

# IoT Lab4 Summary Report

## Group 1

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- What do the acceleration values actually tell us about movement?

Acceleration values observed in x(pitch), y(roll) and z(yaw) directions tells about the movement in respective directions.

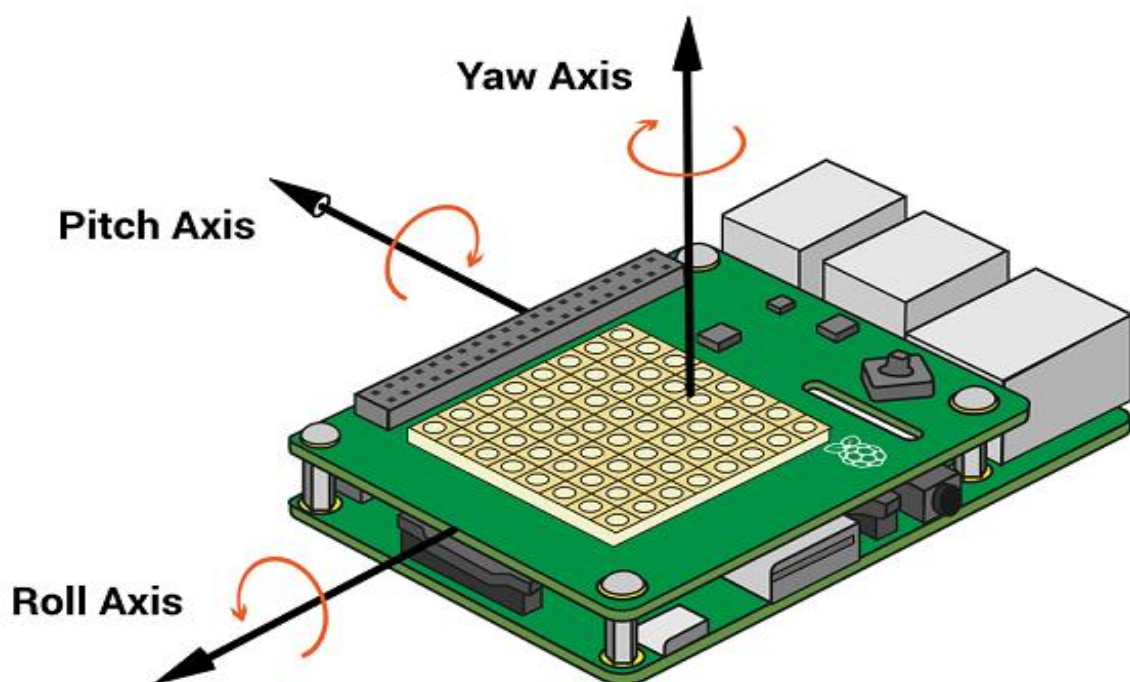


Figure 1: Raspberry Pi IMU movements supported by Sense Hat (Source: <https://projects.raspberrypi.org/>)

- What is the unit of acceleration values?

Unit of acceleration is g - earth mass acceleration (datasheet page 12).

- How is earth mass acceleration showing up in the accelerator values?

Acceleration values read using the API `get_accelerometer_raw()` tells us about the acceleration caused by the movement in x, y and z directions.

- How large is earth mass acceleration in accelerator values?

Below values of accelerations seen in respective x(accel\_x), y(accel\_y) and z(accel\_z) directions while the board kept stationary.

```
{ "timestamp": 1614971094255, "device_id": "rasp1", "moved": 1, "accel_x": 0.0143043091521, "accel_y": 0.00291351089254, "accel_z": 1.01280403137, "direction": 78.5749128534 }.
```

- What is a reasonable trigger value/function for movement?

Movement is detected for slight change for  $\text{accel\_x} > 0.1$  (pitch),  $\text{accel\_y} > 0.1$  (roll) and  $\text{accel\_z} > 1.1$  (yaw) but the reasonable trigger values we figured out are  $\text{accel\_x} > 1$ ,  $\text{accel\_y} > 1$  and  $\text{accel\_z} > 1.1$ .

- How often do we need to sample to be sure to detect movement?

We observed, continuously sampling can be done without giving any delay to detect the movement on raspberry pi.

- If we want to do the detection in google cloud, what are the cloud tools one could use to achieve this (explain the tools needed and how they connect)

We need to use all the tools as we used in detection in edge, only difference will be done in cloud side is, we must implement the code of movement detection in cloud function(index.js) . We need to remove the movement detection code from the edge. From the edge in every 10 seconds we need to send the payload instead of sending it continuously. Under the condition check in index.js we commit the changes in BigQuery.

```
if ( data['accel_x'] > 1 || data['accel_y'] > 1 || data['accel_z'] > 1.1) {
    var d = new Date()
    var cur_time = d.getTime()
    console.log(cur_time)
    console.log(data['timestamp'])
    var latency = cur_time - data['timestamp']
    console.log('Latency in milliseconds: ' + latency)
    bigquery
      .dataset(datasetName)
      .table(tableName)
}
```

Left side shows the code of detection in the edge whereas right side shows the code of detection in the cloud side.

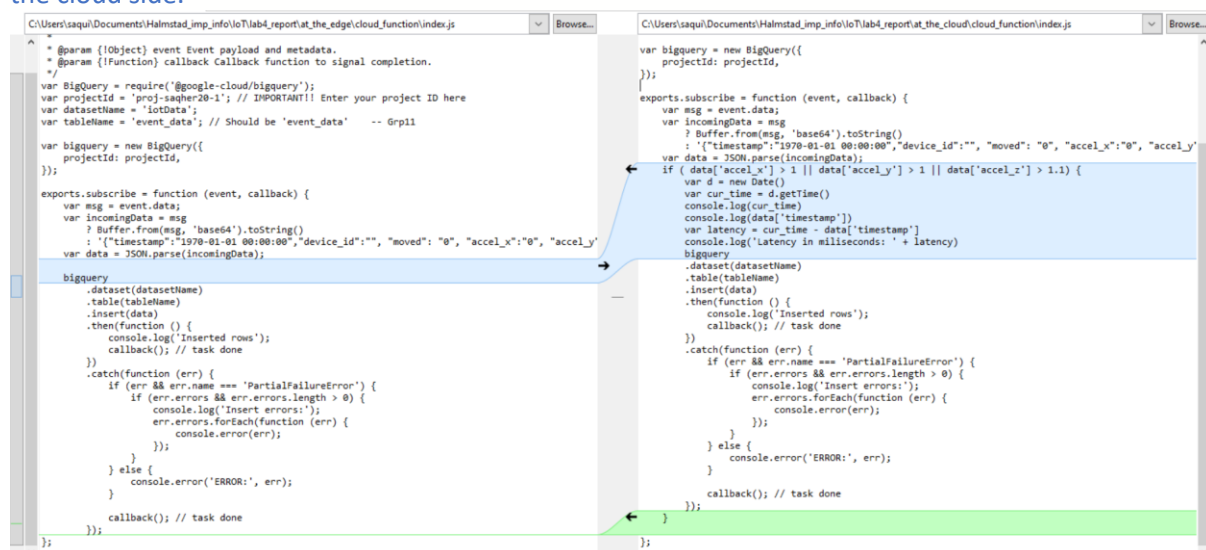
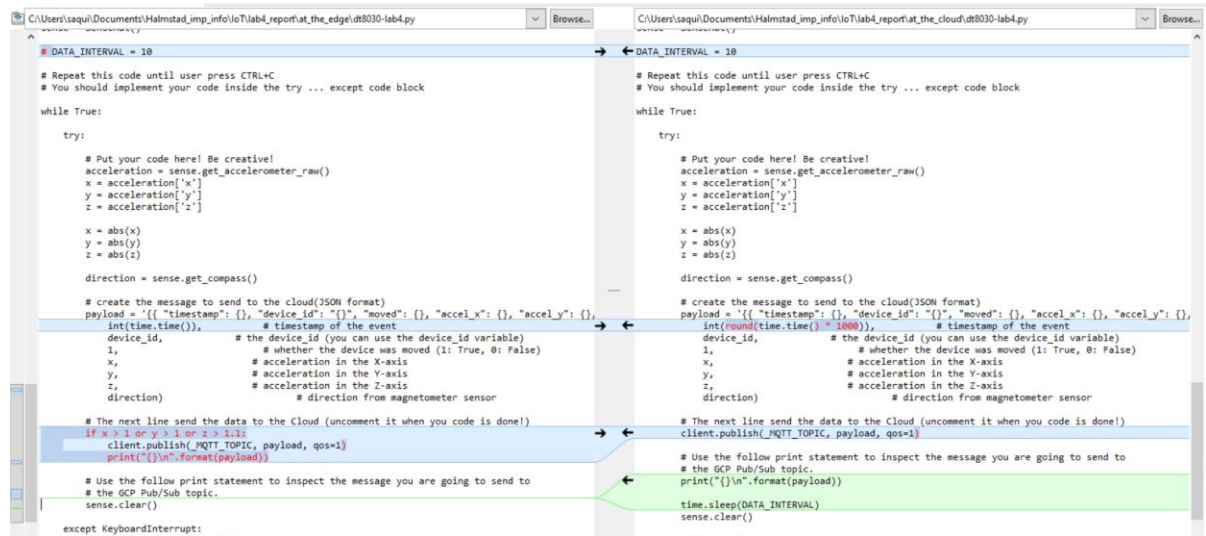


Figure 2: index.js file diff of edge vs cloud side implementation of movement detection.

and also we required to do below code changes in dt8030-lab4.py. Left side shows the code of detection in the edge whereas right side shows the code detection in the cloud side.



**Figure 3: dt8030-lab4.py file diff of edge vs cloud side implementation of movement detection.**

The estimate of the reduction in data transmission with our movement detector at the edge, compared with having the same detector in the cloud is in the order of **100ms**.

function-MovementToBQ Version 15, deployed at Mar 5, 2021, 9:58:52 P...

METRICS	DETAILS	SOURCE	VARIABLES	TRIGGER	PERMISSIONS	LOGS	TESTING
Logs Showing 50 messages Default Filter Filter logs							
	2021-03-05T20:59:24.485723811Z	function-MovementToBQ	vq2ywsb64jzm	Function execution started			
	2021-03-05T20:59:24.584753745Z	function-MovementToBQ	vq2ywsb64jzm	Function execution took 100 ms, finished with status: 'ok'			
	2021-03-05T20:59:34.541472251Z	function-MovementToBQ	vq2ybxmxb5r6	Function execution started			
	2021-03-05T20:59:34.548Z	function-MovementToBQ	vq2ybxmxb5r6	1614977974544			
	2021-03-05T20:59:34.548Z	function-MovementToBQ	vq2ybxmxb5r6	1614977974420			
	2021-03-05T20:59:34.548Z	function-MovementToBQ	vq2ybxmxb5r6	Latency in milliseconds: 124			
	2021-03-05T20:59:34.586048084Z	function-MovementToBQ	vq2ybxmxb5r6	Function execution took 45 ms, finished with status: 'ok'			
	2021-03-05T20:59:44.611345494Z	function-MovementToBQ	vq2ymzvulgp1	Function execution started			
	2021-03-05T20:59:44.792Z	function-MovementToBQ	vq2ymzvulgp1	1614977984791			
	2021-03-05T20:59:44.792Z	function-MovementToBQ	vq2ymzvulgp1	1614977984502			
	2021-03-05T20:59:44.792Z	function-MovementToBQ	vq2ymzvulgp1	Latency in milliseconds: 289			
	2021-03-05T20:59:44.885967201Z	function-MovementToBQ	vq2ymzvulgp1	Function execution took 275 ms, finished with status: 'ok'			

**Figure 4: Log message of cloud side implementation of movement detection shows delay in milliseconds**

Code changes both on the edge side(dt8030-lab4.py) and the cloud side(index.js) are attached in the zip file for both types of implementations.