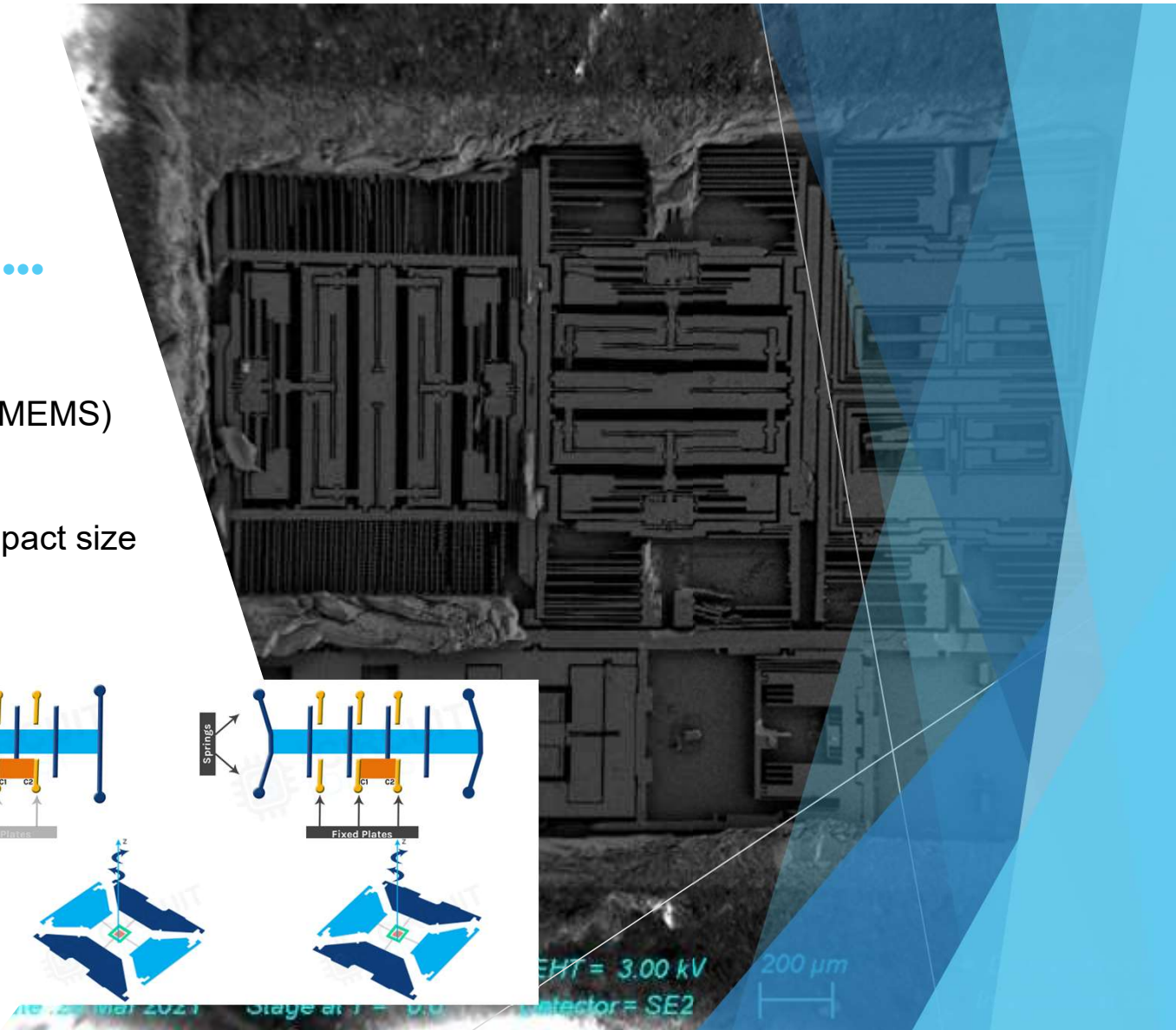
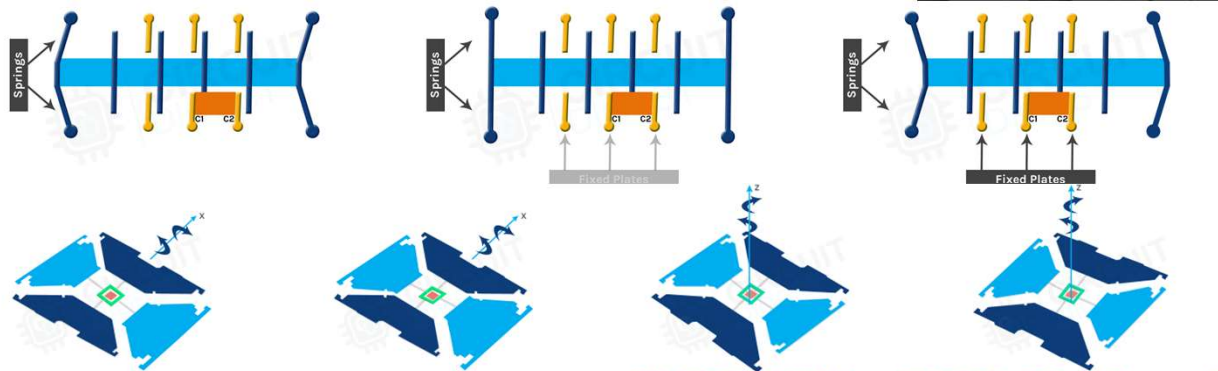
Object Track Matrix: Data Flow



MPU 6050

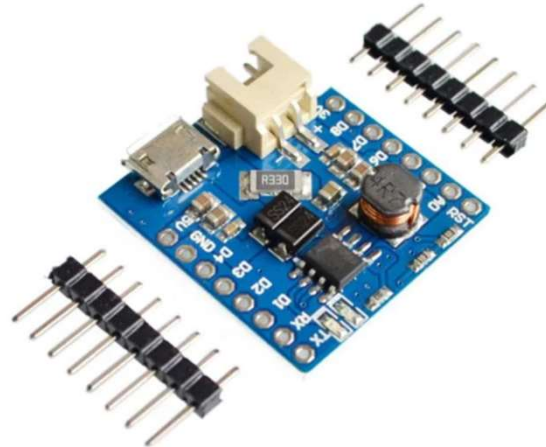
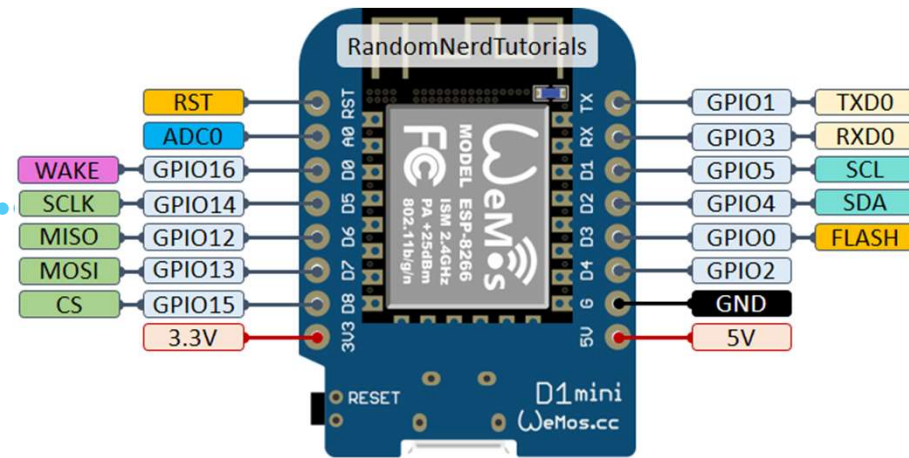


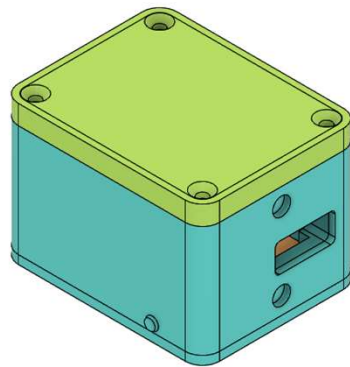
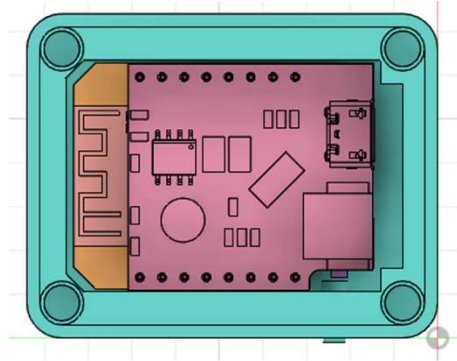
- Is a micro-electromechanical systems (MEMS)
 - 3-axis gyroscope
 - 3-axis accelerometer
- Low cost, low power consumption, compact size
- Interfaces with I2C



D1 Mini

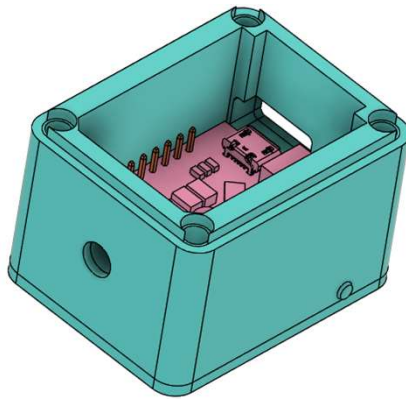
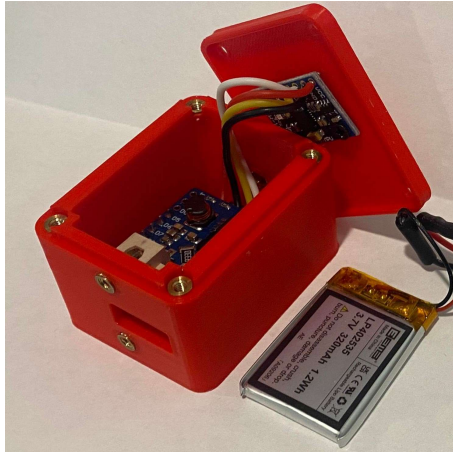
- ▶ The WeMos D1 mini is a Wifi microcontroller development board.
- ▶ Biased on the ESP8266
- ▶ Compatible with the Arduino IDE
- ▶ Utilized in a lot of DIY Internet of Things projects
- ▶ Lots of compatible shields



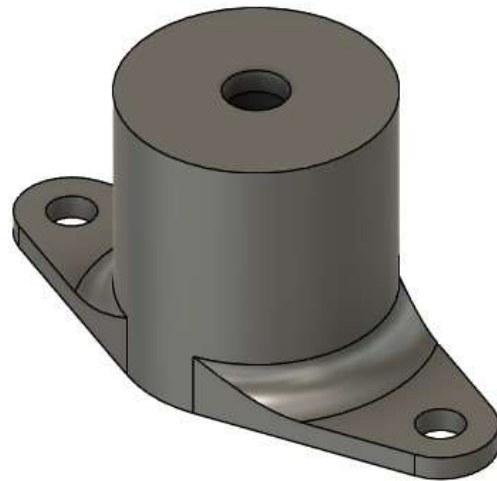
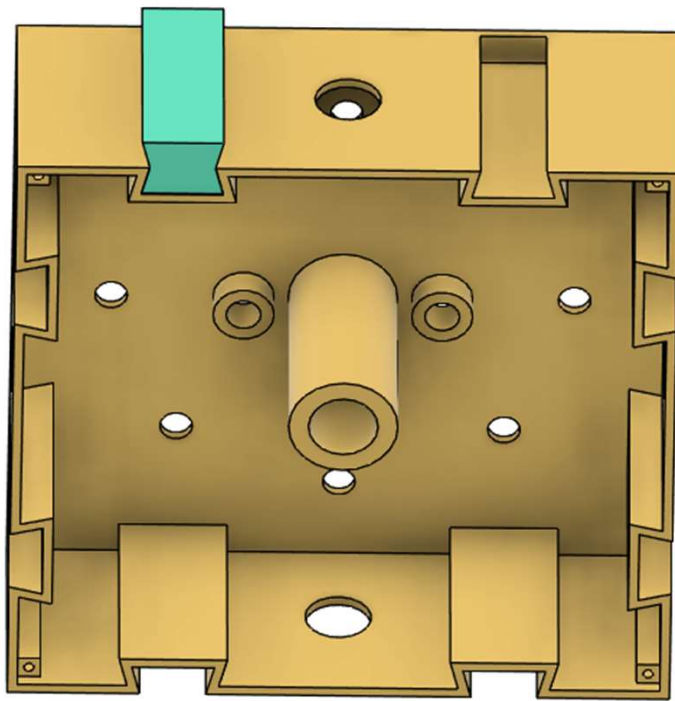


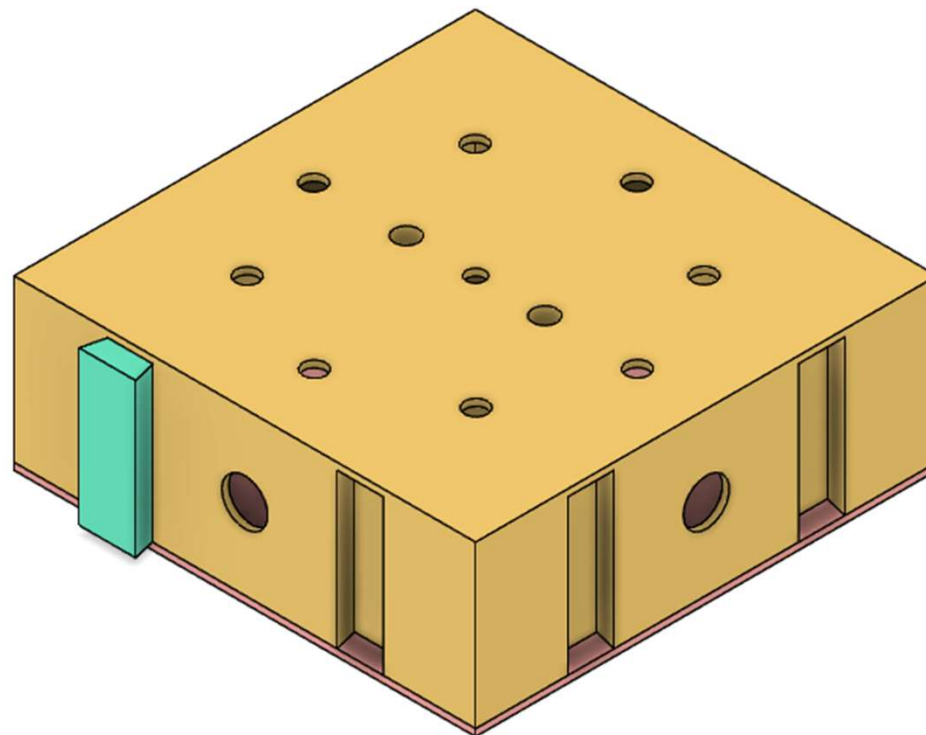
Sensor Case

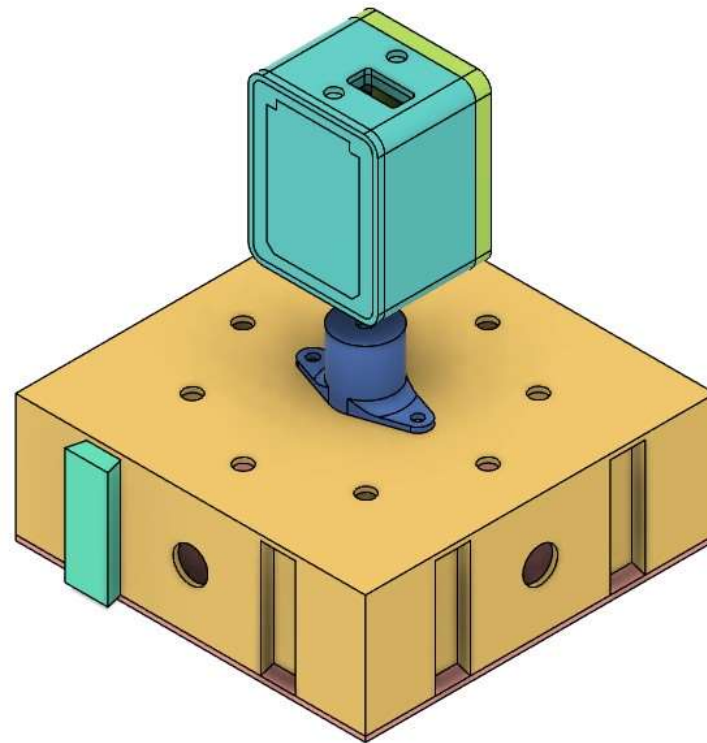
- ▶ Battery 320 mAh LiPo
- ▶ Approx. 3 hr Battery Life



Rod Attachment







ESP-NOW



- ▶ ESP-Now is a wireless communication protocol for fast and reliable communication between ESP32 and ESP8266 microcontrollers without the need for Wi-Fi or Bluetooth.
- ▶ It operates on the 2.4 GHz band and uses a simple, lightweight protocol that is ideal for low-power applications.
- ▶ ESP-Now is designed for
 - ▶ low latency
 - ▶ high reliability
 - ▶ low power consumption

SetUp

MyData Struct

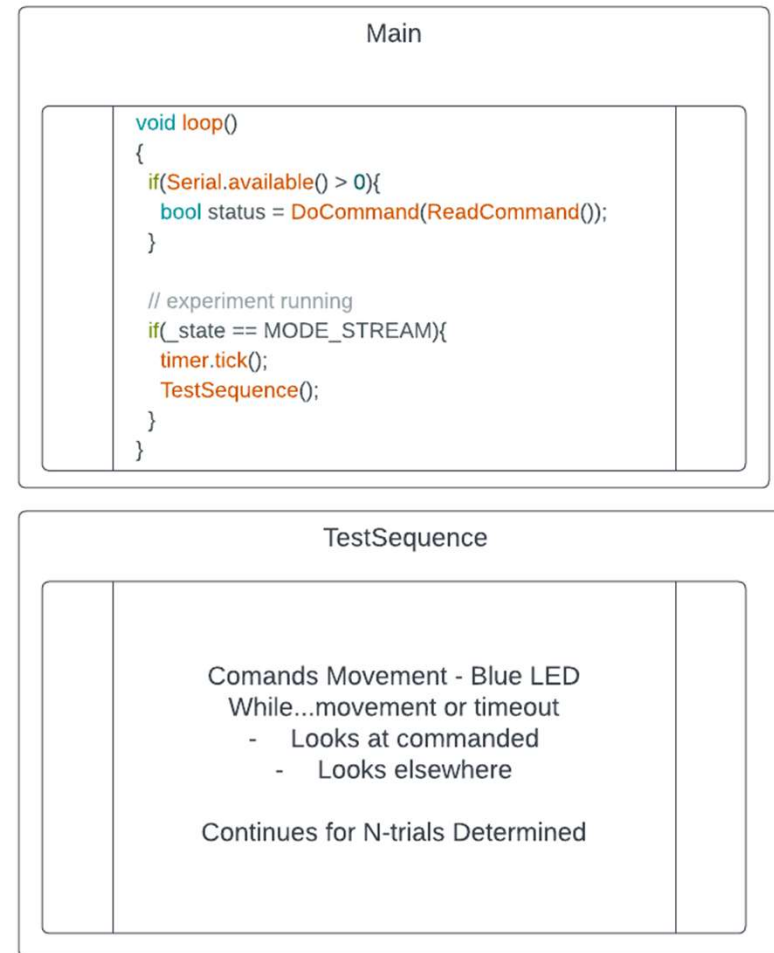
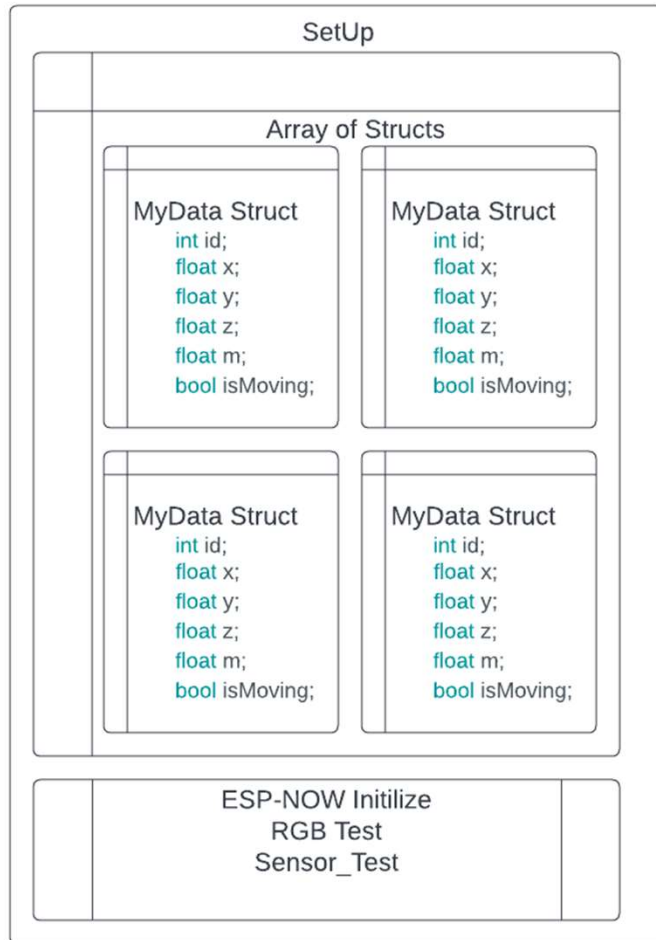
```
int id;  
float x;  
float y;  
float z;  
float m;  
bool isMoving;
```

```
ESP-NOW Initilize  
Set ID from MAC  
MPU-6050 Initilize  
MPU-6050 Calibrate  
Determine Threshold
```

Main

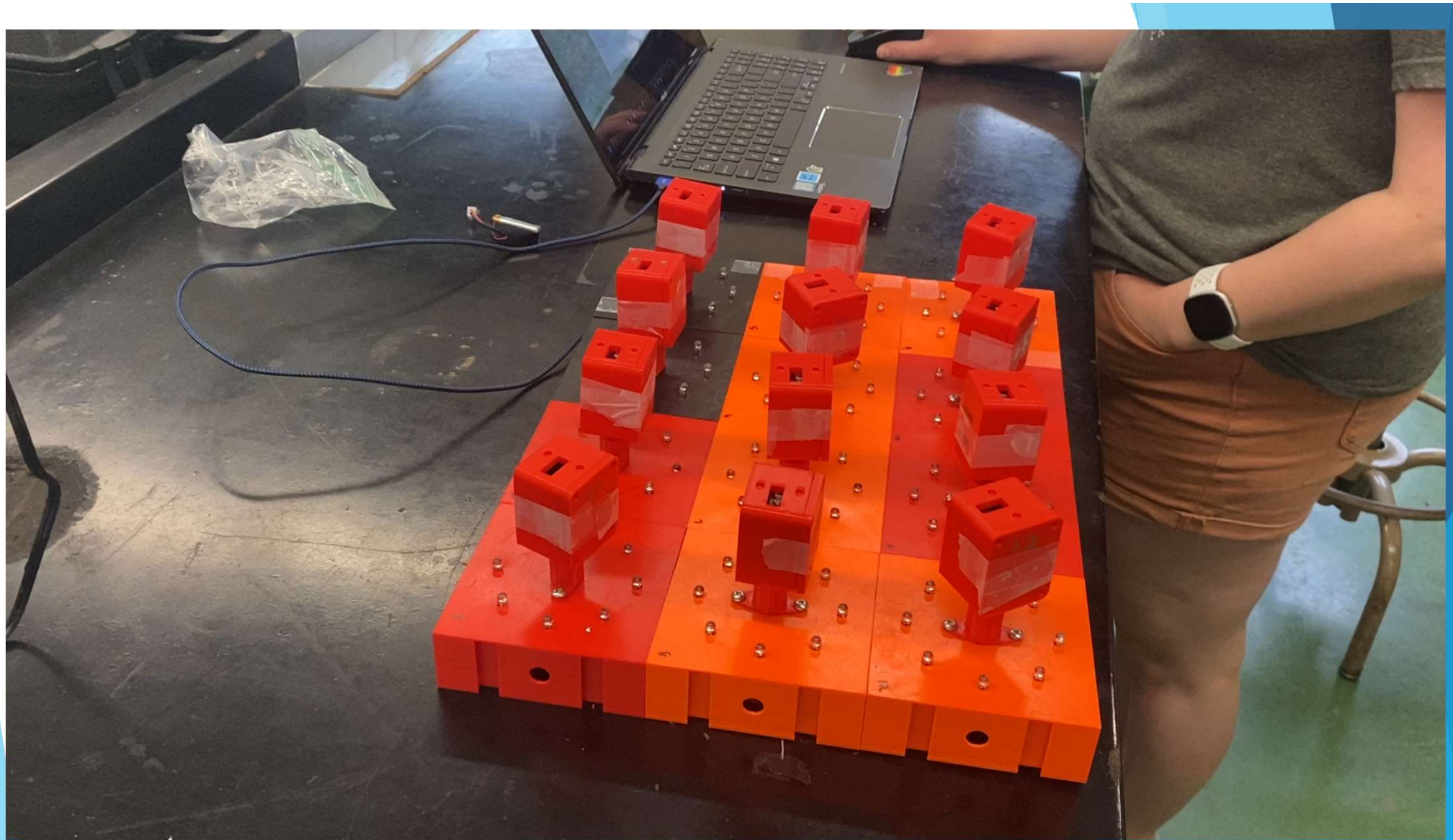
```
mpu.getEvent  
Compares to Threshold  
myData.isMoving = T/F
```

```
if (myData.isMoving != previousMovingState)  
{  
    esp_now_send(0, (uint8_t *) &myData, sizeof(myData));  
    previousMovingState = myData.isMoving;  
}
```





BACK UP DEMO



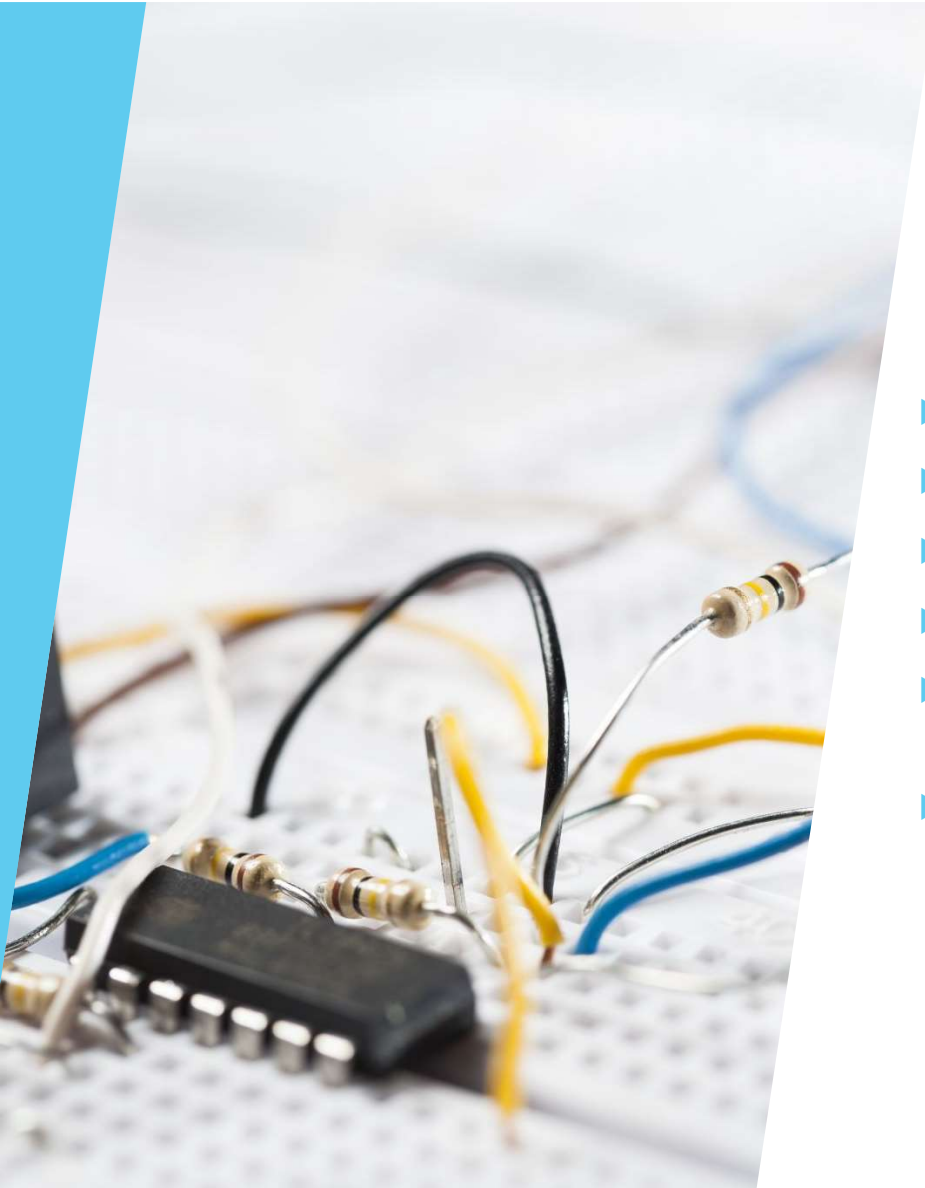
Fun With Accelerometers



chrome://flags

Experimental Web Platform features

https://adafruit.github.io/Adafruit_WebSerial_3DModelViewer/



Improvements

- ▶ ON/Off Switch
- ▶ Hard Mounting on perf board
- ▶ ESP-32
- ▶ Battery Monitoring System
- ▶ Flush Mounting Charging/Data Ports
- ▶ Run entire program over Wifi (Remove need for USB)

