

## Sensor accuracy testing report

### 1 Aim

The purpose of doing the experiment is to test the error rate/ accuracy rate between our app (Sensible app) to the application in the market (Phyphox app).

### 2 Method of testing the accuracy

#### 2.1 First Attempt:

1. Get two application ready on both phones
2. Set a timer to 10 seconds ( start when there is only 5 seconds left)
3. Hold two phones at the same position
4. Press start on both devices
5. Moving in the same direction with the same speed (Accelerometer)\*
6. Press finish/stop when the time is up
7. Export the data to Jupyter Notebook and compare the data

\*Rotate both devices in the same direction for testing the gyroscope, playing a 5 seconds video for testing the Microphone

Result:

Hz used: 40000

Accuracy: x = 800%, y = 3000%, z = 700%

Conclusion: large difference in expected value and actual value

Possible causes: Different OS and different phone might have different sensors and different initial value

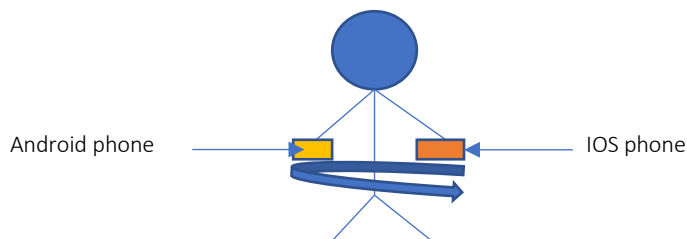
Possible Solution: Normalise the data

#### 2.2 Second Attempt:

Hz used: 40000

1. Get the data from attempt 1
2. Normalise the data from attempt 1 in jupyter notebook
3. Compare the data again

Set up:



Result:

Accuracy: x = 500%, y = 400%, z = 600%

Conclusion: The accuracy difference is decreased but the difference is still too high

Possible cause: different device have different sensors and initial value

Possible solution: Use the same device to carry out the experiment

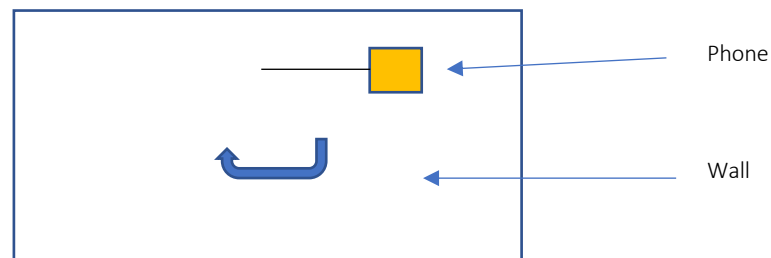
### 2.3 Third attempt:

#### Pendulum Experiment:

Hz used: 40000

1. An Android phone was attached to a 5 cm rope.
2. The rope with phone was stuck under the table
3. Place the phone on a marked position under the table
4. Release the phone for 5 second using the phyphox app
5. Press finish when 5 second is up
6. Replace phyphox app with our testproject app
7. Export both data to computer

#### 2.3.1 Set up



Result:

Accuracy:  $x = 90\%$ ,  $y = 300\%$ ,  $z = 50\%$

Conclusion: the error is still too large

Possible cause: The gravity ( $z$  in both app) is different when the phone was swinging

Possible Solution: Check each  $x$ ,  $y$ ,  $z$  values individually

### 2.4 Fourth Attempt

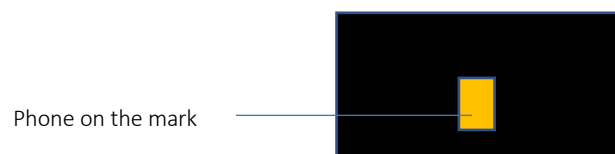
#### 2.4.1 Testing for gravity (z-axis)

1. Place the phone on a marked place
2. Start the phyphox app for 5 second
3. Replace phyphox app with our testproject app
4. Export the data

#### 2.4.2 Testing for x and y axis

1. Use the data from 2.4.1
2. Compare x and y

#### 2.4.3 Set up



Accuracy:  $x = 5\%$ ,  $y = 20\%$ ,  $z = 5\%$

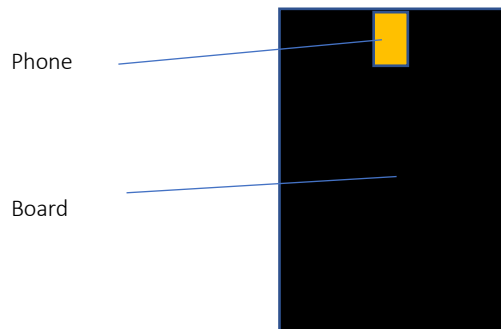
Conclusion: The initial difference between two app are  $x = 5\%$ ,  $y = 20\%$ ,  $z = 5\%$

### 2.5 Fifth Attempt:

### Testing on a sliding board

1. The phone place at the edge of the board
2. Open the phyphox app
3. Press “record” and release the phone
4. Press finish when the phone reached another end of the board
5. Export the data

#### 2.5.1 Set up



Accuracy: x = 5.8%, y = 31%, z = 8.66%

Conclusion: x and z values are normal. y value is different

Possible cause: The friction affect the sliding speed which might affect the value of y

#### 3 Calculation

Expected value of the sensor = The data from phyphox app

Actual value of the sensor = The data from Sensible app

Difference between actual value and expected value = Expected value – Actual value

The Accuracy rate/Error rate =  $\text{abs}((\text{Expected value} - \text{Actual value}) / \text{Expected value} * 100)$

Average Accuracy rate/Error rate =  $(\text{Sum of all value of x or y or z}) / \text{number of row}$

#### 4 Final Result of testing

Sensor get tested	Device used for testing	Application used for testing	Sample rate used (Hz)	Time used (s)	Average error rate (x,y,z) (%)
Accelerometer With gravity	Android phone	Sensible app + Phyphox app	100 Hz	Around 3	6, 31, 8.66