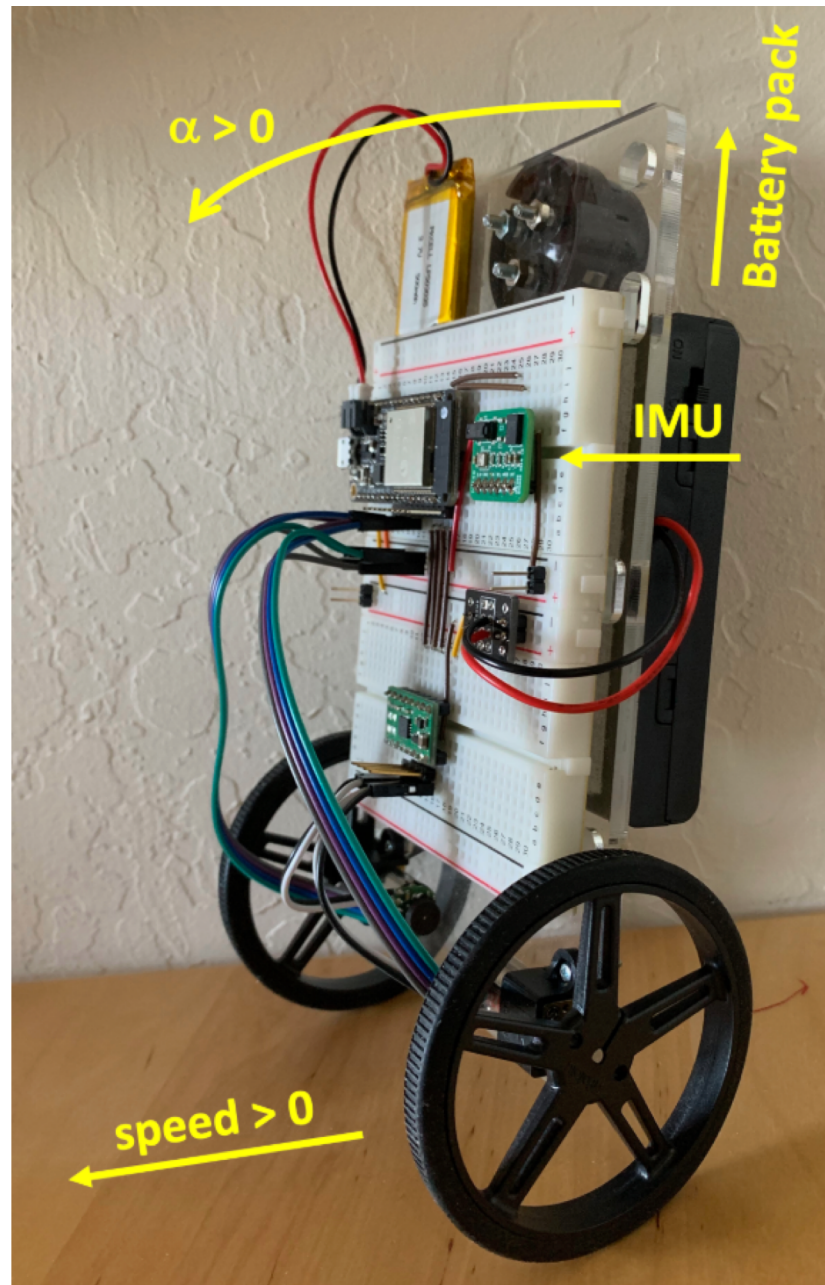


Electronics for IoT

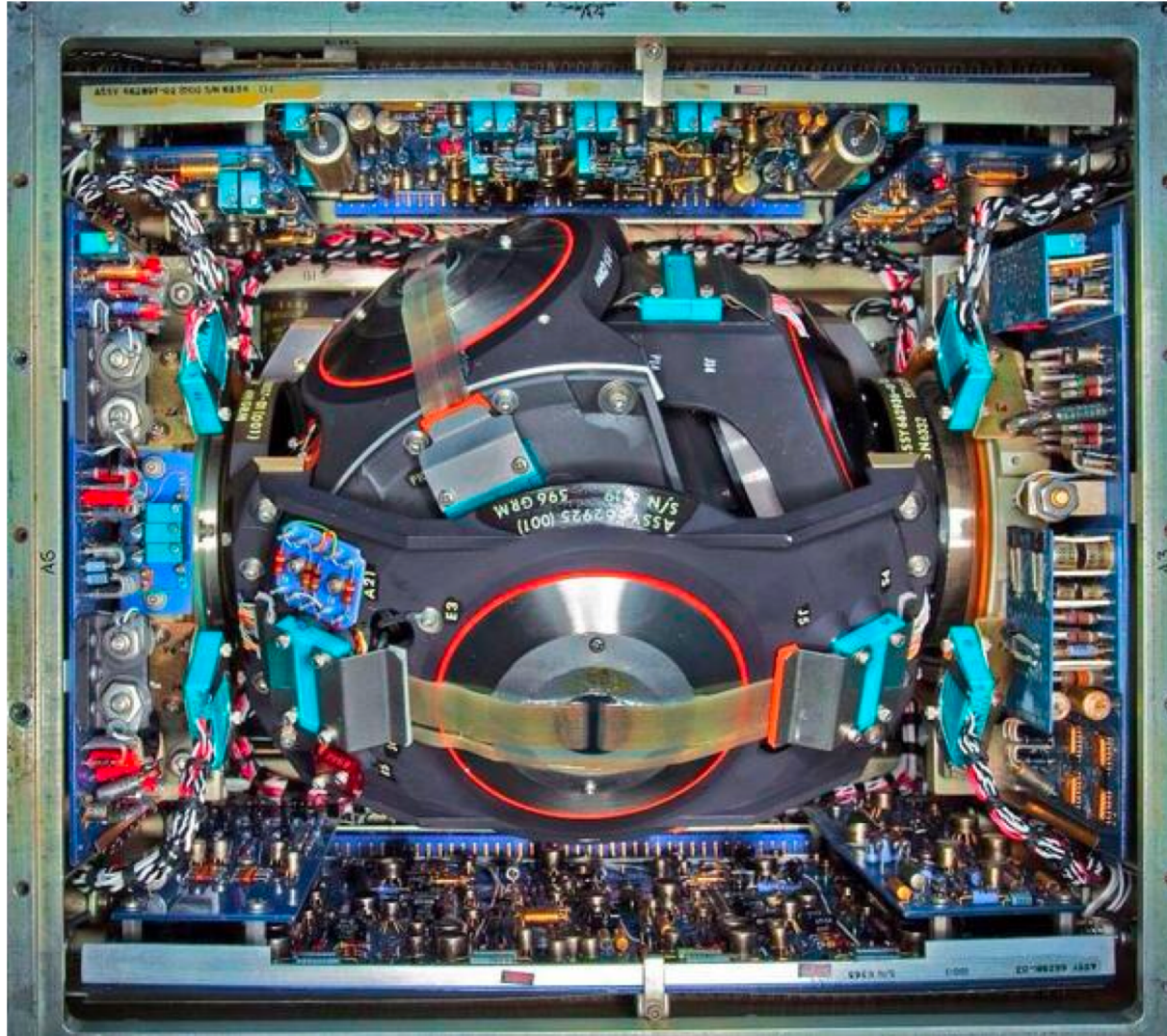
Inertial Measurement Unit

Bernhard E. Boser
University of California, Berkeley
boser@eecs.berkeley.edu

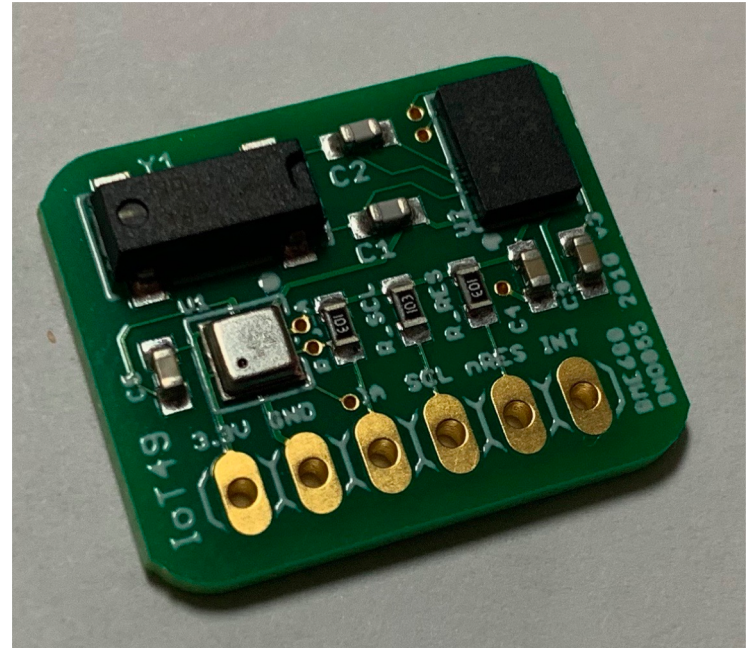
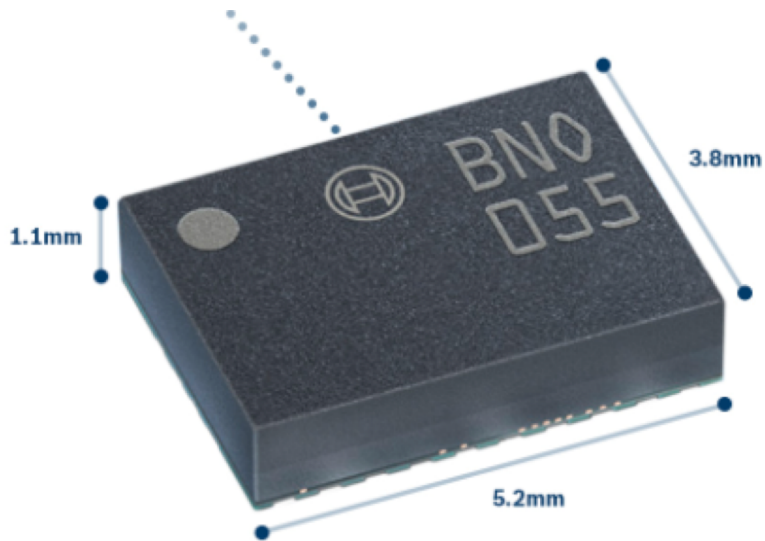


Inertial Measurement Unit (IMU)

IMU

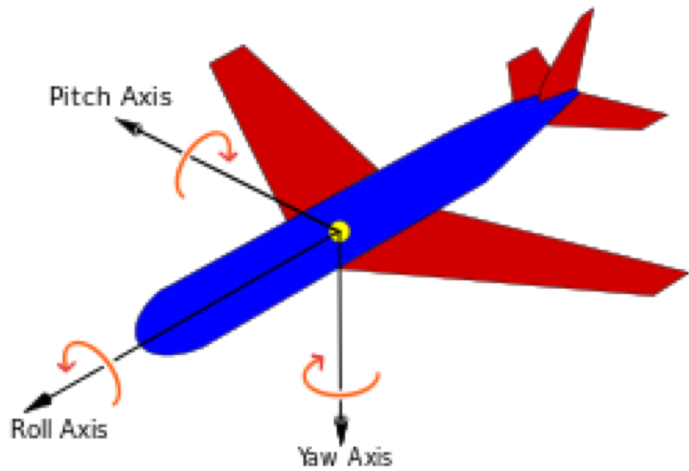


MEMS IMU

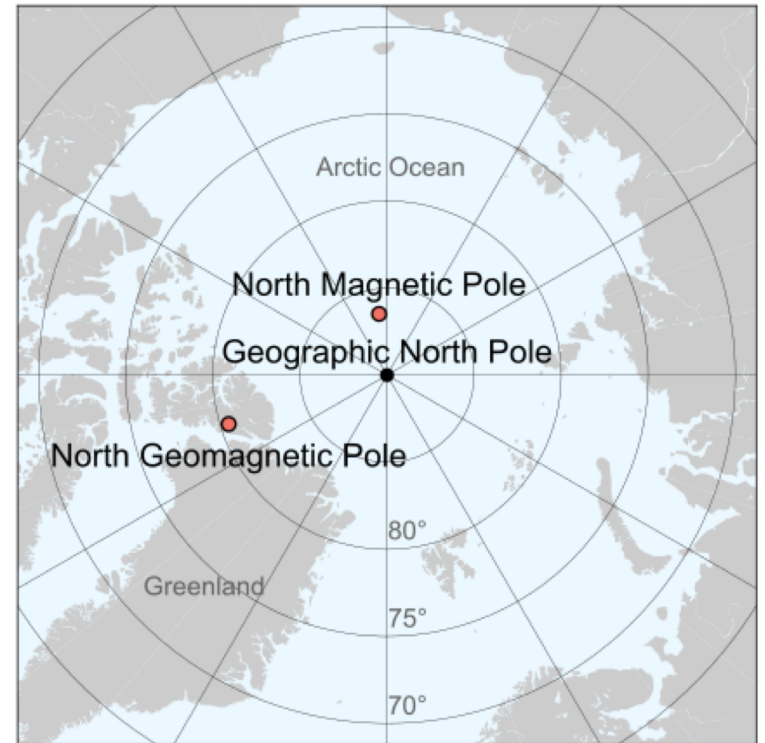


Accelerometer

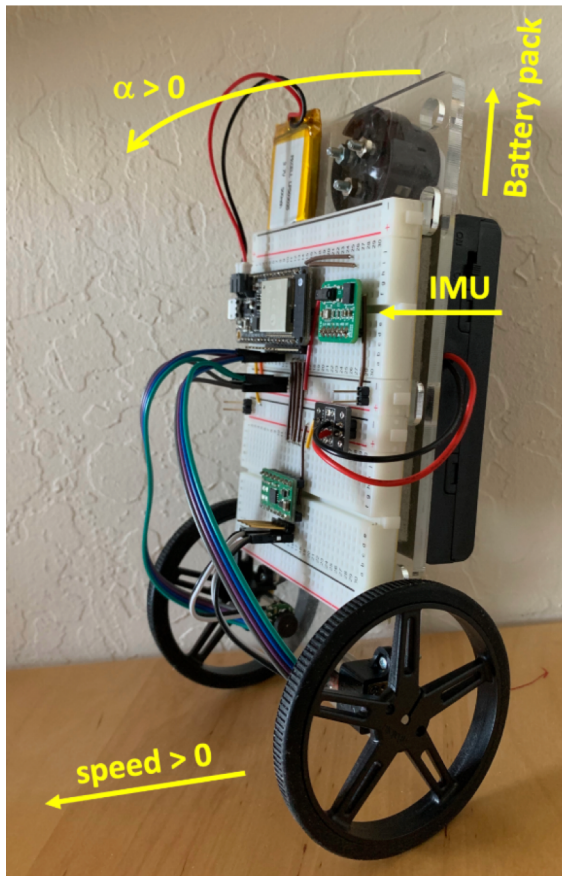
Gyroscope



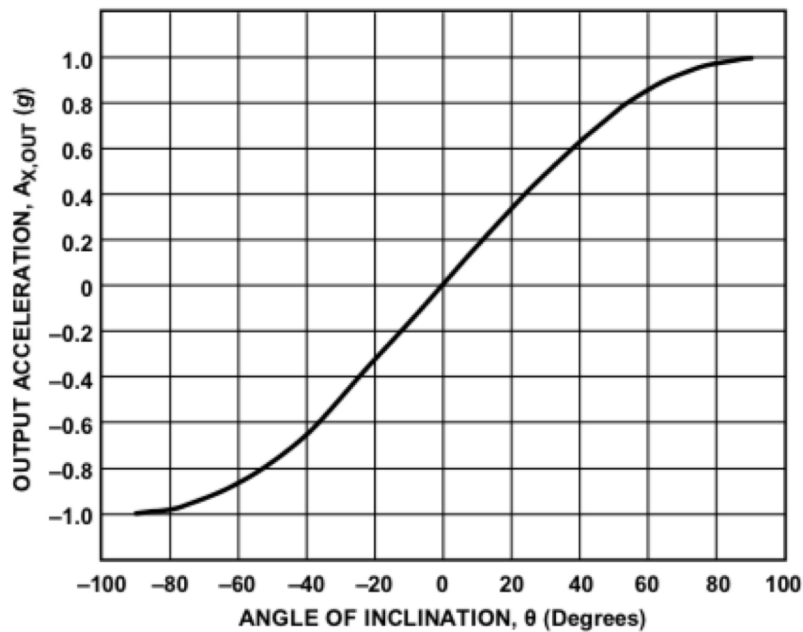
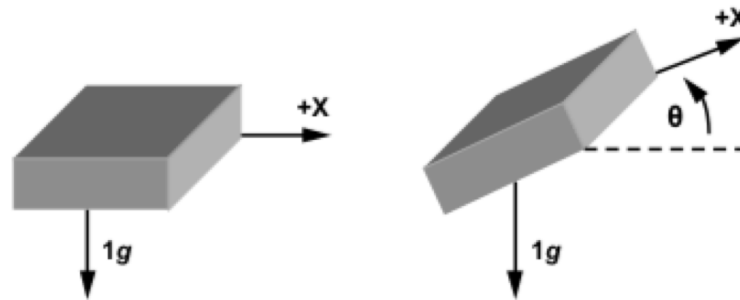
Magnetometer (Compass)



Inclinometer (Tilt)



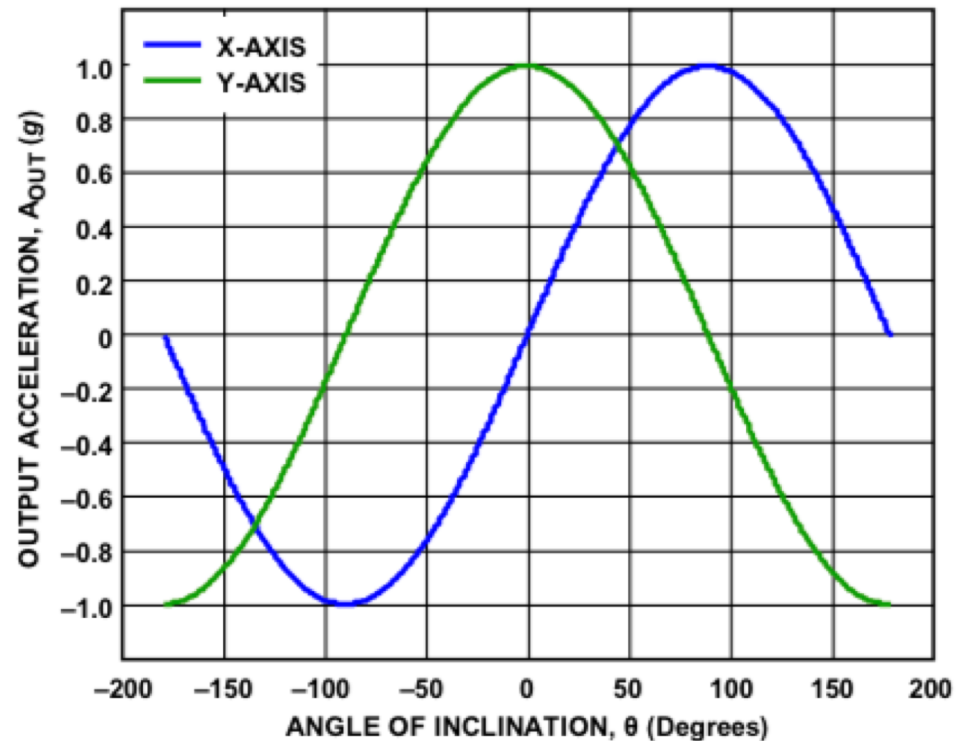
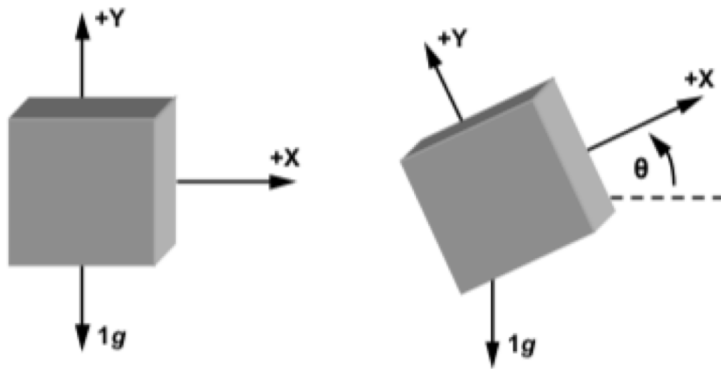
Inclinometer



$$A_{X,OUT} [g] = 1 g \times \sin(\theta)$$

<http://www.analog.com/media/en/technical-documentation/application-notes/AN-1057.pdf>

Dual Axis Tilt Sensor

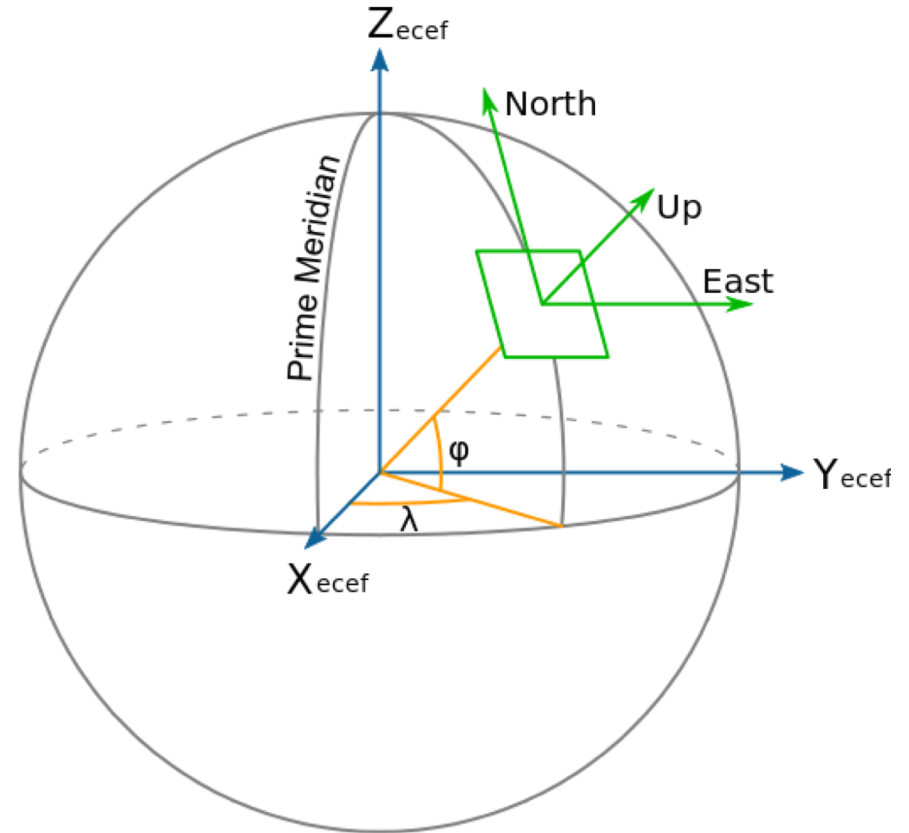
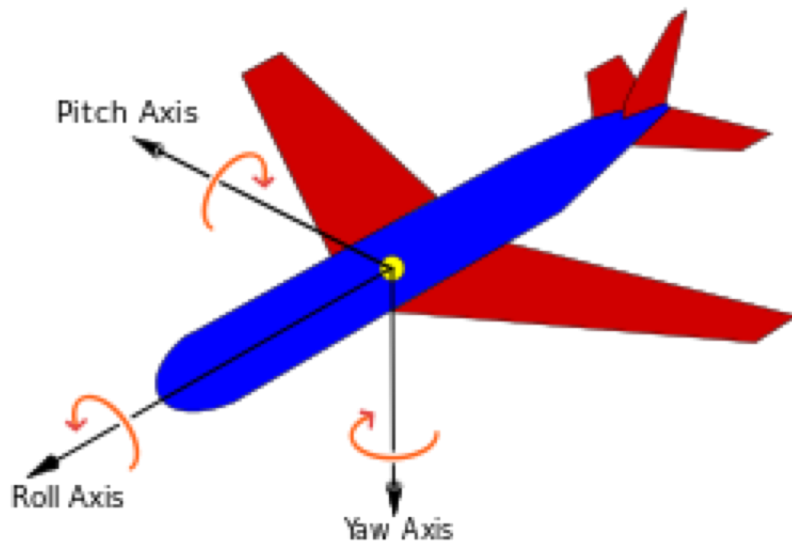


Disturbances

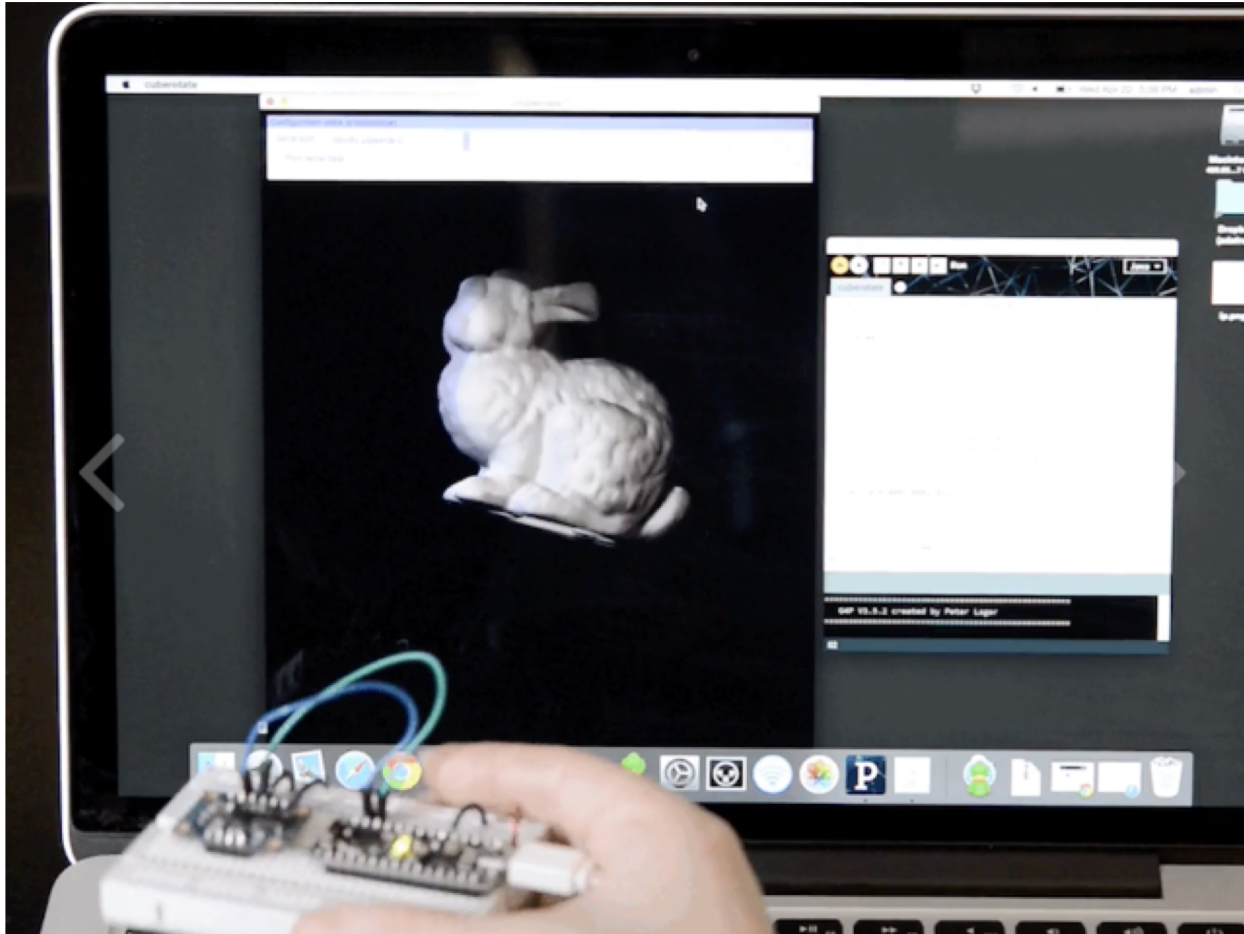
- Moving platform (e.g. quadcopter)
 - Additional sources of acceleration
 - Not just gravity
 - → Incorrect tilt calculation

Complementary Filter

Navigation Coordinates



Attitude and Heading Reference System (AHRS)



<https://www.adafruit.com/product/2472>

BNO055 Python Driver

```
import bno055

i2c = ...

imu = bno055.BNO055(i2c)

print(imu.accelerometer())

print(imu.gyroscope())

print(imu.magnetometer())

print(imu.euler())
```