CA4017 Internet of Things
Group Project

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Planning/Research - March 20th-April 1st

Initially we opted to go for the tutorial that was provided on the Google Sheets, which was the DZone tutorial which manipulated phone sensors using an Android mobile app by the name of Rhiot. The aim was to use phone sensors and connect it to the Kibana dashboard to analyse and summarise the data, such as GPS location, accelerometers and light coming through the front facing sensor into graphs made by Kibana Dashboard. We ran into a number of issues when trying to index the data into Elasticsearch and when trying to create a link between Kibana and Elasticsearch.

However we did make a connection between Elasticsearch and Kibana eventually, but struggled to index the data from our phone sensors using the mapping.json provided in the tutorial. We think this was because they were live sensors rather than just exploiting textual data.

After some time trying to figure out what the issues were we eventually moved on and started our research phase again in search of a new tutorial. Eoin finally found an IBM Cloud tutorial which was a step by step, in depth tutorial on how to manipulate phone sensors and display them on an IBM IoT project dashboard. We followed this tutorial and were successful in completing the project.

Trello Board For Timekeeping Tags: Eoin Dunne , Alex Preston
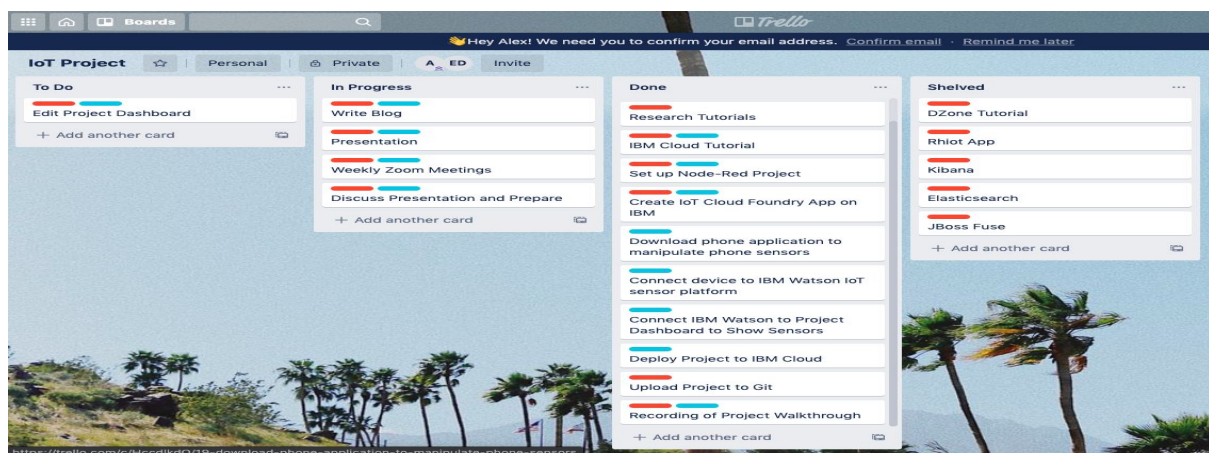
Technologies Used

Initially	Ultimately
Kibana	IBM Cloud Services
Elasticsearch	IoT Sensors Application
JBoss Fuse	IBM Watson IoT Platform
Red Hat	IBM Developers Tools
Rhiot Phone Application	Git

Initially we made the approach of using Kibana, Elasticsearch, and JBoss Fuse however we encountered multiple issues with this approach. Ultimately we decided to use IBM Cloud Services and other IBM Cloud applications.

We have never encountered these new technologies with the exception of Git. We found the IBM Cloud tutorial extremely informative and provided us with all the knowledge necessary to turn our mobile device into an Internet of Things Sensor.

Application Development - April 8th

Choosing a Cloud Service Provider
- There are many cloud services available that could host our Internet of Things Application, however we decided to deploy our application to IBM Cloud Services.
- IBM Cloud Services provided us with the necessary IoT Services to connect our mobile device to, and to collect our sensor data.
- IBM Cloud Services uses an IoT Platform called "IBM Watson". This was extremely useful when turning our mobile phone into an IoT Device.

Application Idea
- Our application was sourced from a GitHub page provided by IBM Cloud Services.
- This application is specifically built for use with the IBM Watson IoT Platform and to communicate with IBM Services for our sensor data to be captured.

What the Application does
- The application provided to us by IBM Cloud Services connects to the IBM Watson IoT Platform.
- Once our mobile phone is also connected to the IBM Watson Platform, the application captures this data and translates it into a visual format on a graph.
- Once a mobile device that is connected to the IBM Watson Platform is selected. The Application can display Historic Data and Live Data feeds straight from your mobile phone.

- Chart types can also be chosen to display the data differently. Data can be shown in,
  - Area Charts
  - Bar Charts
  - Line Charts
  - Scatter Plots
- A customisation feature is also available on the application that allows users to visualise the chart types in different formats. These include,
  - Stack
  - Stream
  - Percentage
  - Value
- An additional customisation feature also allows users to see the inclines and declines in the data by visualising this data in,
  - Cardinal
  - Linear
  - Steps
- Once the user has chosen their preferable way of visualizing the data and their mobile device is connected to the IBM Watson IoT Platform and is selected on the application, data will begin to be updated and will be translated into a visual format on the application in either live feed or historical feed.

IBM Watson IoT Platform Initiation - April 3rd

What is IBM Watson IoT Platform

- IBM Watson IoT Platform is a foundational cloud service that connects and controls IoT sensors, appliances, homes, and industries. IBM Watson IoT Platform is built on IBM Cloud, and provides an extensive set of built-in and add-on tools.
- IBM Watson was an obvious choice for a small project such as ours as it provided us with all the services necessary to connect our IoT Device (Mobile Phone) to.

Installing IBM Watson IoT Platform
- We began this on the 3rd of April. A set of steps were outlined in the IBM Cloud tutorial to follow. The first step within this tutorial was to create an IBM Cloud Services Account. This is entirely free, and was perfect for our small project.
- Once the account was created the next step was to install the Internet of Things Platform Application that's available on the IBM Cloud. This was done within the catalog of applications in IBM Cloud.
- Connecting a cloud foundry service to the IoT Platform App was also a necessary step to collect and store data effectively.
- Installing the IoT Platform Application gave us access to a vital component called "IBM Watson IoT Platform". Once this was initialised, we could then add devices to the platform and gather data that would be displayed on the platform.

Initialising Mobile IoT Application - April 6th

What the Mobile Application is
- This was an IoT Starter for Android app to read and send sensor data on our smartphone.
- We downloaded the source code for the Android Application from GitHub [2]. This is an application that was specifically built to communicate with the IBM Watson IoT Platform.
- This mobile application collects sensor data from the accelerometer on the mobile phone.

Setting up the Mobile Application
- Once the application was installed on our Android phone from the APK package that we obtained from GitHub we could then begin to initiate the connection between the mobile device we set up on IBM Watson IoT Platform and the mobile application.
- With the details and device names/passwords that we entered in on the IBM Watson IoT Platform, we then entered this into the application on our mobile device. This then initiated a connection between the two platforms.
- We tested to make sure the data was being collected by navigating to the IBM Watson IoT Platform App on our desktop. If the data was present, we would see multiple X , Y, and Z values with a corresponding time showing when the data was being collected.
- Once this data was being collected in real-time we could begin to connect it to our IoT Web Application so that the data can be visualised on a graph.

Cloud Deployment to Visualise Sensor Data - April 10th
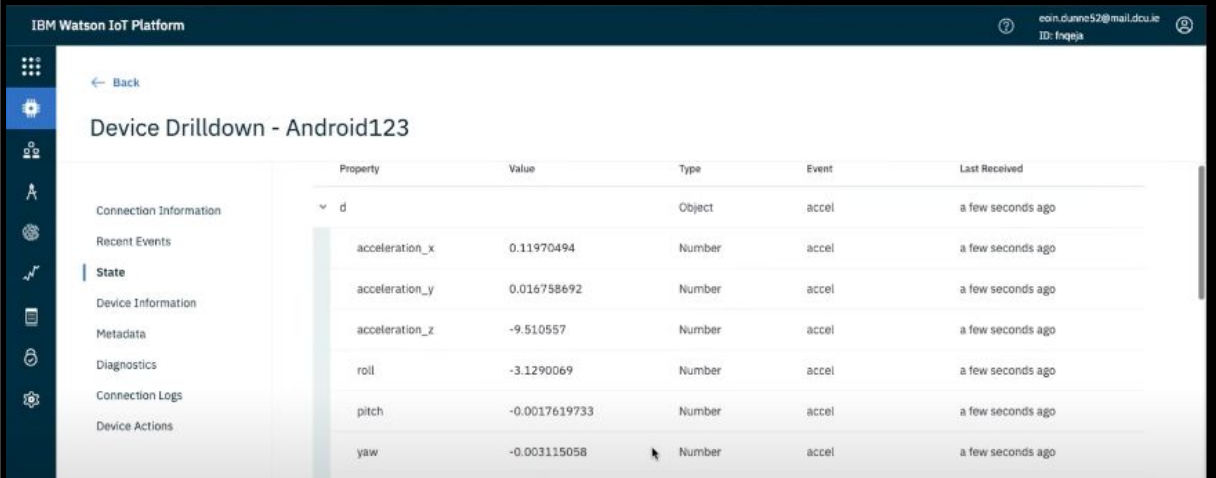
IoT Web Application Initiation
- Once our web application was installed on our local machine, it was necessary to change the mainfest.yml file in order to create a connection between the IoT Platform and our application when we deploy.
- As our region was in western europe, the closest server to host our application was London. We changed our domain to **eu-gb.mybluemix.net.**

Installing Necessary IBM Tools + Deploying
- Our deployment of the application was done through the command prompt on our local machine.
- Before deploying, we needed necessary IBM Developer tools installed on our machine so that we could use IBM functions on the command prompt.
- We downloaded these from, https://cloud.ibm.com/docs/cli/reference/ibmcloud?topic=cloud-cli-getting-started
- We could then finally deploy our completed application. This was done using the command "`ibmcloud cf push iotproject`"
- Once our application was deployed we could then access it from our new project on the IBM Cloud Platform and visit the URL that then links to the deployed app.

Testing Phase - 12th April

We tested the system by connecting new phones and seeing how the platform reacted to moving the phone around. We knew that the IoT sensors were connected when the data showed up in the live feed on the IBM Watson platform. Phone sensor data changed as we moved the phone around. X, Y and Z accelerometer data changed as we moved the phone up, down and side to side.

We then had to check if this data was connecting to the IoT project dashboard and if it was importing the data into the graphs. We knew that the IBM Watson platform was indeed connecting to the project dashboard when the live data started streaming in and this screen was visible:

Problem Encountered and Solutions

Rhiot App.
- The first issue we encountered was using the DZone tutorial mentioned above. We ran into numerous issues when trying to connect the Rhiot app to Kibana Dashboard to analyse our phone sensors. The tutorial was very vague and didn't have much detail at all so after about 15-20 hours of work we finally gave up and decided to move onto a new tutorial. Our solution was finding an IBM cloud tutorial which had a step by step process and a very detailed description of each step.

Wrong Node-Red extension
- Once we got started on the IBM Cloud tutorial we noticed that the tutorial was slightly out of date and the same Node-Red extension was not available for us to use. We decided to choose one Node-Red app from the IBM catalog but it turned out to be the wrong extension. We noticed this when we had to change the mapping for the Node-Red app to connect to our IoT project. To fix this issue we started the project again and chose the other Node-Red extension available on the IBM Cloud catalog.

Phone Sensor Application
- Finally we had an issue with connecting the phone sensor application to the IBM Watson platform. This caused huge issues as we could not connect our phone sensor information to the IBM Cloud platform and the data could not be displayed. To fix this issue we updated the phone we were using and the application started acting correctly. We believe our phone version was too outdated to manipulate the sensors using the application in which we had downloaded.

Conclusion

Overall the project was a great learning experience. We ran into a number of challenges and worked as a team to overcome them, through research and using a number of online tools such as YouTube and stack overflow to help us along the way with any issues. We learned how to use a number of new tools such as Kibana and Elasticsearch, even though we were not successful with both, we know more about them now then we did previous to this assignment. We now know that we can manipulate sensors from our mobile phones and send the data to an online platform and analyse the data through the use of various applications. There are a huge amount of sensors we could now go on to manipulate, such as PC or GPS sensors for future projects.

We worked and recorded our tutorial separately due to Covid-19 through the use of a number of collaboration tools such as Google Docs, Gitlab for sharing files, a Trello Board to allow us to keep track of what we had to do and when and finally Zoom for meetings daily/weekly whenever we needed help with any issues we ran into. Eoin used his fantastic editing skills to combine both of our separate tutorial videos into one allowing us to upload it as a single video to YouTube for optimum efficiency.

References

IoT Deployed App:
 https://github.com/ibm-watson-iot/rickshaw4iot

[2] IoT Starter Application:
 https://github.com/ibm-watson-iot/iot-starter-for-android

IBM Cloud Tutorial Link:
https://developer.ibm.com/technologies/iot/tutorials/iot-mobile-phone-iot-device-bluemix-apps-trs/

IBM Cloud Tutorial Step 1 Link:
https://developer.ibm.com/tutorials/how-to-create-an-internet-of-things-platform-starter-application/

Youtube Tutorial:
https://www.youtube.com/watch?v=qhcsUTfqeOk

IBM Developer Tools:
https://developer.ibm.com/

DZone Tutorial:
https://dzone.com/articles/how-to-exploit-all-sensors-of-your-mobile-phone-as-1