

Activity 5: Sensors and IoT (Part 1)

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Objectives

- To know the capabilities of sensors on smartphones.
- To get experiences in interpreting data from accelerometers and gyroscopes on smartphones.
- To apply data read from sensors to an application.
- To implement a simple web application as a foundation of the IoT systems.

Part 0: Preparation

- Open a web browser on a smart phone and go to:
<https://compengssensorv3.web.app/>. We will refer to this web page as “CompEngSensor”.
- For each group, prepare at least one device that can obtain accelerometer and gyroscope data with “CompEngSensor”.
- Record the device information in the table below.

Device Model	OS Name	OS Version	Browser Name	Browser Version
iPhone 13	iOS	16.4	Safari	16.3

Part 1: Get Familiar with the Sensor Outputs

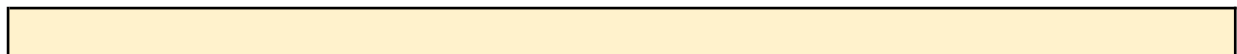
1. Use a web browser to go to “CompEngSensor” and observe the UI.
 - 1.1. What are the types of sensors that “CompEngSensor” have?
 - 1.2. What is the unit of the data measured from each sensor?
 - 1.3. What is the value range of the data displayed on each meter?

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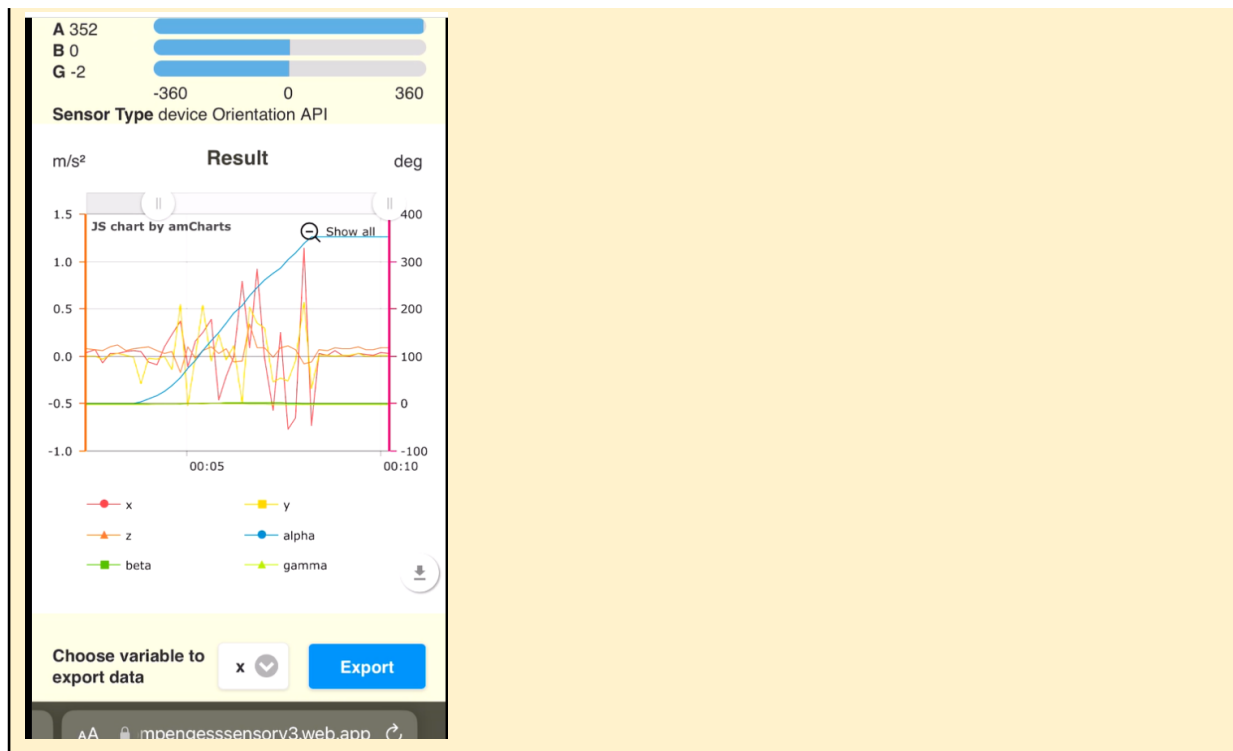
- 1.4. How many meters (**horizontal bar**) are there to display the data from each sensor?
- 1.5. What are the labels of each meter?

Sensor Type	Unit of Measurement	Value Range	Number of meters	Labels of the meters
Accelerometer	m/(s ²)	-10 -> 10	3	X, Y, Z
Gyrometer	deg	-360 -> 360	3	A,B,C

2. Place your device face-up on the surface of your group's table. Press the **"Start"** button, wait around 5 seconds, and then press the **"Stop"** button. You will see that there are 6 data series shown on the plot of the result.
3. Try to relate the 6 data series with the three dimensions of the output from each sensor. First you will observe the device orientation data, place your device face-up on the surface of your group's table.
- Press the **"Start"** button.
 - Wait 5 seconds.
 - Turn it 360 degrees (anticlockwise) with its back still lying on the surface of the table.
 - Wait 5 seconds.
 - Press the **"Stop"** button.
- 3.1. Show the resulting plot.



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- 3.2. Which data series in the plot is significantly related with the movement you have done in 3.? Explain the graph.

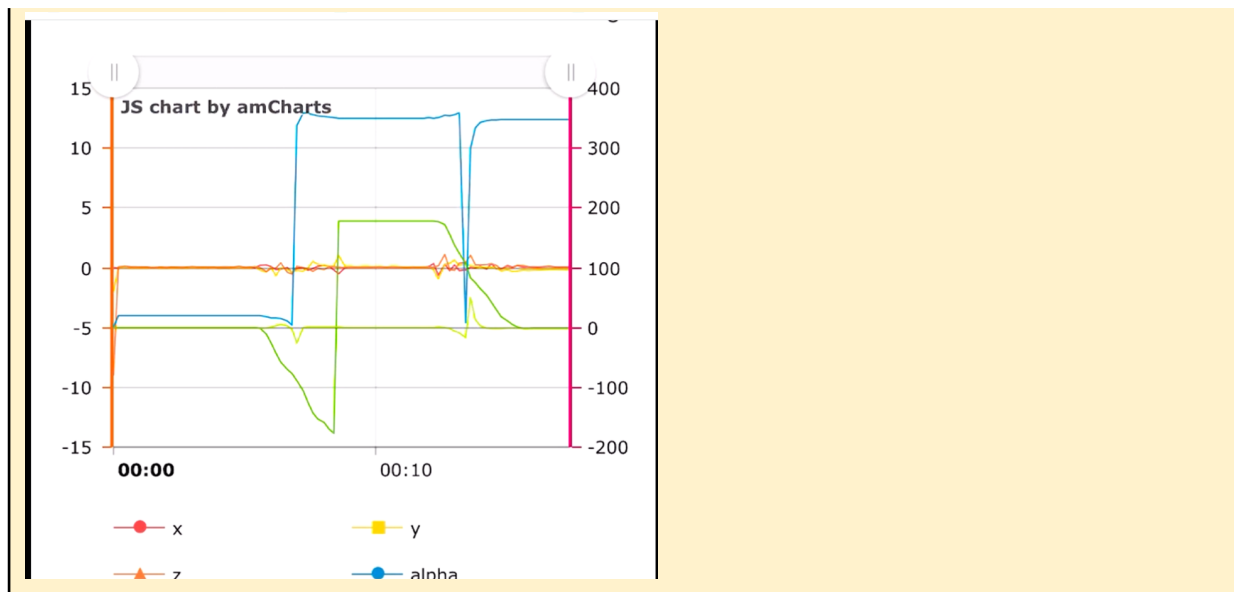
The value of Alpha increases over time.

The values from the accelerometer from the x and y axis consistently change from positive to negative.

The rest of the values significantly remain constant.

4. Place your device face-up on the surface of your group's desk.
 - Press the **"Start"** button.
 - Wait 5 seconds.
 - Hold the bottom side of the device and slowly turn it over (to its face-down position) by using the top side of the device as the rotating axis.
 - Wait 5 seconds.
 - Hold the top side of the device and slowly turn it back up to its face-up position by using the bottom side of the device as the rotating axis.
 - Wait 5 seconds.
 - Press the **"Stop"** button.
- 4.1. Show the resulting plot.

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- 4.2. Which data series in the plot is significantly related with the movement you have done in 4.? Explain the graph.

The value of Alpha increased to around 360, remained constant, dropped to around 0, and returned to 360.

The value of Beta decreased overtime, escalated to around 180, remained constant, and decreased over time to around 0.

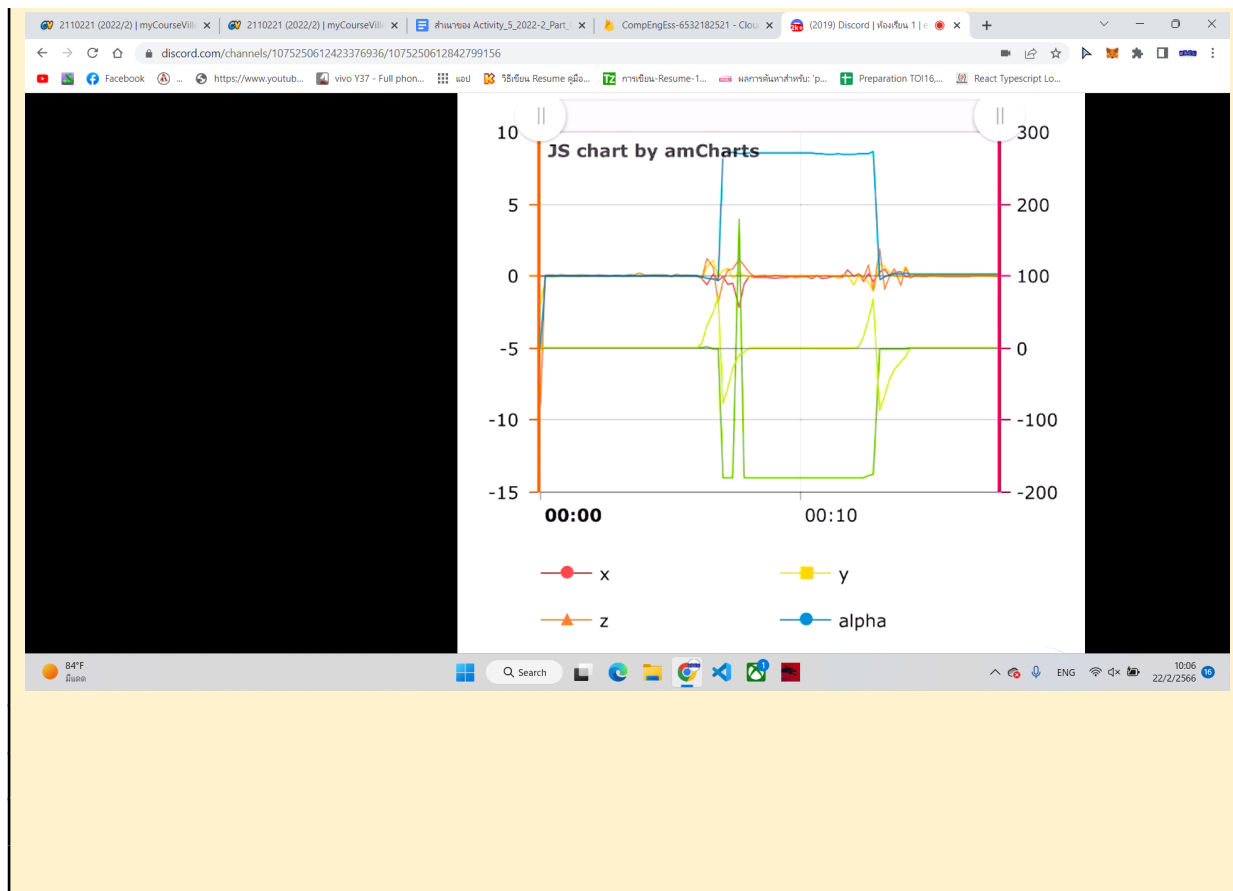
The rest of the values remained constant.

5. Place your device face-up on the surface of your group's desk.

- Press the **"Start"** button.
- Wait 5 seconds.
- Slowly flip it face-down to the right.
- Wait 5 seconds.
- Slowly flip it face-up to the right.
- Press the **"Stop"** button.

- 5.1. Show the resulting plot.

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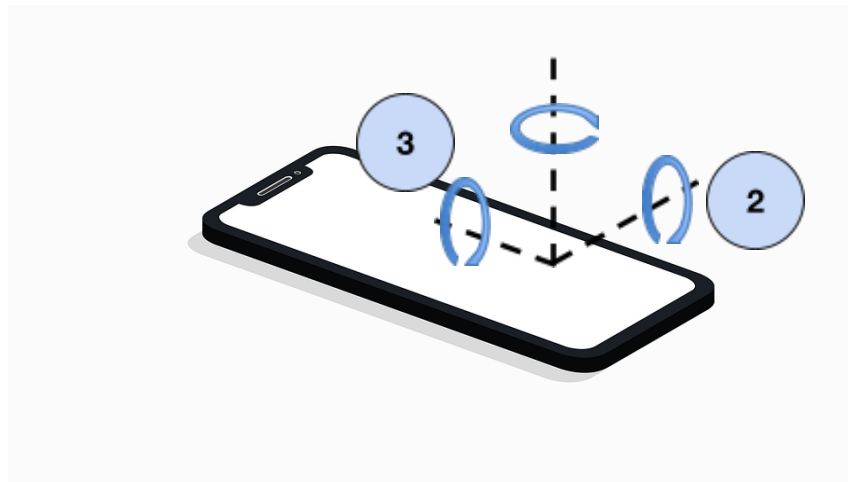


- 5.2. Which data series in the plot is significantly related with the movement you have done in 5.? Explain the graph.

The value of Gamma increases over time.
The rest of the values significantly remain constant.

6. In the figure below, match your device orientation with the data series obtained from “CompEngSensor” by putting the names of the data series next to their corresponding orientation in the table below.

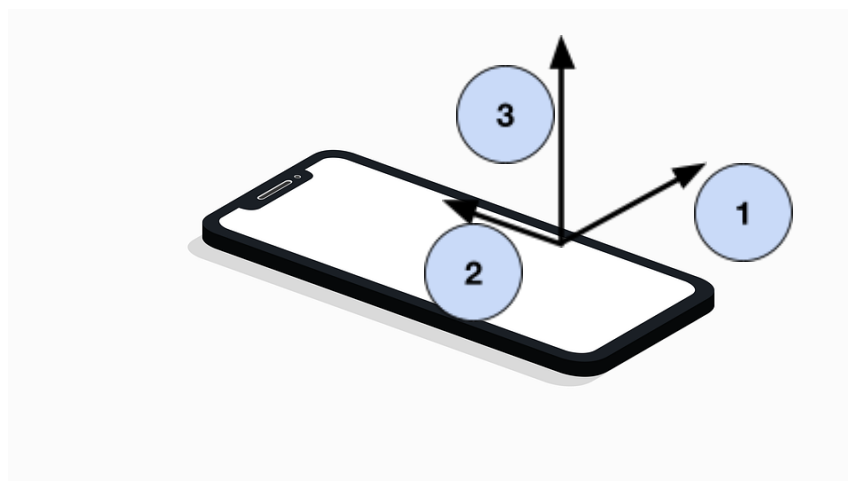


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Corresponding orientation	Names of the data series involved
1	alpha
2	beta
3	gamma

7. Now you will observe the device acceleration data. Do your own experiment to match your device acceleration direction with the data series obtained from “CompEngSensor”.

- 7.1. Put the names of the data series next to their corresponding acceleration directions in the table below.



Corresponding acceleration	Names of the data series involved
1	X
2	Y

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3	Z
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7.2. Explain how you design your experiment to get the result in 7.1.?

Start the timer then wait for 5 second. After that begin by moving the device back and forth in a linear motion in each dimension starting with X axis. Then, wait for 5 seconds. Repeat the experiment with Y axis and then Z in that order. Finally, read the data from the graph corresponding to each axis.

Once you finish, students must inform an instructor or a TA for inspection.

— THIS IS THE END OF PART 1 —
