Advanced Technology Attachment Programme (ATAP)

Interim Project Report

at

Intra Technologies Private Limited

Reporting Period

6 Jan 2020 to 19 June 2020

by

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Project Title: Web Dashboard Designing
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Summary

My internship focuses on Full-Stack Software Development to build interactive Web Dashboards. The purpose of these Dashboard's is to serve as administrative systems that administrators can use to interact with the Database and perform complex operations with ease. This involves me following the Requirements/Specifications for the software and implementing it using Software Design Patterns. I am also gaining a deeper undertanding of Software Architectures of Web Applications, by working on all layers of the application from Database modelling using firebase, backend using Node and the User interface using VueJS.

Subject Descriptors:

D.2.1 Requirements/Specifications

D.2.10 Design

D.2.11 Software Architectures

Keywords:

Web Dashboard, Databae, Testing and Debugging, Web Applications

Implementation Software and Hardware:

VueJS, Node.JS, Javascript, Firebase

Contents

1 Introduction

1.1 Background and Organizational Structure of Host Organization

I am doing my ATAP at Intra Technologies Private Limited, a software development house start-up that has a few self-initiated projects. The CEO, COO and CTO work together to manage the timelines, business development of these projects. The projects the company has initiated include Lemon and Rest. I am currently focused on developing software for Lemon, with the CTO as my supervisor.

1.2 Principal Activities of Host Organization

Intra Technologies is a start up that has projects that capitalise on opportunities in various markets.

Lemon serves to offer additional services to customers who hail ride sharing services such as Grab or Gojek. In their pilot trial, customers can buy various items from within the vehicle. Lemon is the main focus of the company now.

Rest is a service that allows customers to book Hotel Rooms in advance or with short notice from its platform to maximise convenience. Additionally customers can pay by the hour for said rooms, and can choose from many established Hotel partners that Rest has.

1.3 Training Programme within Host Organization

As the company is a start-up, the structure of the organization is not fixed and we are asked to be open to changes in said structure. Nevertheless, I am considered to be part of the software development team supervised by the CTO. Intra Technologies provided various Udemy courses [**?**] on Software Development for interns to learn using. These courses aim to help us familiarise with the tools that will be used to build the platforms for Lemon and Rest.

2 Training Schedule And Assignments

2.1 Training Schedule By Month For The Entire Training Period

The training schedule is depicted in the Table below 1. This schedule was developed by my supervisor, and is a rough guideline at best as the objectives of the company are evolving. As such there may be important tasks that crop up that I may need to work on.

Table 1: Training Schedule

Task	Metric	Month
Familiarise with VueJS and Firebase, Start developing Inventory Management System (IMS) in the Lemon Dashboard	Integrate User Interface with backend	Jan
Continue Development of IMS and conduct developer testing	Accuracy of Lemon IMS flow based on given Requirements	Feb
Working on backend to track earnings of drivers involved in Lemon earnings	Accuracy of payment flow	Mar
Integration Testing of Lemon Dashboard with other Lemon platforms	Robustness and latency	Apr
Collect user feedback from pre-pilot trial and work on improving the dashboard	Speed and responsiveness	May
Deploy using Docker and open-source CI/CD system	Robustness	Jun

2.2 Training Assignments Completed in 1st Month

My first sub-task for the month was to familiarise with VueJS and Firebase. This was a manageable task as I had previous experience in Javascript and Backend-as-a-service (Baas) tools such as Firebase. The main takeaways from the Udemy course was routing, authentication, state management and design patterns in VueJS. It also introduced me to the Model-View-ViewModel (MVVM) architechture that that the framework uses. With the help of the course, I built a simple location based chat application shown below.

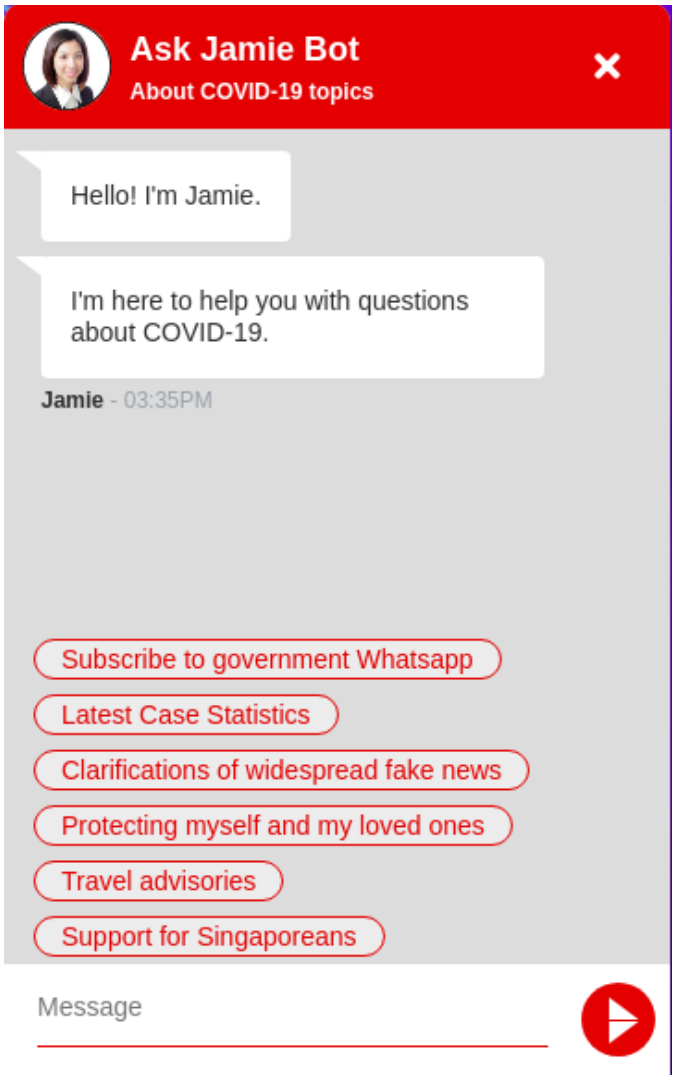

Figure 1: Location based chat application

After which, I started work on the Inventory Management System (IMS) for the Lemon Project.

This constituted developing the user interface to help administrators perform create, read, update and delete (CRUD) operations for inventory items. As such I also began interacting with the Database to perform the CRUD operations.

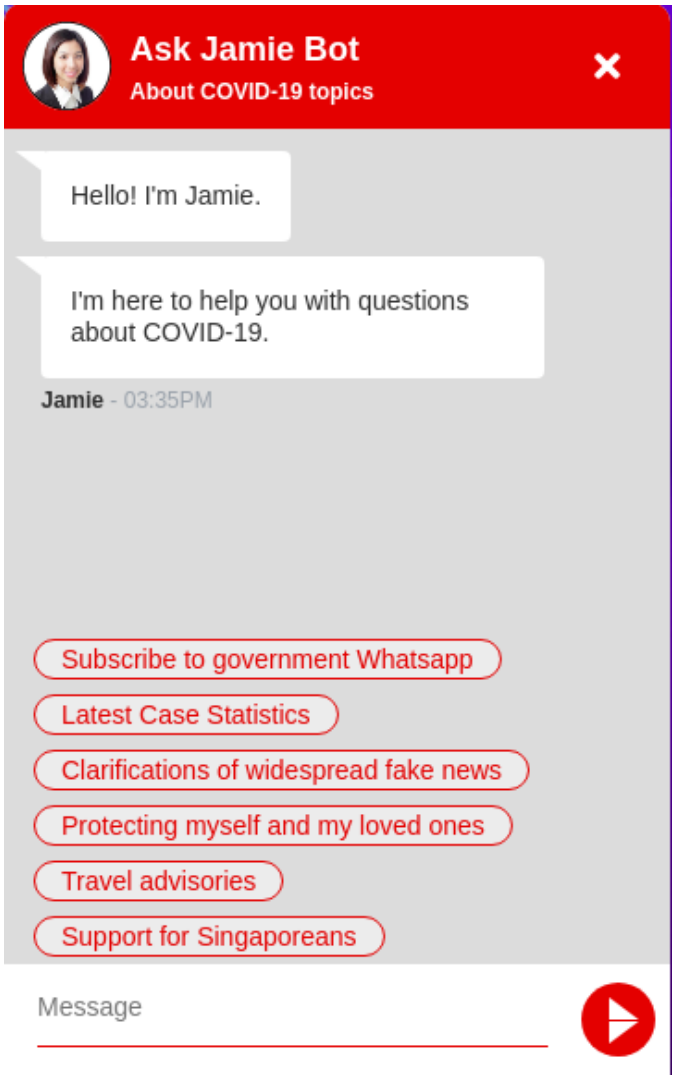

Figure 2: Inventory Management System: Shipments and Suppliers

2.3 Training Assignments Completed in 2nd Month

In this month, I continued my main task of developing the IMS. I completed work on integrating Suppliers, Shipments and Inventory to the IMS. The increasing complexity of the code base helped

me improve important web development techniques such as introducing asynchronous programming and a more advanced state management pattern.[?]

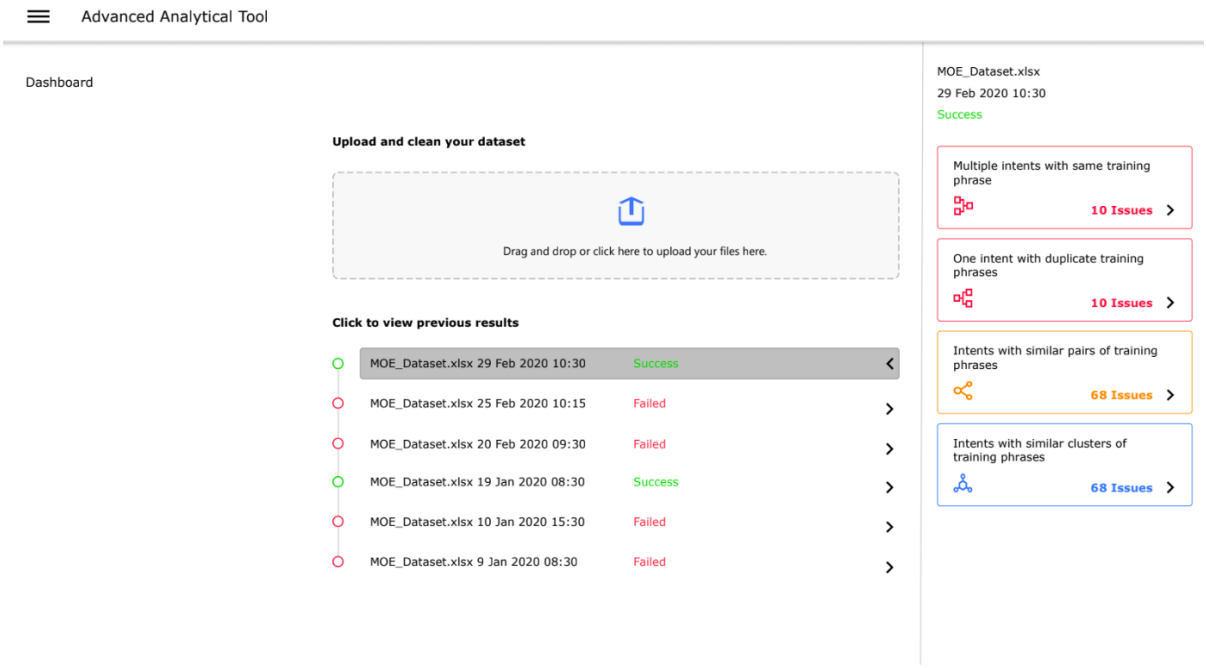

Figure 3: Inventory Management System: Inventory

My second main task was to perform developer testing for the IMS. Through developer testing of the IMS my supervisor and I discovered errors in the code where the behavior did not match the specifications in the requirements. As such I performed bug fixes and deployed them as well. This process also helped me improve the efficiency in which the front-end code manipulated the Domain Object Model (DOM).

2.4 Training Assignments Completed in 3rd Month

One task I completed was working on the backend code in Node.JS for the payment flow. Drivers enrolled in Lemon's pilot programme are to be paid by customers. In the case of credit card payments, Lemon uses Stripe [?] as its payment gateway to facilitate payments. Software Development Kits (SDK) such as Stripe use Webhooks to perform actions once payments are successful. I was expected to test these webhooks and ensured they behaved as expected in various situations. My supervisor also tasked me with optimising the payment flow, such as improving error handling

with the client side, and updating driver earnings after each successful cash or credit payment. Subsequently the backend code was deployed to Firebase.

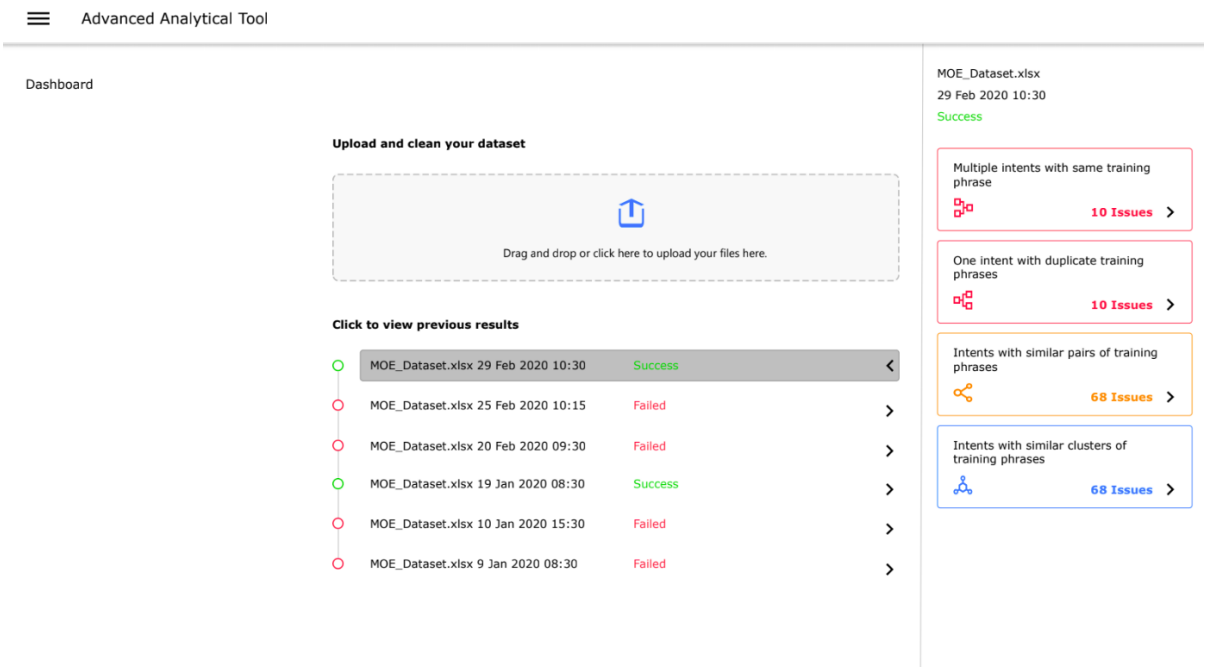

Figure 4: Driver earnings UI

Another task I completed was securing the Database. I wrote Firebase security rules to ensure that certain collections in the NoSQL Database collections tree are protected from unauthenticated users. This was imperative for the pilot trial of the system.

3 Knowledge And Experience Gained

3.1 Technical Knowledge Gained From Assignments

The first technical knowledge I gained was learning about NLP. I had the opportunity to learn different unsupervised clustering techniques, such as HDBSCAN, Agglomerative, and DBSCAN. I also had hands-on experience with Tensorflow and PyTorch to use BERT and ALBERT to convert text into embeddings. Another opportunity I had was to do Topic Modeling for positive and negative sentiments with one of the datasets using Gensim and Mallet. I later learned about using TextRank as an alternatives for Topic Modeling. One of the biggest challenges I faced is the memory usage and computational time. Currently, I have a fairly large dataset that consumes over 200GB of RAM for the unsupervised clustering and overs 6hrs of computation time for one of the NLP steps. I am still investigating how I can optimize the pipeline to handle large dataset more efficiently.

The second technical knowledge I gained was developing the web-based platform from scratch. I also had to do mock-ups and conduct user testing to check whether my designs would be intuitive for end users. Having taken CS3216, I wanted to apply the technologies and practices I learned from my seniors when I worked on projects with them. I am current using ReactJS with Typescript, Flask, and MongoDB. The application is deployed over Docker. As the platform is still in development, I may be able to explore Kubernetes and GraphQL later in the project for better support. Finally I also integrated a queue based system using RQ to managed processes that requires long computation time in the background.

3.2 Organizational/Industry Experience Gained From Assignments

The first industrial experience I gained was sharing my NLP results with government agencies. The very first presentation I gave was to MOE, but that was a last minute notice and I did not have any slides prepared. During the meeting, I could tell the audience could not follow. After that incident, I prepared a PowerPoint template to share my results that is easy to understand for end users. When I finally presented my results to MOE and IRAS again, there was a huge difference and the audience were asking questions that showed they understood my sharing. Most importantly, the

government agencies know how to use the CSV files to clean their chatbot's dataset.

The second industrial experience I gained was working with the team. My team has daily stand-ups which I was unused to at first, as I was clueless the first few weeks and did not know how to report my activities in NLP. After asking around and observing how others report, I was able to. My team also uses JIRA to track issues and also uses it for sprint planning. It took me about a week to adjust because I do not use such platform often in school. The most exciting part was emergency request to develop a chatbot within 2 days to disseminate information about masks due to the Coronavirus situation in Singapore. I first-hand saw how a single developer was able to build it in 2 days. Even though I training the chatbot through DialogFlow that 2 days, I helped out with redesigning the chatbot interface, scraping MOH web contents to populate the statistics into the database, and automating the regression testing for the training dataset.

The third industrial experience I gained was understanding the terminologies that government agencies used. In my first team meeting, the Director was present to supervise the team's progress. During the team meeting, there were many acronyms thrown that left me confused. I was not familiar with many of the government agencies and little did I know the purpose of each of these agencies. However, I was able to follow the conversations in subsequent meetings as I became more familiar with the terminologies.

3.3 Areas of Applicability of Knowledge And Experienced Gained

NLP is a niche field in Machine Learning and Deep Learning, but is growing rapidly. NLP has directly applications to any projects related to developing chatbot and understanding consumers' sentiments. The concepts and skills in Machine Learning and Deep Knowledge, however, is applicable to other fields, such as Computer Vision. As I hoped to develop a talking robot that can conversational capabilities of a human one day, I believe the NLP skills I gained at GovTech would help me in future.

4 Conclusion

4.1 Summary Of Work Completed And Training Received

The training I received was learning about the project's background and the skills in NLP.
One of the major work I completed is setting up the NLP pipeline that can easily integrate into the backend code.
The second major work I completed is the setting up the backend endpoints to fetch data from database.
Other works I have done include topic modeling, web scraping, user testing with mockups, queue system for pipeline, sharing NLP results, redesigning chatbot interface, automating regression testing, and training chatbot with DialogFlow.

4.2 Problems Faced

One problem I am investigating is how I can optimize the NLP pipeline to handle large datasets more efficiently as the current computation time and memory usage is unfeasible for long term usage.
The second problem I am exploring is to optimize the platform for production-ready software. I plan to integrate Kurbenetes and GraphQL into the platform in future.

4.3 Assessment Of Training Experience And Concluding Remarks

I enjoyed learning about NLP. In fact, I am learning how to use NLP for foreign languages, since I am also learning a foreign language currently. I hope to have opportunities to learn Natural Language Understanding (NLU) in chatbot if the project caters for it. Besides my current team, I would be joining another team to work on Robotics and Artificial Intelligence. I cannot wait to learn more about Machine Learning and Deep Learning in the other team.