# HOME SOS SYSTEM

# FOR ELDERLY PEOPLE

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10th SCIUS FORUM
MAHASARAKHAM UNIVERSITY


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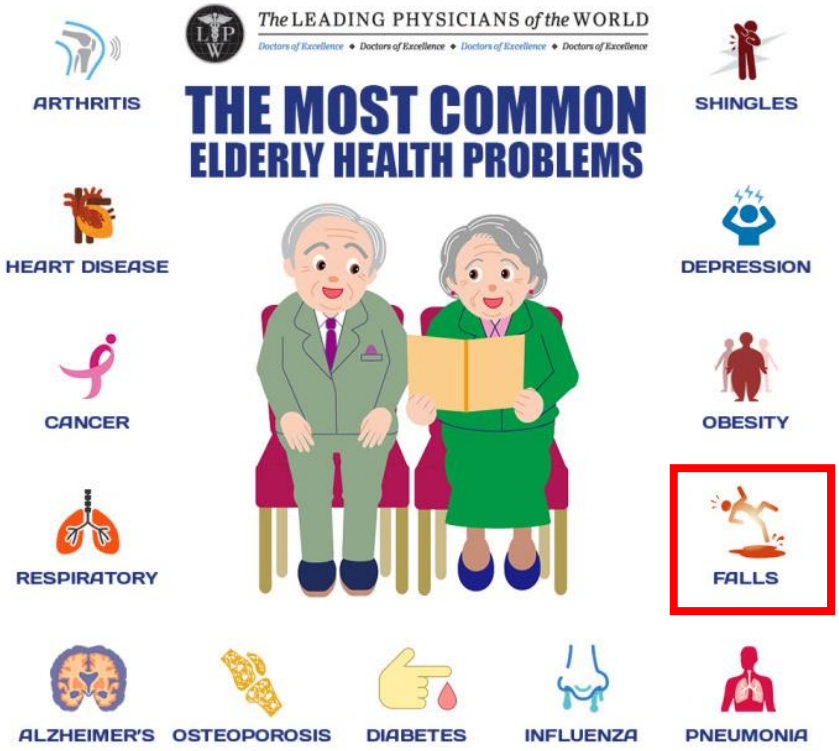
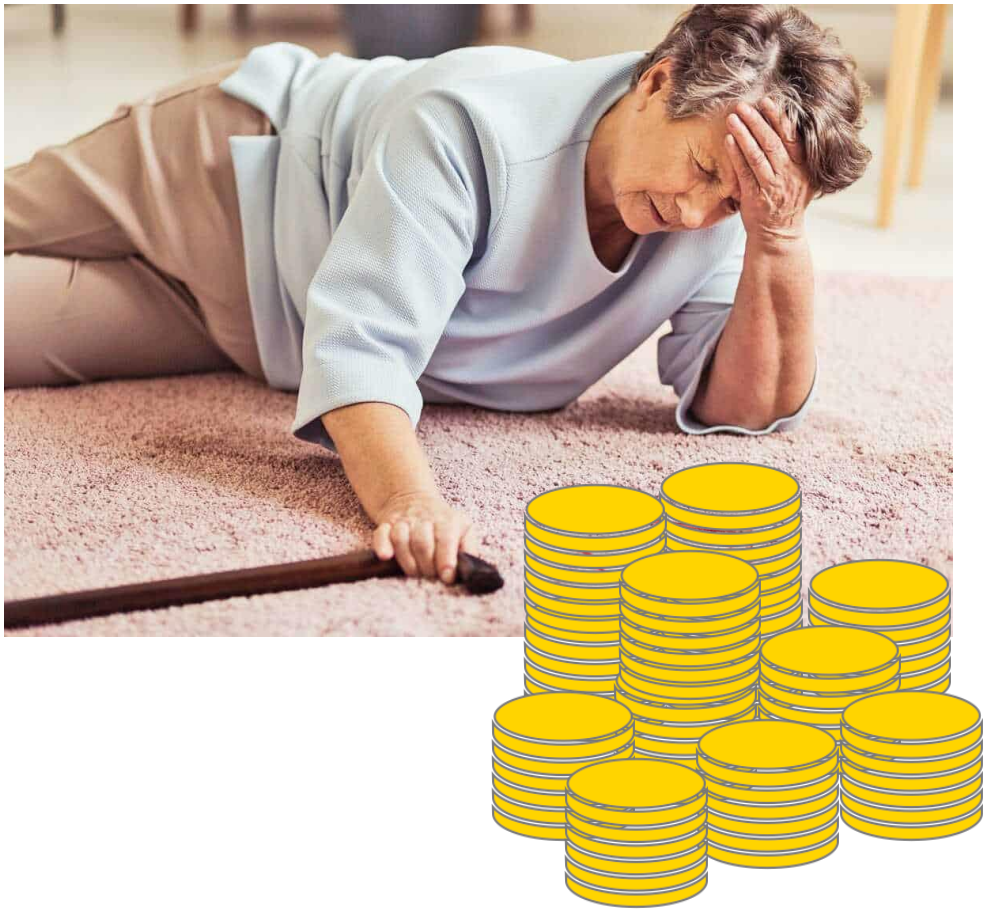
STEM
Science · Technology · Engineering · Math

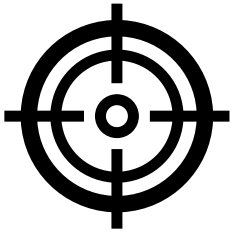
# Problem



When stepping into the old age. . . . .

# Objective



1. Making a low-cost real time Fall detection for the elder.

2. Study the fall characteristics of the elderly for use in detecting fall.

3. The device to be able to collect data and analyze the results for the development of the device's accuracy.

4. The device can automatically ask for help to the caretaker. When falling.

# Method

## Part 1: (Hardware)

- Find equipment information
- Test equipment
- Assemble the equipment

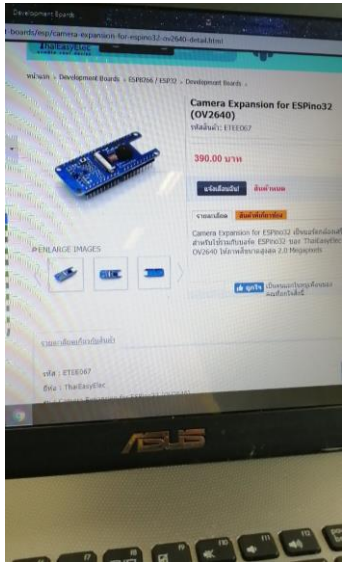
## Part 2: (Software)

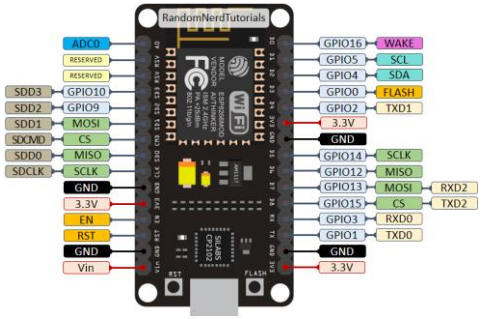
- Data transmission
- Create a program with Python
- Notification sending to LINE
- Using WiFi to determine the location

## Part 3: (Test)

- Collecting data as numbers
- Collecting data in video and real time graph

# Part 1: (Hardware)

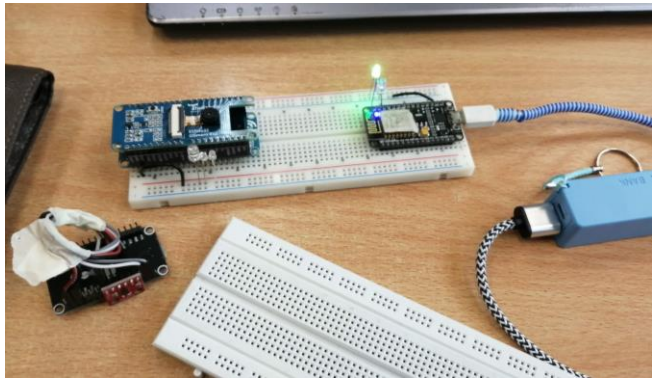


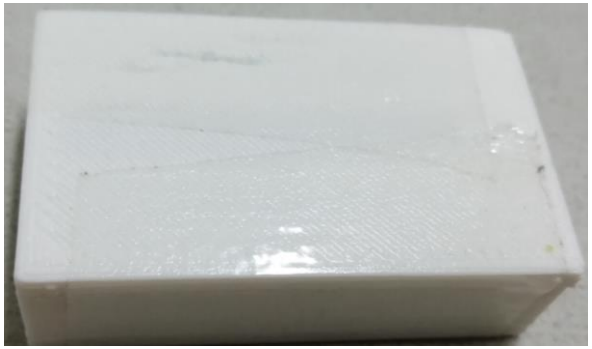

Study equipment information

Buy equipment

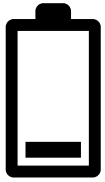
Assemble the equipment



Test equipment



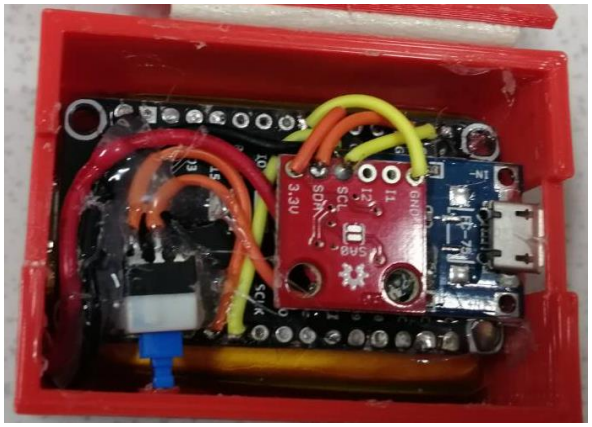
## Model 1



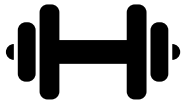
Small size, less weight

Problem : Can’t be used for a long time

**Engineering Design**



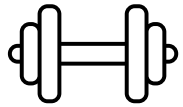
## Model 2



More battery, heavy weight

Problem : It is dangerous to the user

## Model 3



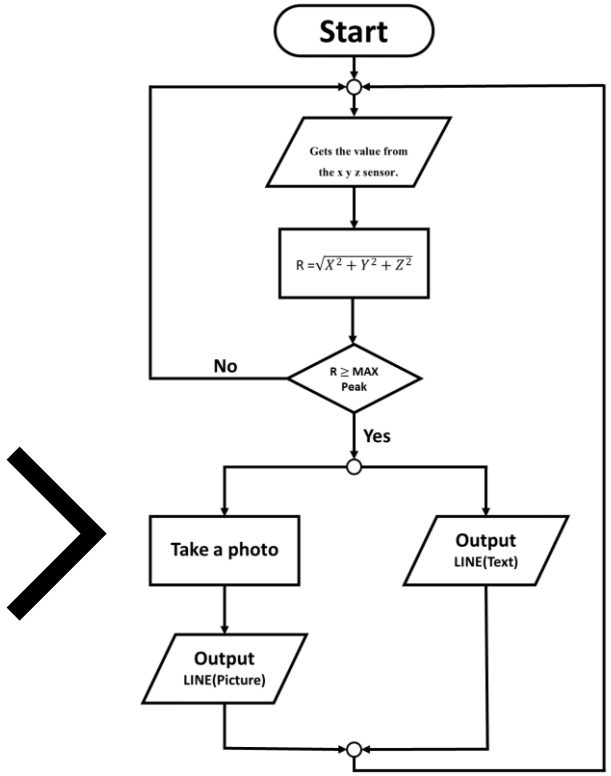
Small size, enough battery

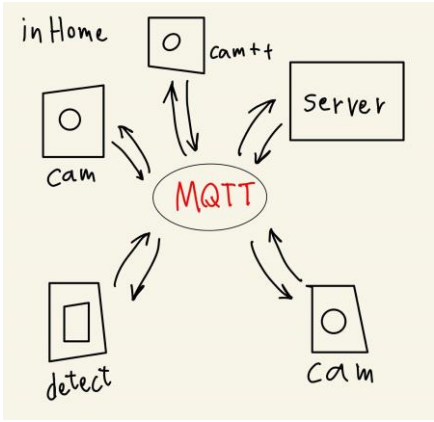
and not harmful to users

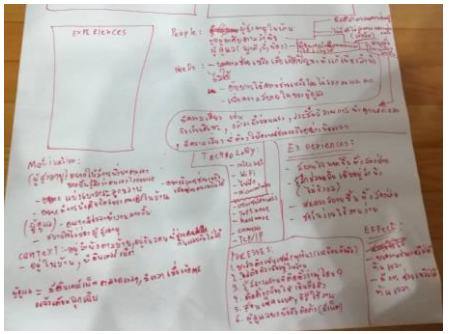
# Part 2: (Software)

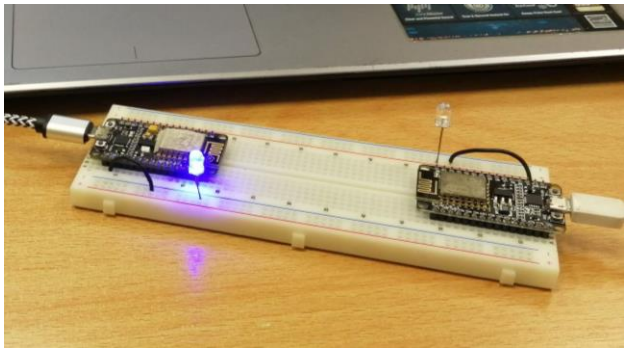
## Step 1

Learn how to write a program

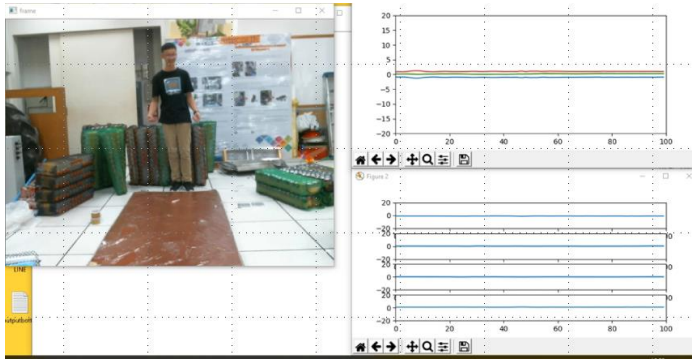


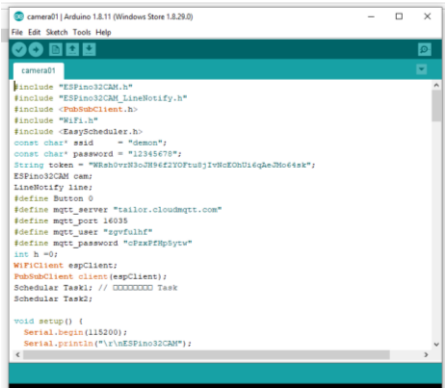





Connect the transmission device to the wireless

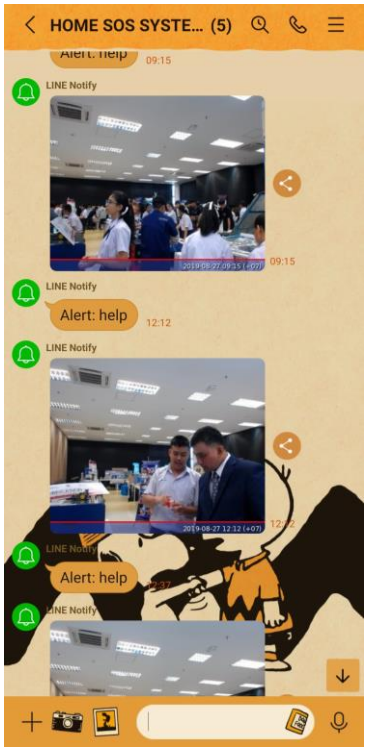


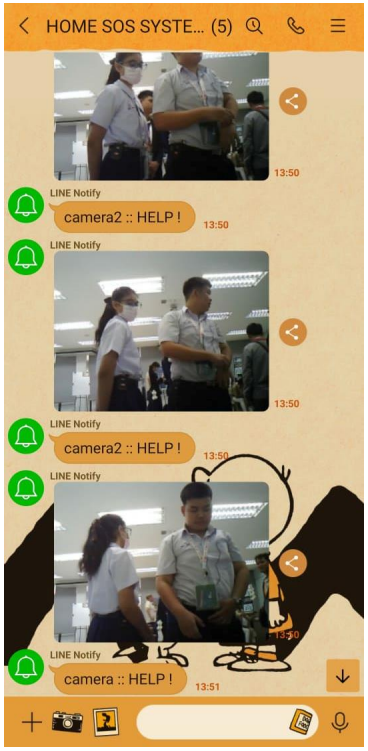
Write a program, get the data and process it in a graph with Python

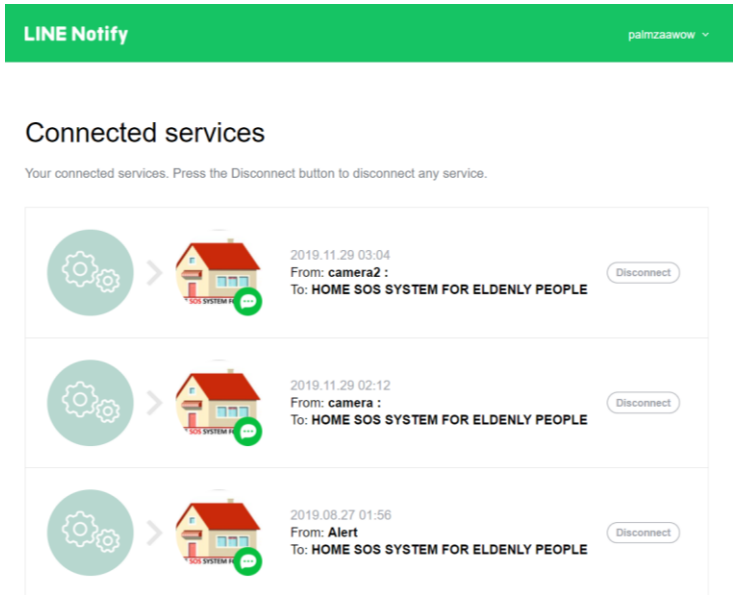


Write a program to identify the device location with Wi-Fi

# Step 2



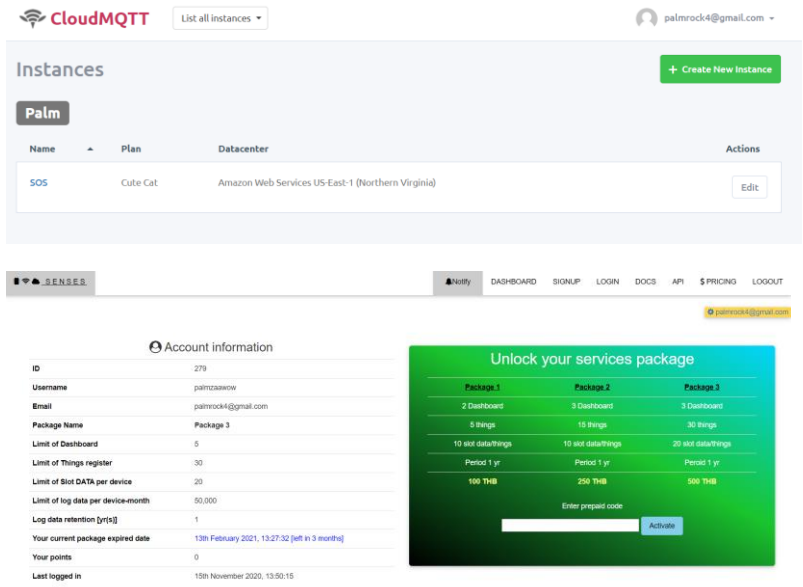




Sending images and message alerts to line

```
    Serial.print(client.state());
    Serial.println(" try again in 5 seconds");
    delay(5000);
    return;
  }
}
if (accel.available()) {      // Wait for new data from accelerometer
  // Acceleration of x, y, and z directions in g units
 /* client.print(accel.getCalculatedX(), 3);  // แสดงค่าแกน x
  client.print("\t");
  client.print(accel.getCalculatedY(), 3);   // แสดงค่าแกน y
  client.print("\t");
  client.print(accel.getCalculatedZ(), 3);   // แสดงค่าแกน z*/
 float a = (accel.getCalculatedX());
 float b = (accel.getCalculatedY());
 float c = (accel.getCalculatedZ());
 // b = (accel.getCalculatedY(), 3);
 // c = (accel.getCalculatedZ(), 3);
 float tol = 0.0;
  tol = float(sqrt(pow(a, 2)+pow(b, 2)+pow(c, 2)));
  //Serial.println(tol);
  delay (10);
  if (tol >= 3.2){
     client.publish("SOS/data/detect","CAMALL");
     delay(100);

  }
```




Connect the device to communicate through the cloud

in it can work automatically

## Part 3: (Test)

Daily life activities

Save

Falling patterns

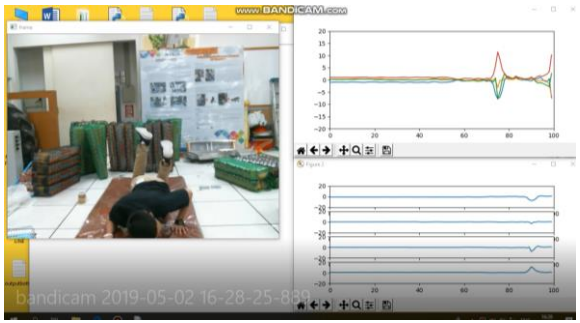

Save

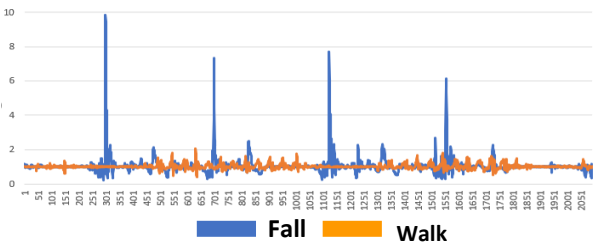
Volunteer

1 DAY


Save

# Test 1



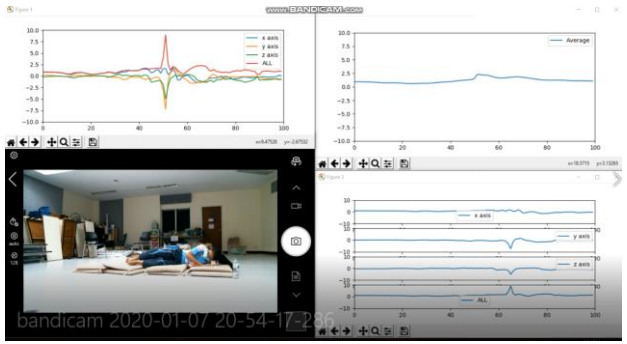


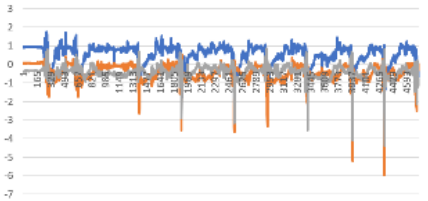

```
0.918 0.262 -0.164
0.988 -0.215 -0.09
0.977 0.117 -0.066
0.969 0.094 -0.07
0.980 0.078 -0.102
0.980 0.09 -0.09
0.992 0.102 -0.086
0.973 0.074 -0.078
0.973 0.113 -0.062
0.977 0.086 -0.082
0.977 0.102 -0.074
0.992 0.113 -0.051
0.973 0.094 -0.074
0.984 0.102 -0.066
0.977 0.098 -0.074
0.980 0.09 -0.066
0.977 0.094 -0.062
0.980 0.098 -0.062
0.980 0.117 -0.059
1.027 0.176 -0.062
0.977 0.191 -0.012
1.000 0.355 0.062
0.879 0.355 0.113
0.926 0.312 0.027
0.898 0.465 0.047
0.875 0.492 0.027
0.848 0.512 -0.012
0.789 0.547 0.121
```

**Objective :**

Collected falling data from experiments in the use of equipment for everyday activities to compare with the falling data.

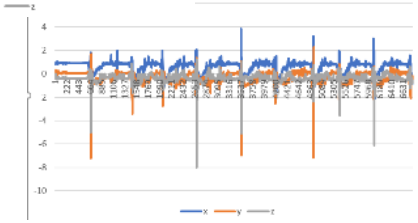
# Test 2





Slipping on the left

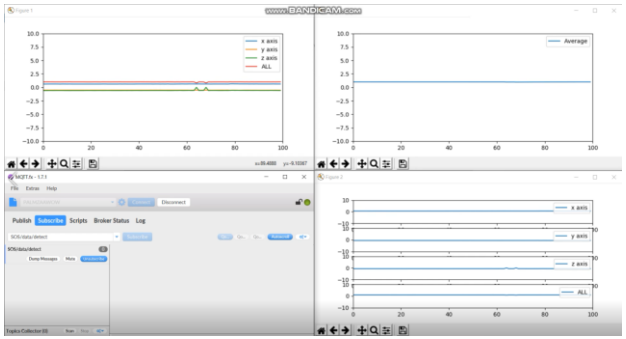
Falling on the left

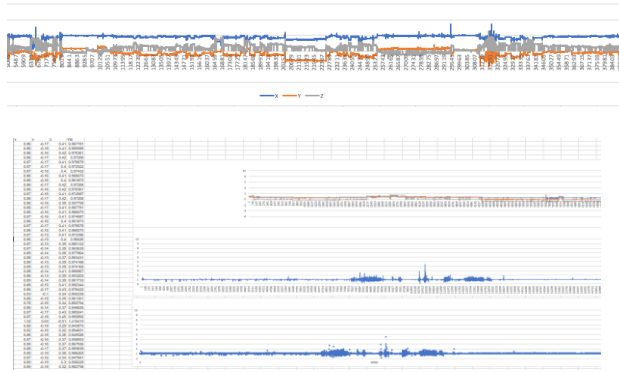


**Objective :**

Collect data on different types of falling for identify the similarities and differences in each type of fall.

# Test 3

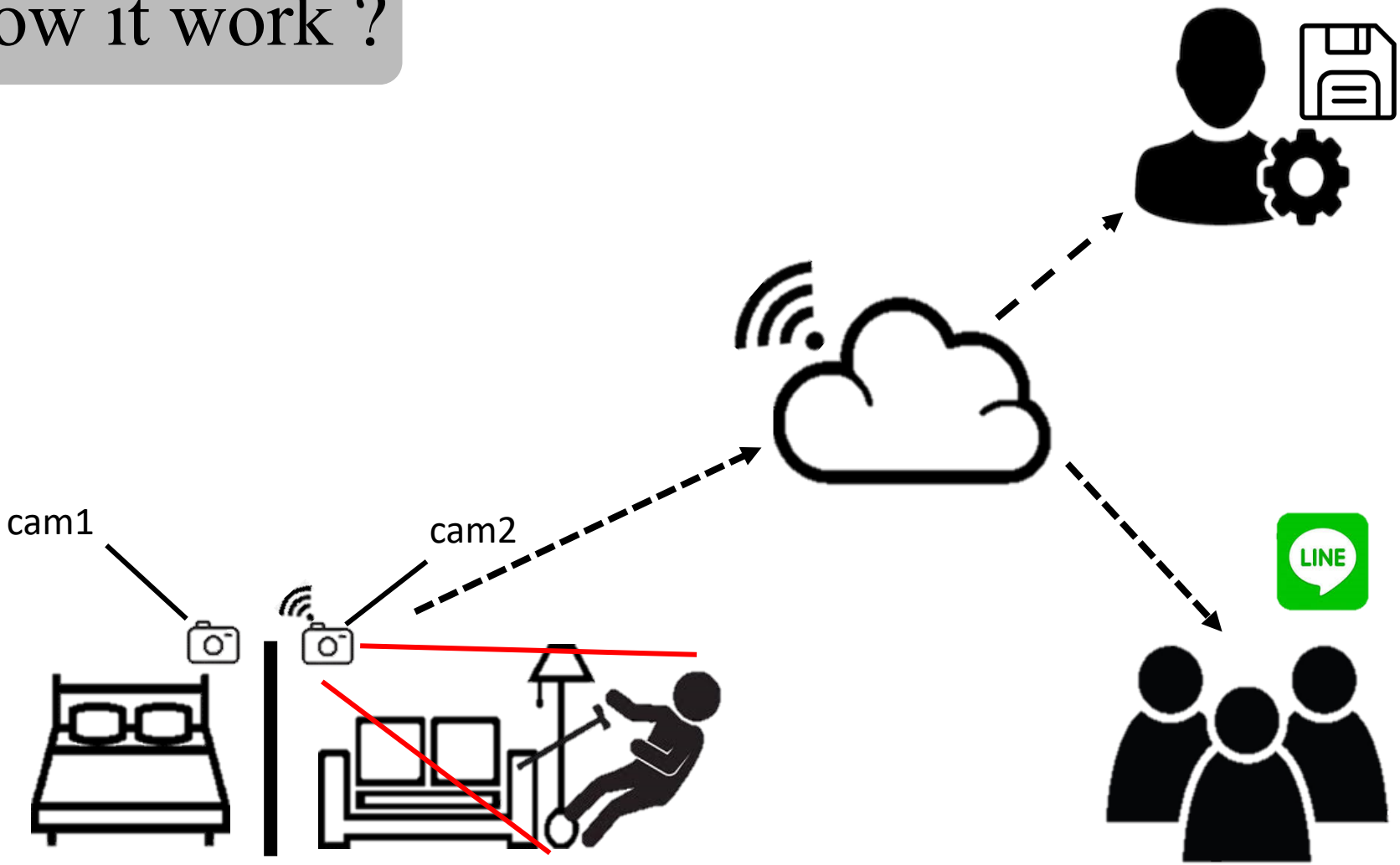




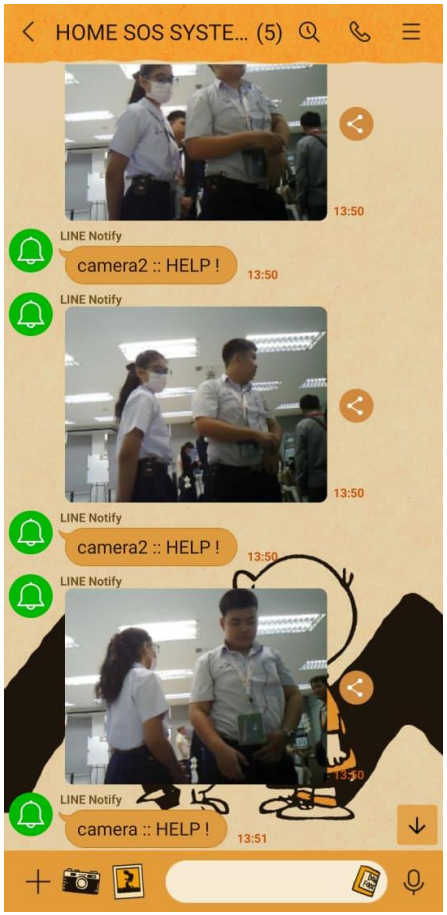
**Objective :**

Collect daily equipment usage data for find device errors when in real use.

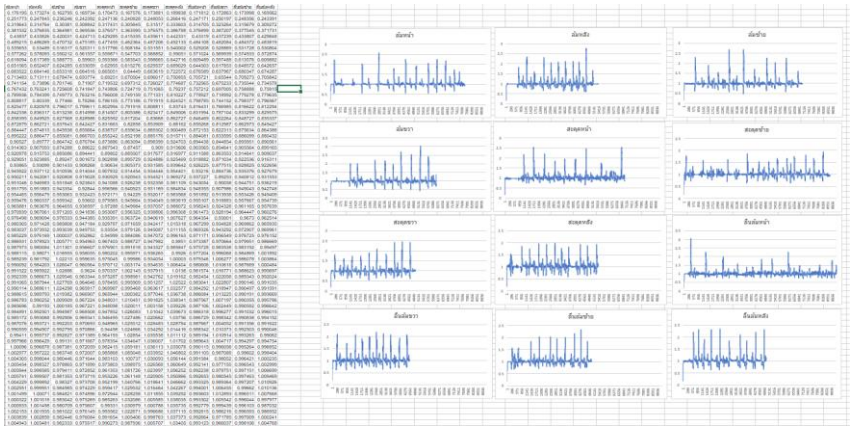
# How it work ?



# Result




Notification

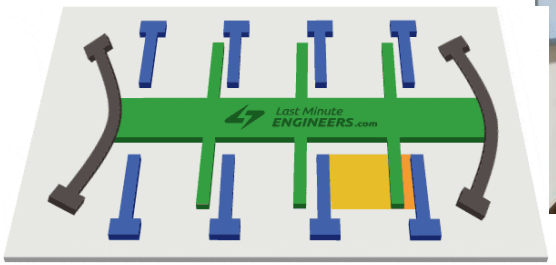


Data from the fall test

Device

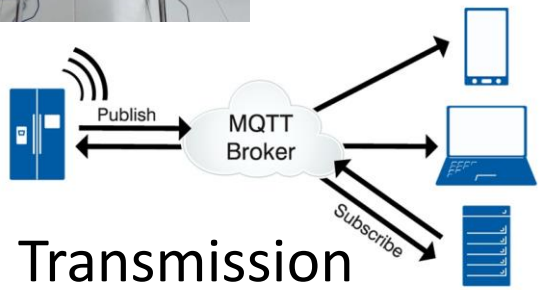
Battery 24+ hr.

S




Process, sensor


T



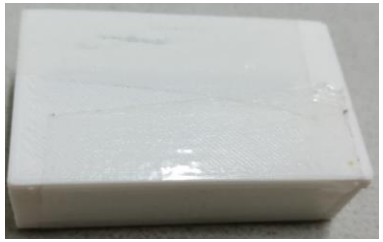

Transmission

# STEM

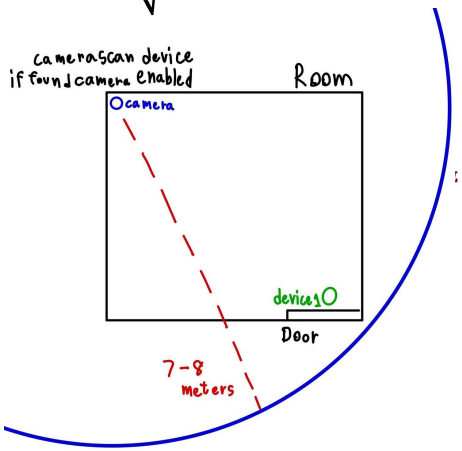
Science · Technology · Engineering · Math

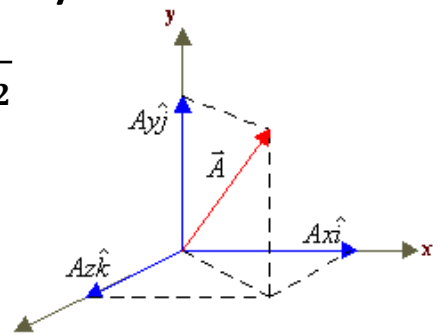
Design

Analyze results



$$\mathbf{A} = \sqrt{\mathbf{A_x}^2 + \mathbf{A_y}^2 + \mathbf{A_z}^2}$$




E

M

# Conclusion

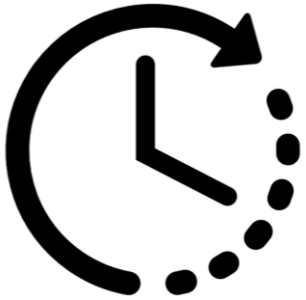
Total accuracy

**96.67 %**

Fall detection accuracy

**100 %**

Time spent in warning

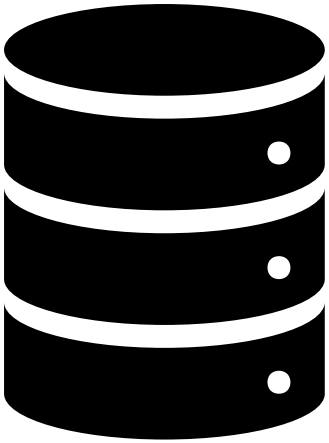


**6 Second**

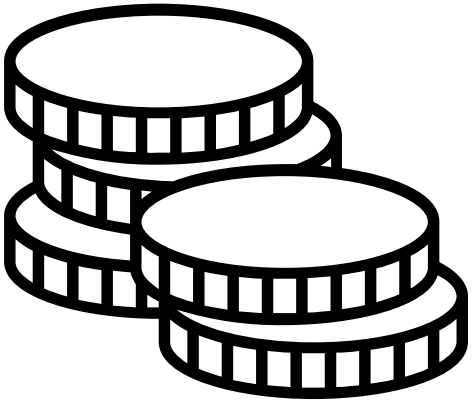
Tell the device location

The device is safe

# Benefits



Data from the fall test



Cheap price

Take care 24 hr.

# ?Question

# &

# Answer ؟

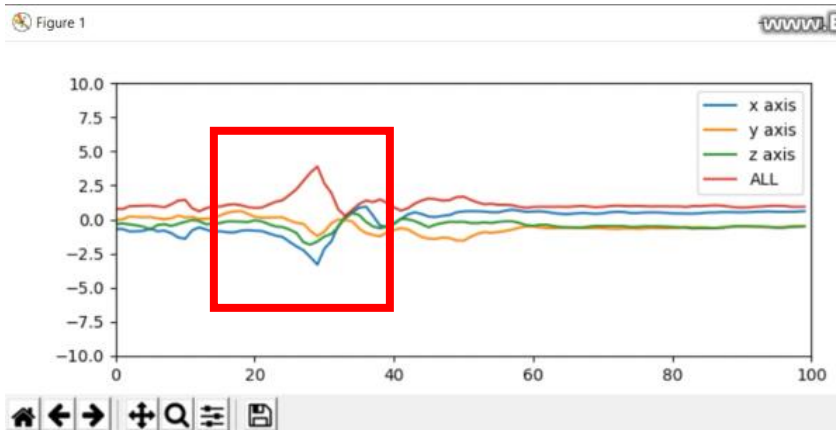
# Method used to detect falls

## Step 1

G10 - Notepad

File Edit Format View Help

```
0.426 0.687 0.578
0.414 0.68 0.551
0.418 0.707 0.551
0.418 0.707 0.543
0.414 0.695 0.555
0.414 0.707 0.547
0.406 0.699 0.562
0.430 0.699 0.547
0.430 0.699 0.586
0.375 0.789 0.52
0.328 0.781 0.49
0.320 0.777 0.598
0.391 0.613 0.793
0.277 0.879 0.562
.285 0.824 0.578
0.402 0.473 0.645
0.379 0.699 0.582
0.383 0.617 0.523
0.273 0.52 0.625
0.348 1.02 0.332
0.367 0.98 0.797
0.469 0.645 0.66
0.160 0.73 0.492
-0.043 0.949 -0.332
-0.496 0.781 -0.098
-0.559 0.895 -0.039
-0.469 0.785 -0.219
-0.352 0.926 -0.156
```




$$A_{all} = \sqrt{A_x^2 + A_y^2 + A_z^2}$$

$A_x$ = X-axis acceleration
$A_y$ = Y−axis acceleration
$A_z$ = Z−axis acceleration

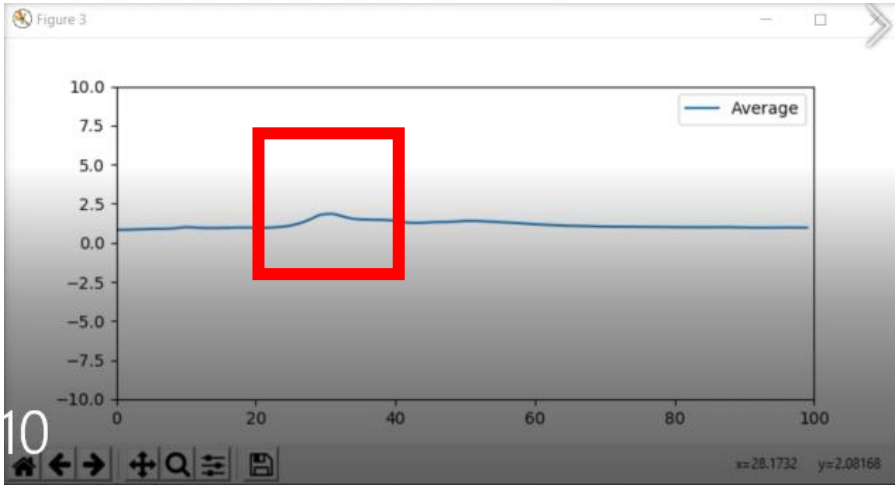
If the total acceleration is greater than 3.2, then it is one of the factors for detect falling.

# Step 2

Put the total acceleration into the formula for the moving average.

**Weighted moving average**

$$\frac{10(A_{before}) + A_{After}}{11}$$




then it is two of the factors for detect falling.

# Total accuracy

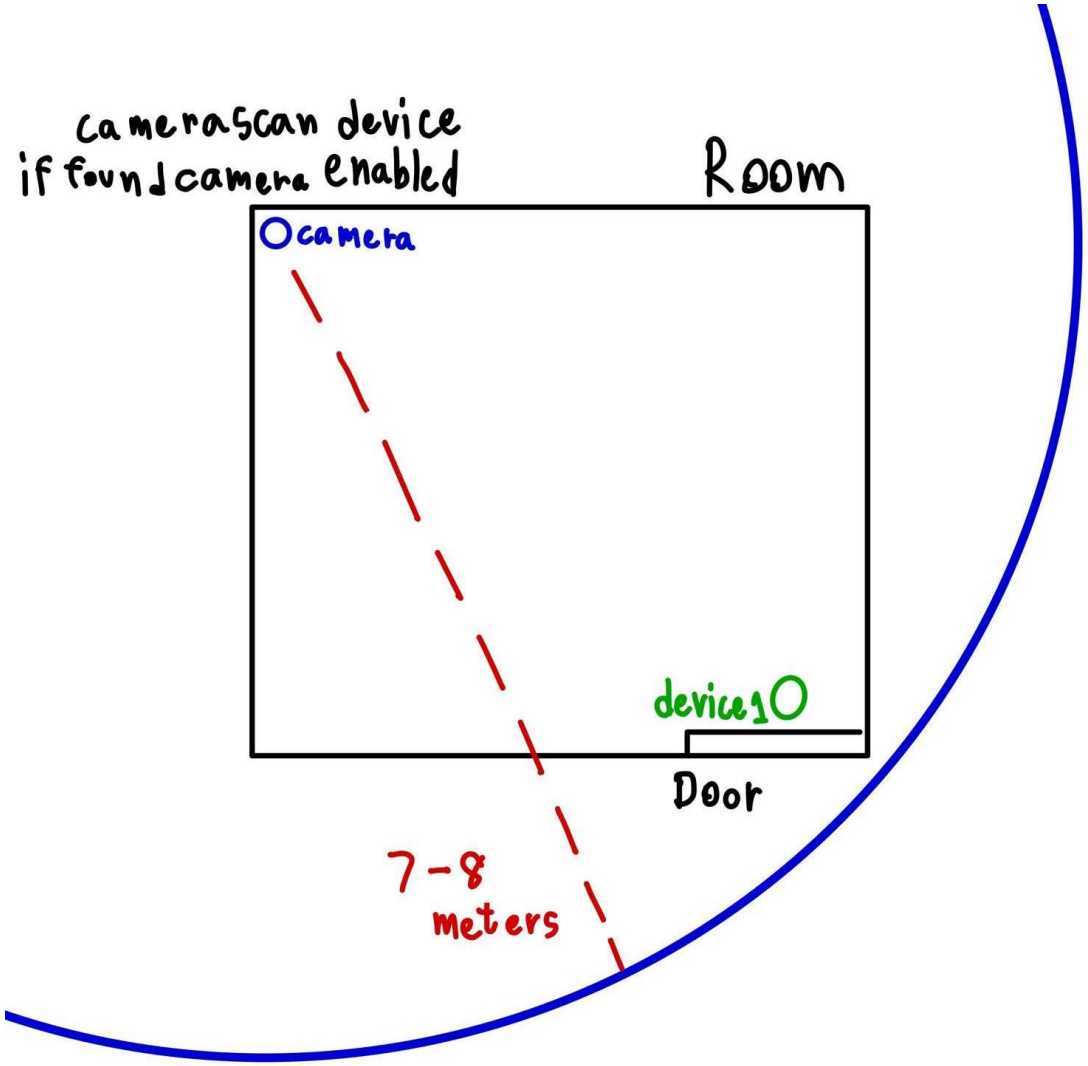
$$Relative\ error = \left| \frac{X_{all} - X_t}{X_t} \right|$$

$X_{all}$ is the total experimental value

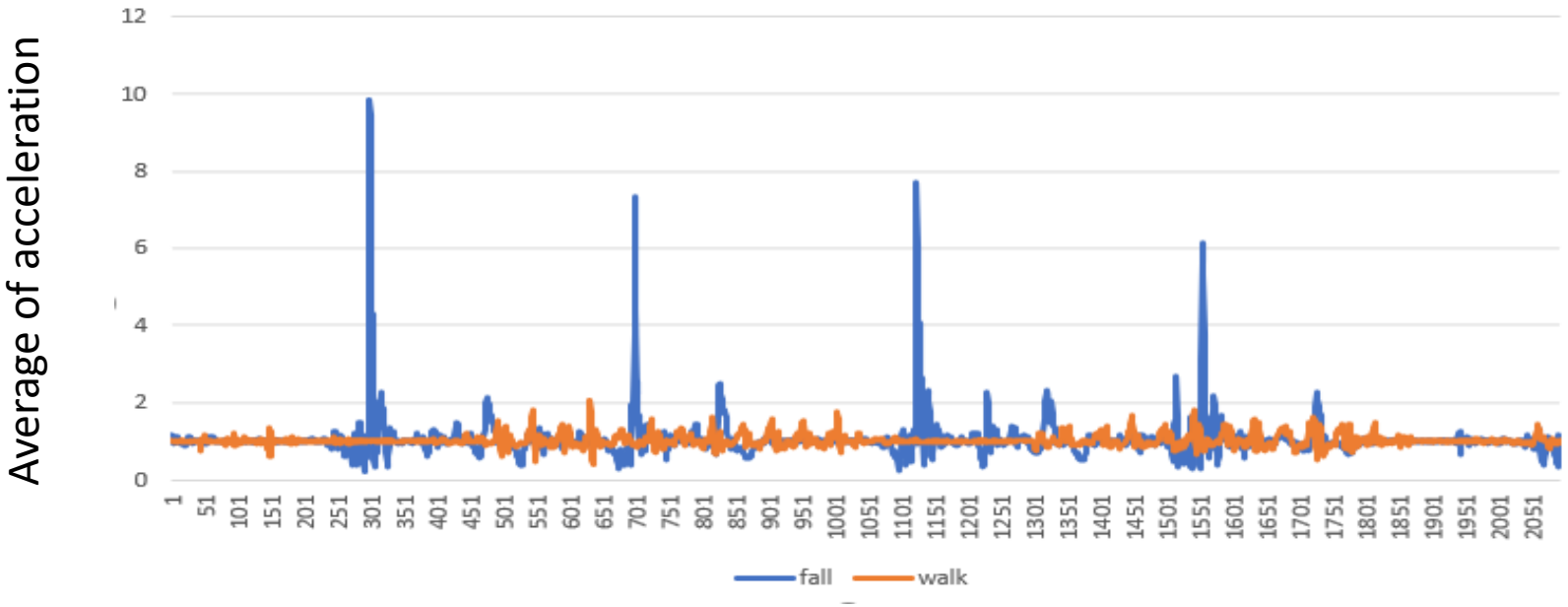
$X_t$ is the alert value when actual falling occurs

$$\frac{124 - 120}{120} \times 100 = 3.33\%$$

# Find location work



# Graph


Average of acceleration
12
10
8
6
4
2
0
1
51
101
151
201
251
301
351
401
451
501
551
601
651
701
751
801
851
901
951
1001
1051
1101
1151
1201
1251
1301
1351
1401
1451
1501
1551
1601
1651
1701
1751
1801
1851
1901
1951
2001
2051
fall
walk

Time

# Accelerometers work