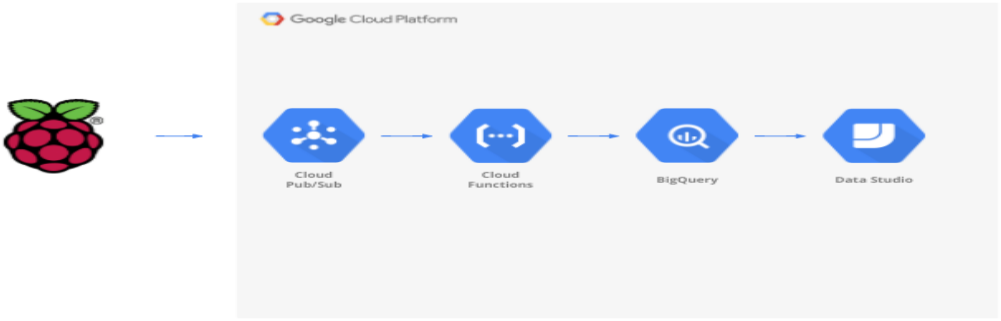
IoT Lab 3 Summary Report

Group 1

(By Hélder Monteiro and Saquib Herman)

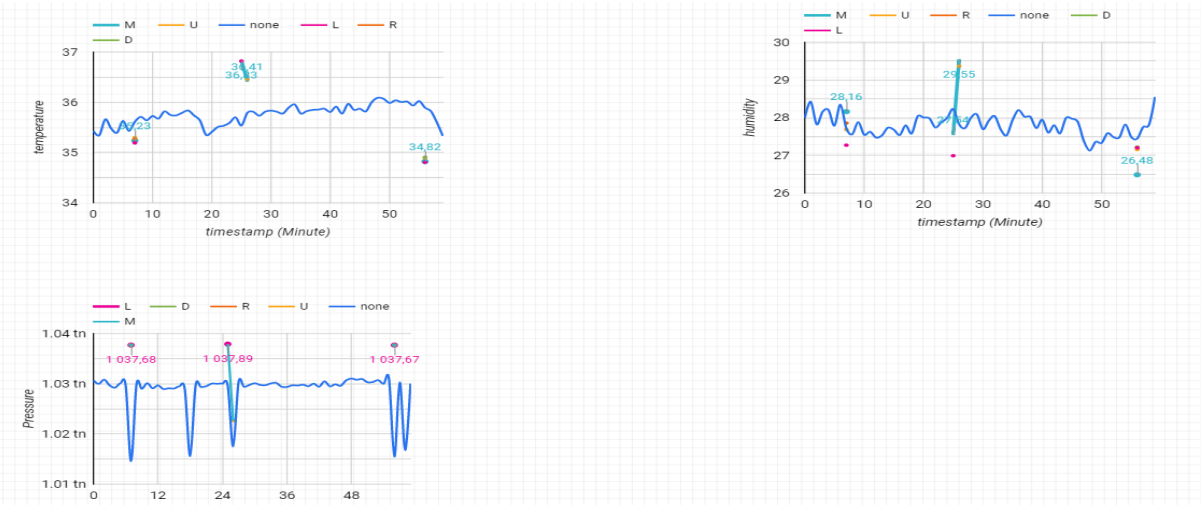


Above diagram shows the data flows from the sensor device (the Raspberry Pi) to the data storage location (Big Query).

The steps for publishing to BigQuery

- Create a Pub/Sub topic.
- Create a bucket and folder to store data.
- Create a registry.
- Create a device.
- Create a BigQuery dataset and table.
- Streaming accelerometer and magnetometer data to the cloud Query the data in BigQuery.
- Reformat the data in BigQuery.
- Connect Data Studio to your BigQuery table.
- Create a report of the data.
- Clean up by deleting dataset.

Analyzing with Data Studio



Imagine you want to include additional sensors to your system, and collect data from them (for example a GPS module which collects the latitude, longitude and altitude data). Which components should you modify to end with the data in your BigQuery Table? To simplify, let's suppose that the SenseHat provide these data using the methods "sense.get_latitude", "sense.get_longitude" and "sense.get_altitude").

Answer:

We need to add the following fields to the table:

Field name	Type	Mode
latitude	FLOAT	NULLABLE
longitude	FLOAT	NULLABLE
altitude	FLOAT	NULLABLE

Describe the steps to include an additional IoT sensor to this system (i.e., another Raspberry Pi collecting data).

Answer:

- Create a new Pub Sub Topic.
- Create a new IoT Core Registry.
- Create a new device.
- Authorize the device.
- Create a new BigQuery Table.
- Add a Cloud Function to add data from the Pub/Sub Topic to the BigQuery Table.
- Start streaming data from new IoT sensor (Create and run new script on new IoT Sensor).

How often can our program dt8030-position.py sample the acceleration (and send it to the cloud)?

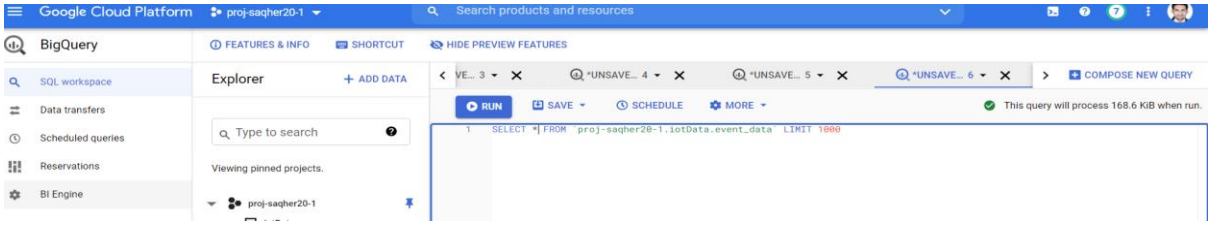
Answer: By seeing the logs it is found that for DATA_INTERVAL = 0 sample rate of acceleration data is ~ 29 times / second.

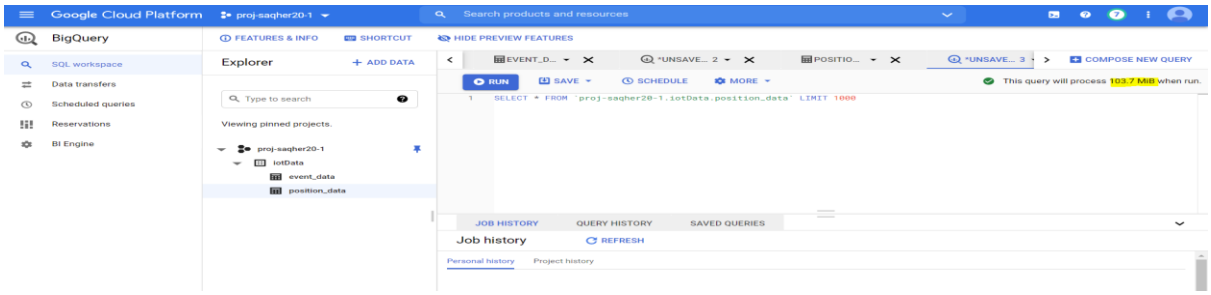
Estimate how much data is flowing in this and the earlier scenarios.

Answer: Position Data: ~ 104 MB (position data). Data type TIMESTAMP takes 8 bytes; STRING takes 2 bytes and FLOAT64/FLOAT takes 8 bytes. Therefore timestamp (TIMESTAMP), device_id(STRING), accel_x, accel_y, accel_z and direction each float would take total 42 bytes.

Event Data: ~168 KB (event data). Data type TIMESTAMP takes 8 bytes; STRING takes 2 bytes and FLOAT64/FLOAT takes 8 bytes. Therefore timestamp (TIMESTAMP), button (STRING), temperature, pressure, and humidity each float would take total 34 bytes.

Source: Pricing | BigQuery | Google Cloud





Elaborate on the possibility to reliable detect movement of the Raspberry Pi.

Answer: The IMU can be used. The IMU (inertial measurement unit) sensor is a combination of three sensors, each with an x, y and z axis.

- Gyroscope
- Accelerometer
- Magnetometer (compass)

The APIs related to these sensors allows us to use these sensors in any combination to measure orientation or as individual sensors. APIs are as below:

- get_orientation_radians
- get_orientation_degrees
- get_orientation
- get_compass
- get_compass_raw
- get_gyroscope
- get_gyroscope_raw
- get_accelerometer
- **get_accelerometer_raw** (this method tells you the amount of G-force acting on each axis (x, y, z). If any axis has ±1G, then we know that axis is pointing downwards.)