

Introduction to Android Accelerometer Sensor

CS 436 Software Development on Mobile

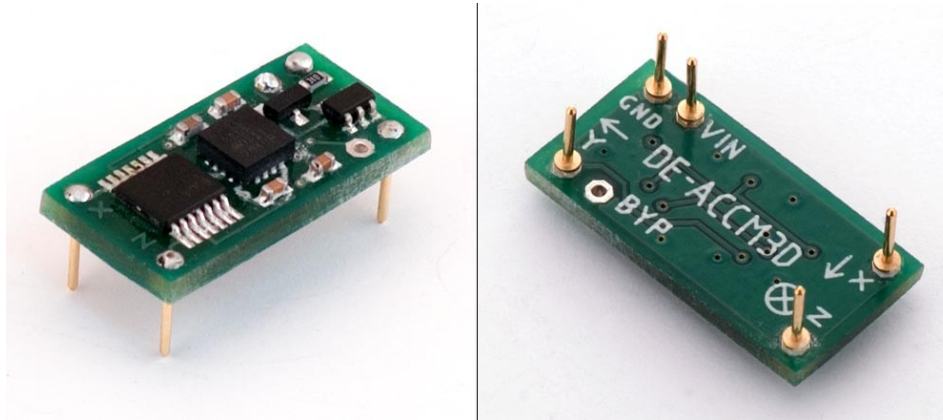
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Accelerometer sensor

- Measure Acceleration forces
- Static force and Dynamic force
- Measure Linear acceleration in X, Y, Z



Accelerometer sensor

What is acceleration forces

Newton's second law

$$F = m \frac{dv}{dt}$$

$$F = ma$$



How Accelerometer work

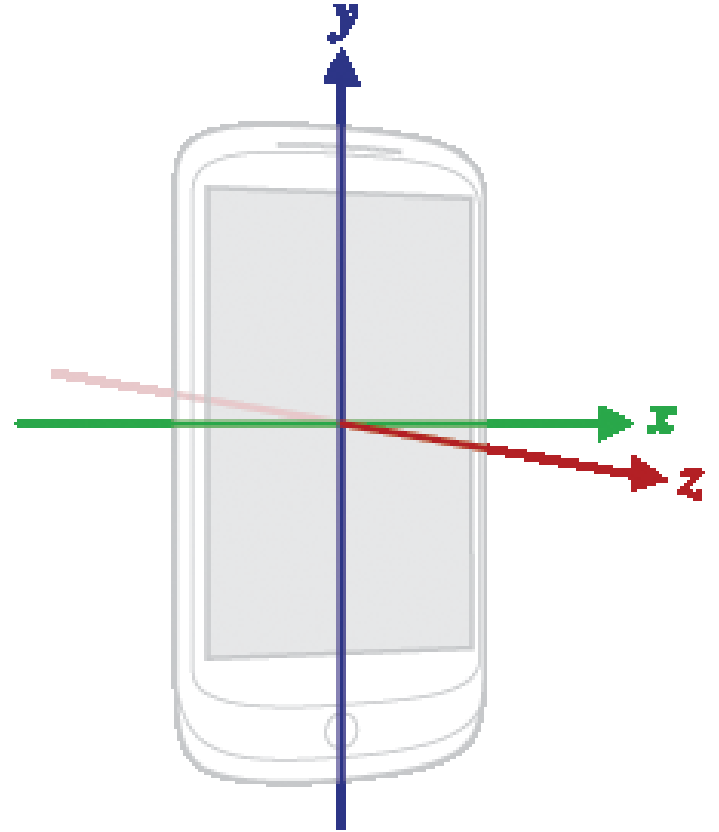
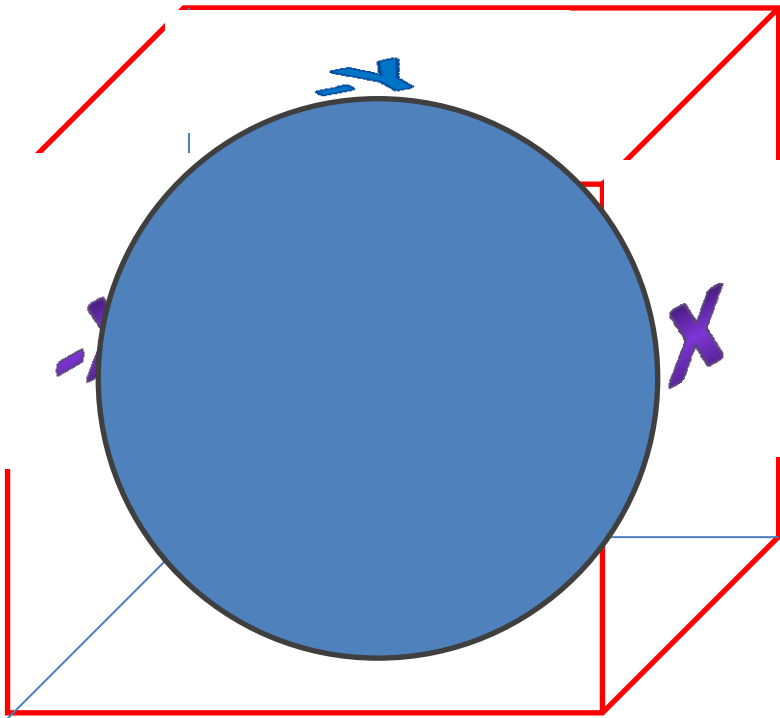


$$F=mg$$

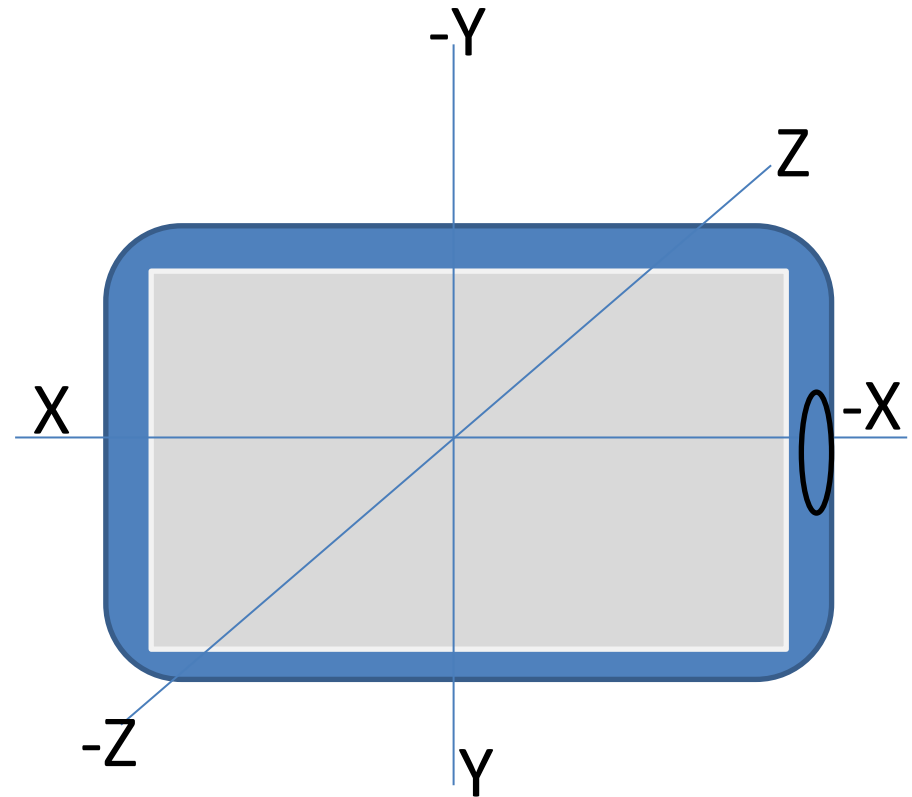
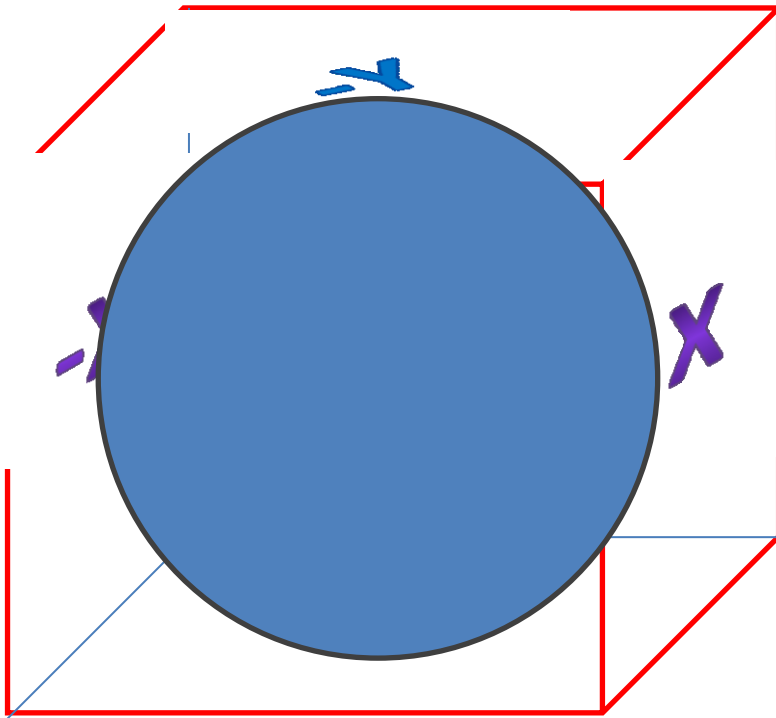


$$g=9.80665 \text{ N}$$

Accelerometer sensor



Accelerometer sensor



Accelerometer sensor

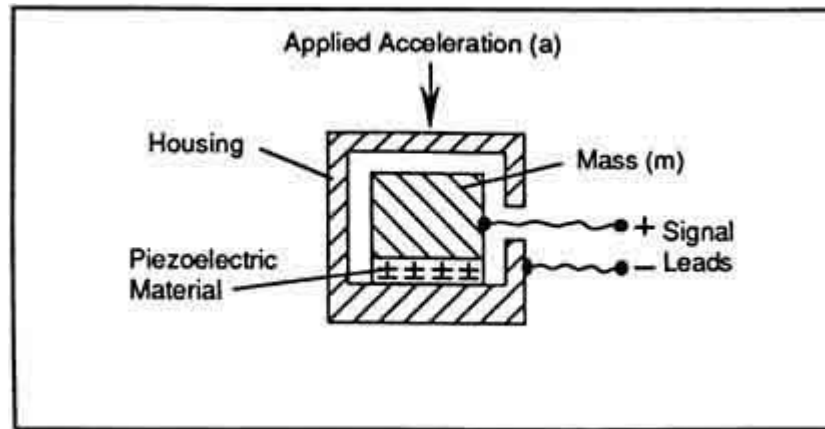
Can be implement using the following

- Piezoelectric
- Piezoresistive**
- Capacitive

Accelerometer sensor

Can be implement using the following

Piezoelectric



Accelerometer sensor

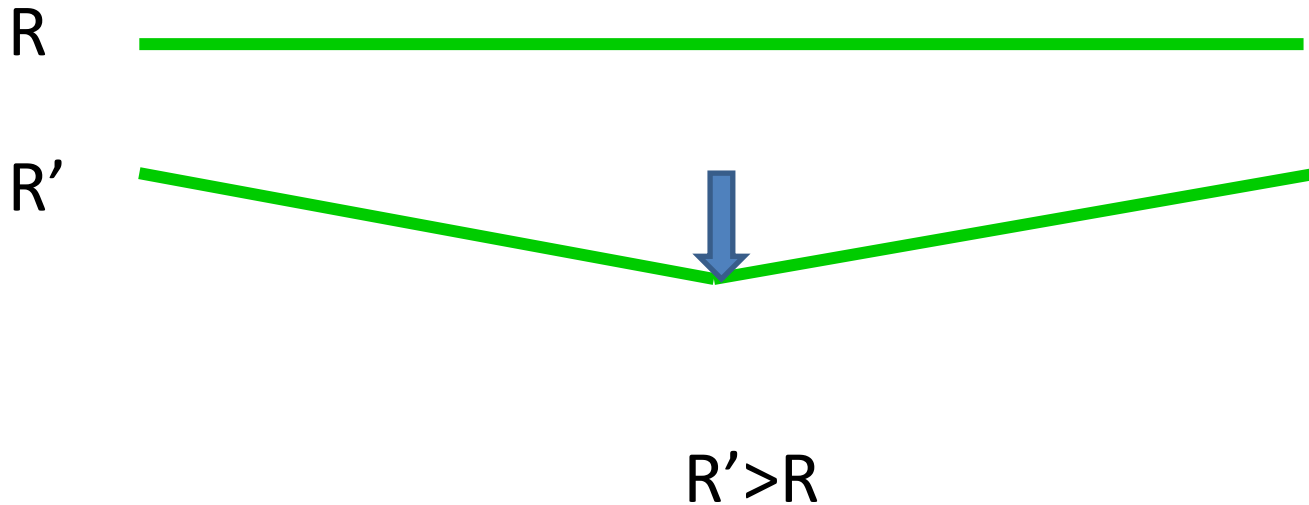
Resistive principle



$$R = \rho \frac{l}{A}$$

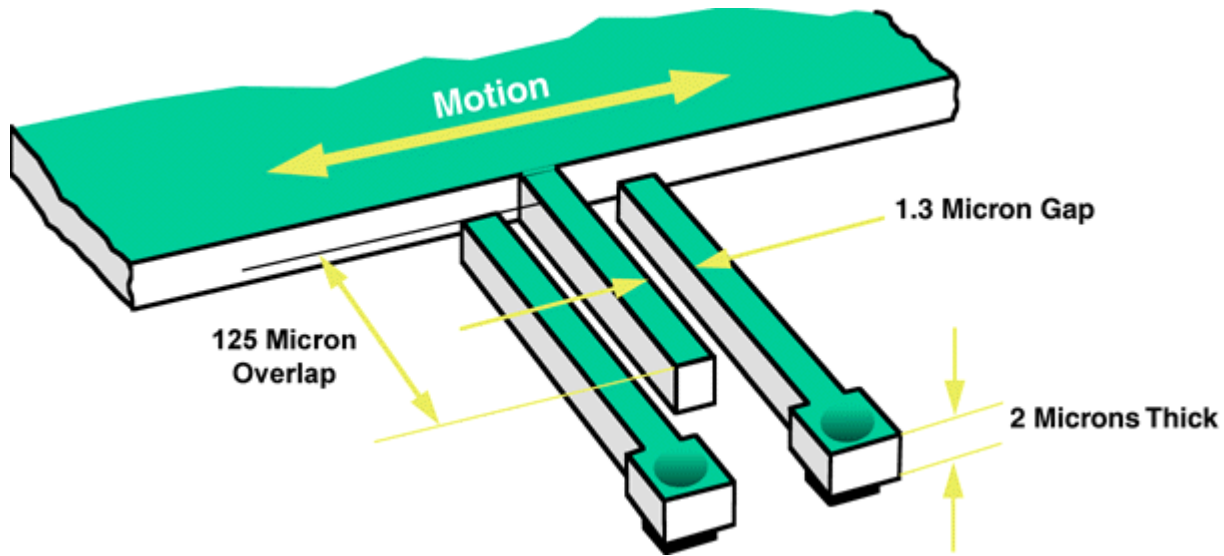
Accelerometer sensor

Resistive principle $R = \rho \frac{l}{A}$



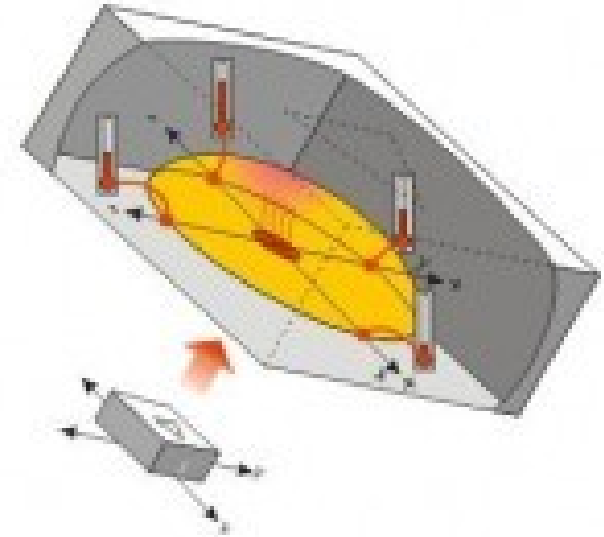
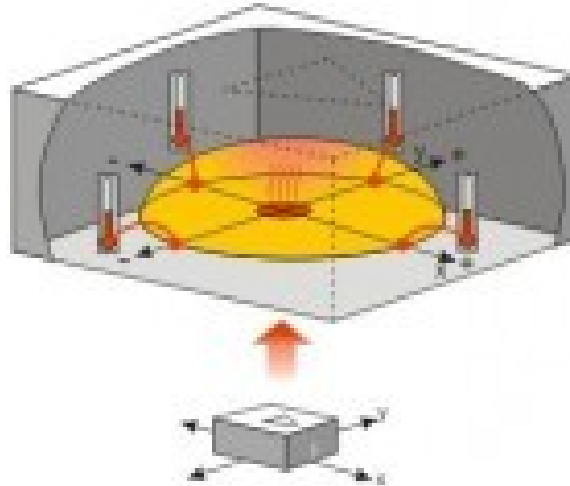
Accelerometer sensor

Capacitive principle



Accelerometer sensor

MEMSIC



Accelerometer sensor



$$X=0$$

$$Y=0$$

$$Z=9.8$$



$$X=0$$

$$Y=0$$

$$Z=-9.8$$

Free fall



$$X=0$$

$$Y=0$$

$$Z=0$$

Accelerometer sensor



$X=-9.8$

$Y=0$

$Z=0$



$X=9.8$

$Y=0$

$Z=0$



$X=0$

$Y=0$

$Z=0$

Accelerometer sensor



$$X=Y$$
$$Z=0$$



$$-X=Y$$
$$Z=0$$

Programming Accelerometer Sensor

Get the sensor

```
SensorManager mSensorManager;  
Sensor mAccelerometer;  
mAccelerometer= mSensorManager.getDefaultSensor(Sensor  
.TYPE_ACCELEROMETER);
```

Get the sensor data

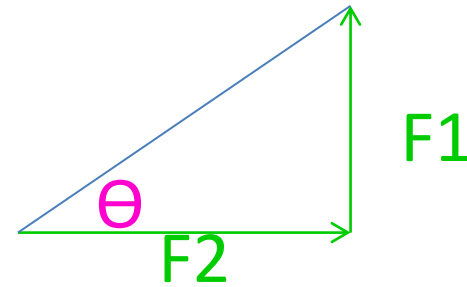
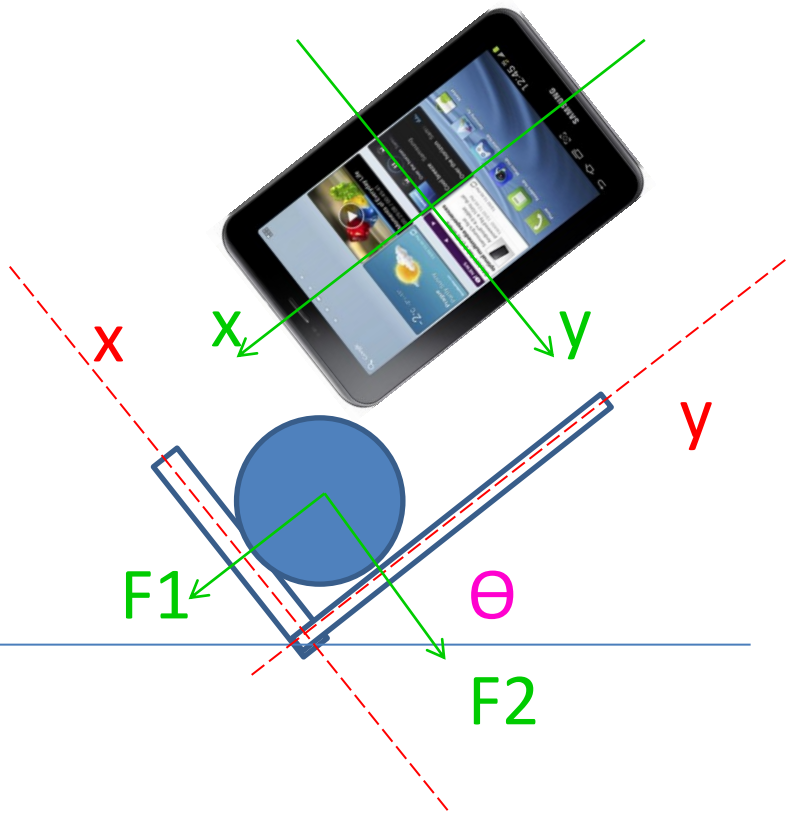
```
@Override  
    public void onSensorChanged(SensorEvent event) {  
        if(event.sensor.getType()==Sensor .TYPE_ACCELEROMETER){  
            Float x= event.values[0];  
            Float y= event.values[1];  
            Float z= event.values[2];  
        }  
    }  
}
```


Programming Accelerometer Sensor

Spirit Level Application

Programming Accelerometer Sensor

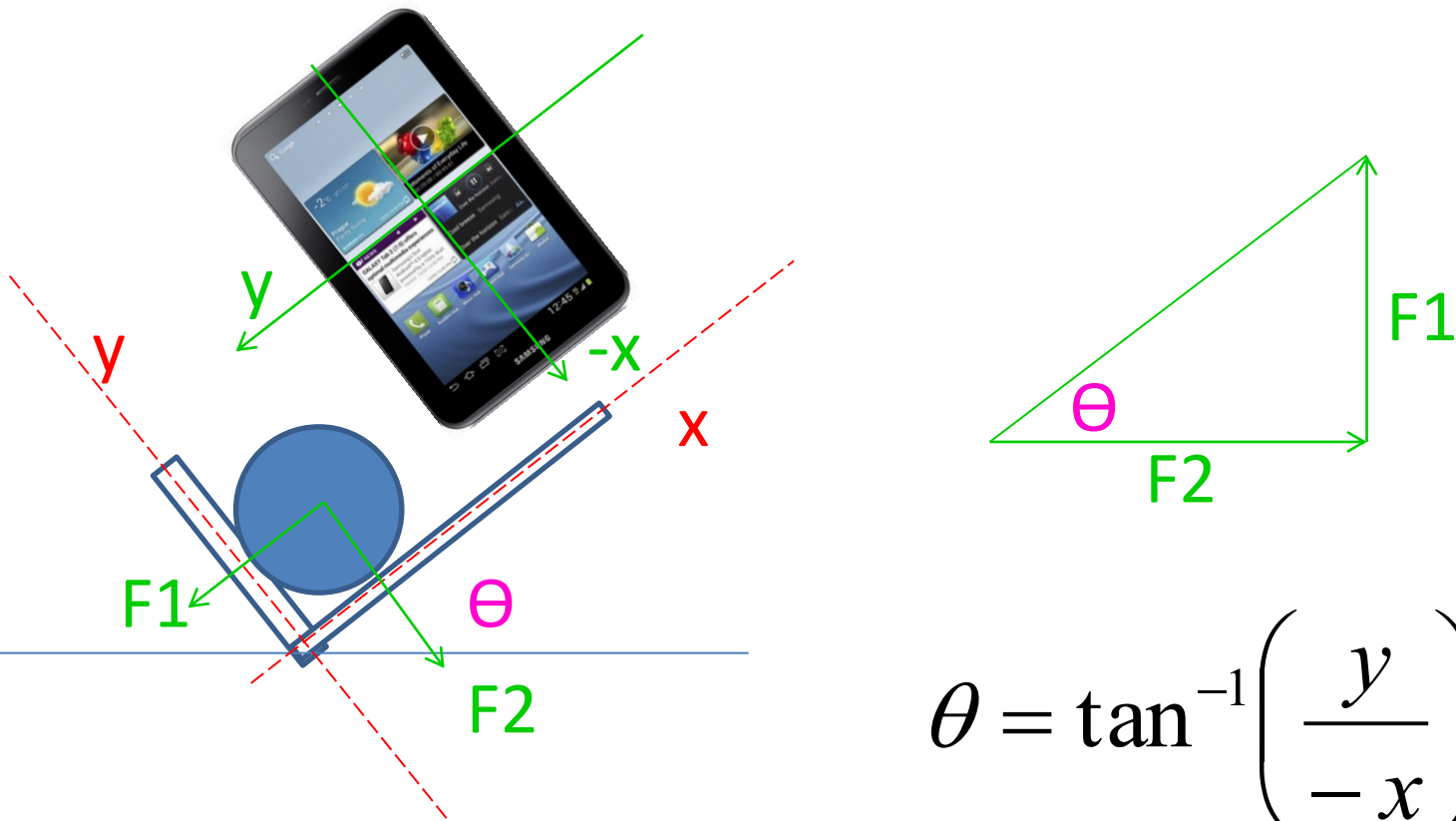
How to determine pitch and roll using accelerometer



$$\theta = \tan^{-1}\left(\frac{x}{y}\right)$$

Programming Accelerometer Sensor

How to determine pitch and roll using accelerometer



Programming Accelerometer Sensor

Pedometer (Footstep counter)

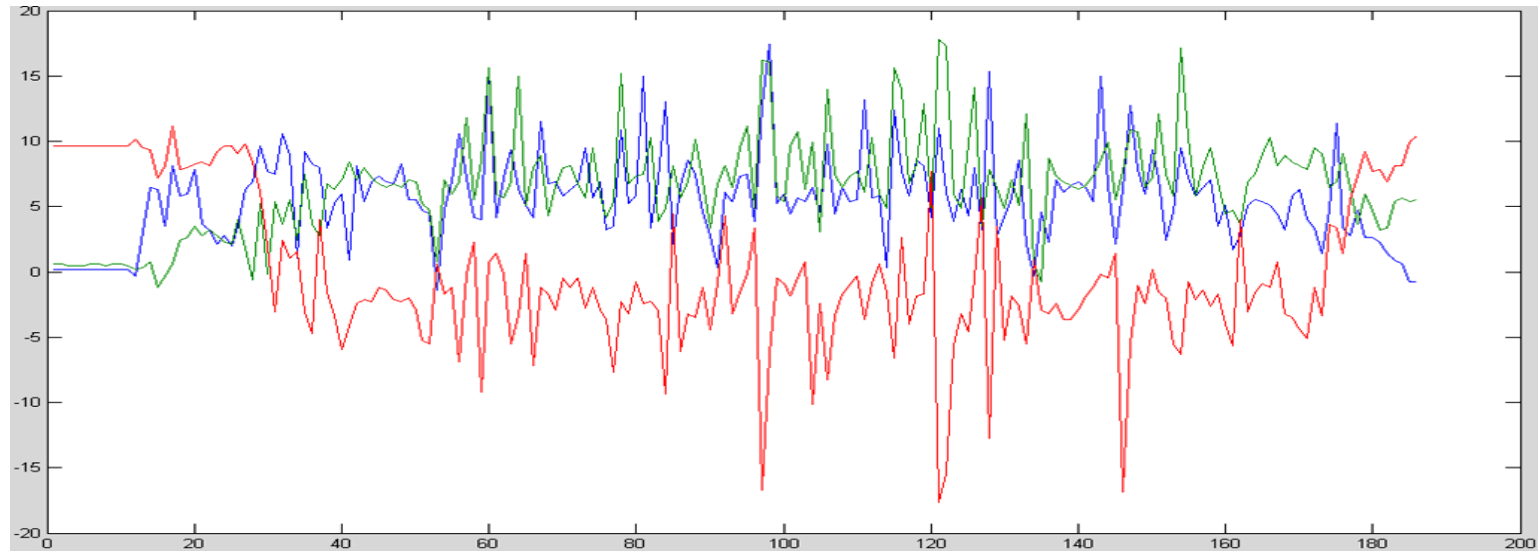


Programming Accelerometer Sensor

X

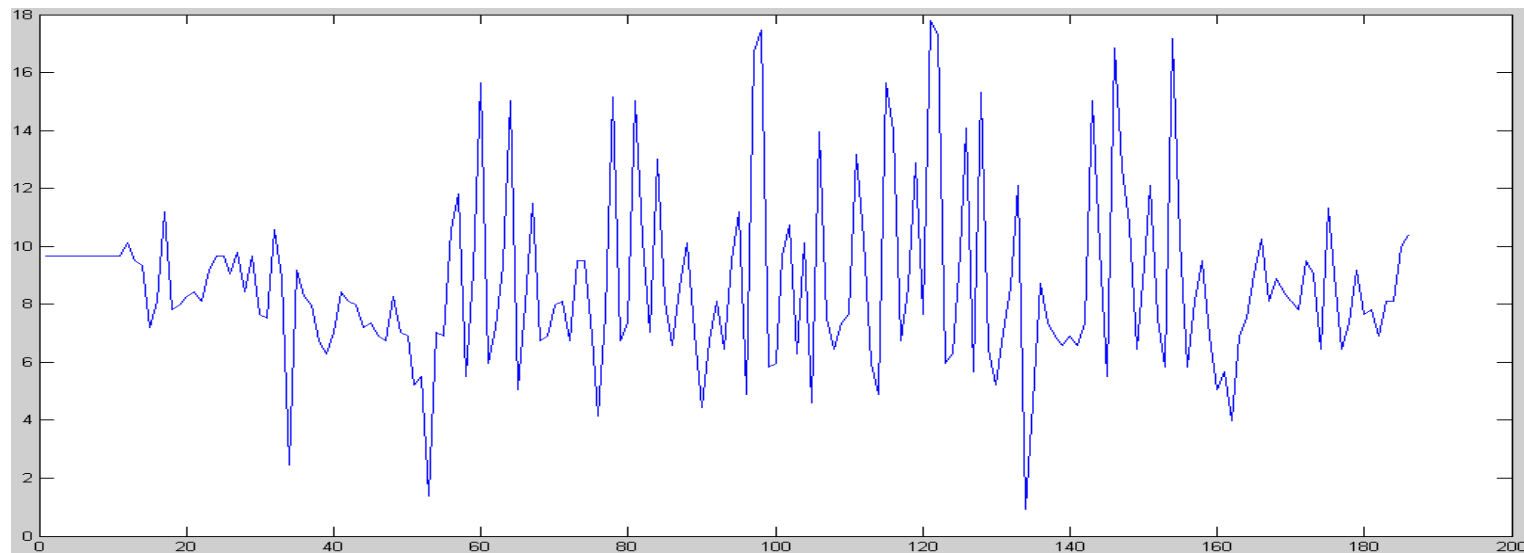
Y

Z

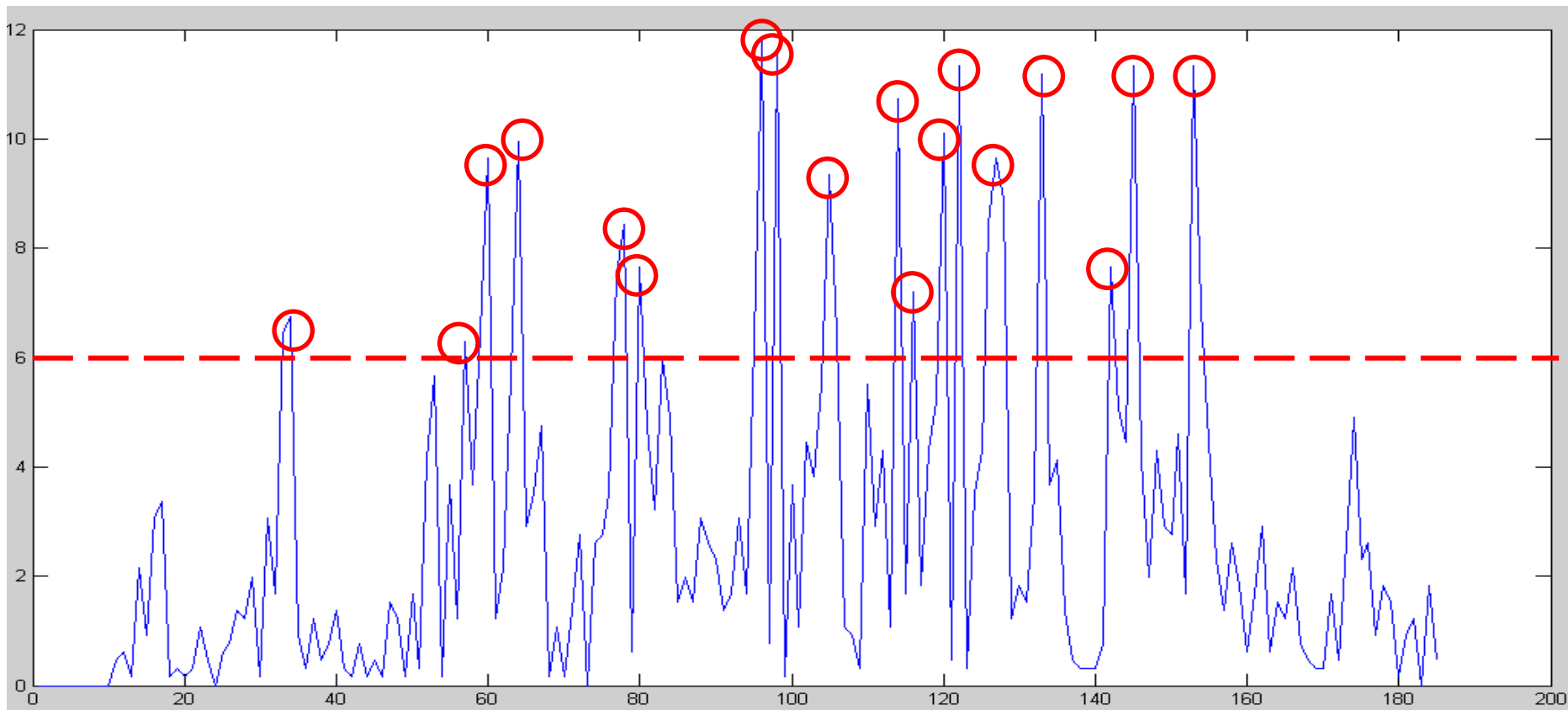


$$F = \max(|X|, |Y|, |Z|)$$

F



Programming Accelerometer Sensor Algorithm



$$Y = |\Delta F|$$

Programming Accelerometer Sensor Algorithm

- 1) GET X,Y,Z
- 2) $F = \text{MAX}(X,Y,Z)$
- 3) IF $|F - F'| > c$ THEN StepFound()
- 4) $F' = F$
- 5) GOTO STEP 1

Thank you 😊