OLLSCOIL NA GAILLIMHE
UNIVERSITY OF GALWAY

Driving analysis application for commercial fleet sustainment and replacement selection.

College of Engineering and Informatics

BSc – Computer Science & Information Technology

CT413 Final Year Project Definition Document

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1. Summary

This project definition document aims to provide an overview of the

The purpose of this project is to create an intuitive and useful driving data analysis tool for use by commercial entities. The primary aim of this tool is to contribute to the decision making process surrounding the sustainment and replacement of commercial fleet but also has potential secondary applications in the provision of data for other business related processes like taxation returns.

2. Project deliverables

#	Deliverable	Date
1	Project Definition Document	11th November 2022
2	Final Project Report	1st April 2023
3	Project Demonstration & Viva Voce	3rd – 6th April 2023

3. Project inspiration

During the course of my Professional Experience Programme(PEP) placement with Manna.aero, an Irish drone delivery service provider I saw first-hand the importance of data for modern day firms both in terms of regulatory requirements and its' use in driven decision making. An example of data driven decision were the selection of only certain craft which had passed the required number of test flights to be certified for operations i.e. reducing the likelihood of a critical system failure during flight operations. I also saw the importance of the human factor for the successful operation of a logistical system that cannot be fully extrapolated with vehicle telematics. From surveys carried for Manna in partnership with Tesco we tailored our product to cater to consumer feedback. For example customers wanted a simple, quick user interface so instead of picking individual items a wide variety of bundle options were implemented e.g. the breakfast bundle which contained bacon, eggs, pudding etc. This experience showed the usefulness of data but also that for success the human element of a service cannot be ignored.

Tumultuous conditions the world has experience in recent times. In Ireland we have weathered the brunt of the covid-19 pandemic although its effects are still felt. The unique conditions of restricted liberty experienced here and similar conditions still being enacted in certain areas of the world exposed some hard truths. In normal times some of these truths would be overshadowed and disregarded since they are unpalatable and do not fit our often rose-tinted vision of our society. One such truth is that we project a view of our economy through the lens of firms in software and pharmaceuticals exporting high value goods while simultaneously driving growth and jobs in the country. We style ourselves as leaders in innovation and the 'green transition' which in some respects we are but when you remove the lens of the Irish Development Agency(IDA) which occurred during times of covid we received an x-ray view of the economy i.e. the gritty back end on the economy which sustains the others. That is the hospitality, waste, shipping, agriculture, utilities and construction to name but a few. The focus of my project is the logistics sector upon which

we rely so heavily but especially during covid to deliver our packages, groceries, medicines amongst an infinite amount of wants and necessities. In essence we like to view the economy as a pharmaceutical worker in a white lab coat but the reality is that the economy looks and smells like a diesel powered lorry whose contents be it food, medicine or oil underpin the economic activity and the standard of living we enjoy in this country

We are in the midst of a period of very high inflation with Irish inflation running at 9.6%, far in excess of the ECB target of 2%. This due to a variety of factors such as supply shortfall and pent-up demand in all sectors arising from the disruption to world trade caused by covid-19. Also the war in Ukraine has caused energy and fuel inflation to skyrocket in Europe. All of this means that firms are facing higher overheads and tighter margins. Consumers have relatively less purchasing power and in many cases are cutting back on spending. Logistics firms to avoid raising prices to untenable levels for their customers need leverage technology to keep costs under control. It is no longer tenable to remain ambiguous as to specific reasons behind growing overheads and crucially the means to mitigate against this.

Social pressure on firms to reduce their carbon footprint has been steading growing since the turn of the millennium and this has been heightened by recent uncharacteristically severe weather events e.g. wildfires in Australia and flooding closer to home. Fortunately there is a synergy between the two goals of becoming more environmentally friendly and cutting costs in that reducing one's carbon footprint be it on waste, electricity or fuel also very often means savings on those overheads which is good for business sustainability.

In summary I have explained my view of how important 'behind the scenes' economic activity such as logistics are to our economy. I have detailed the various challenged firms in this industry face such as inflation and declining consumer outlook and my placement experience gave me first hand insight into how data and human feedback can be leveraged to improve a service. The combination of all these factors point to a real need for innovative solutions at the business level now rather than waiting for other firms to do so on your behalf. That is to say we know electric trucks and other cleaner fuels will be used in the future replacing diesel equivalents but that technology is still in development and businesses cannot soak losses until such time as they are ready to incorporated.

4. Project Idea

Outside of college I am a commissioned Officer in Irish Defence Forces which has gained me a lot of valuable experience. One of the main challenges I have faced planning any military tasking outside of the base installation is the means of getting your people and equipment to and from that area of operations. For example ferrying recruits to military training area for an exercise or repairing radio equipment located on radio masts which are often located in remote mountain areas. Within the Communication and Information Services(CIS) Corps unit which I help lead we have several types of vehicles from 4x4s, crew-cab jeeps, flatbed truck and large work vans with ladder cages. This is a broad spread of vehicles to enable us to tackle any mission we may regularly face. Vehicles are used to varying degrees and as such the unit maintains a log of the timings vehicles were signed out for use, the appropriate tasking and the journey distance as per the odometer. It is here I first thought about the loss on information regarding the routes taken, duration of journey, load factor. As the saying goes “what’s measured get managed” and I believe that digitisation and dissemination of this information could provide insights as to how the unit is functioning and possible better ways to deploy resources.

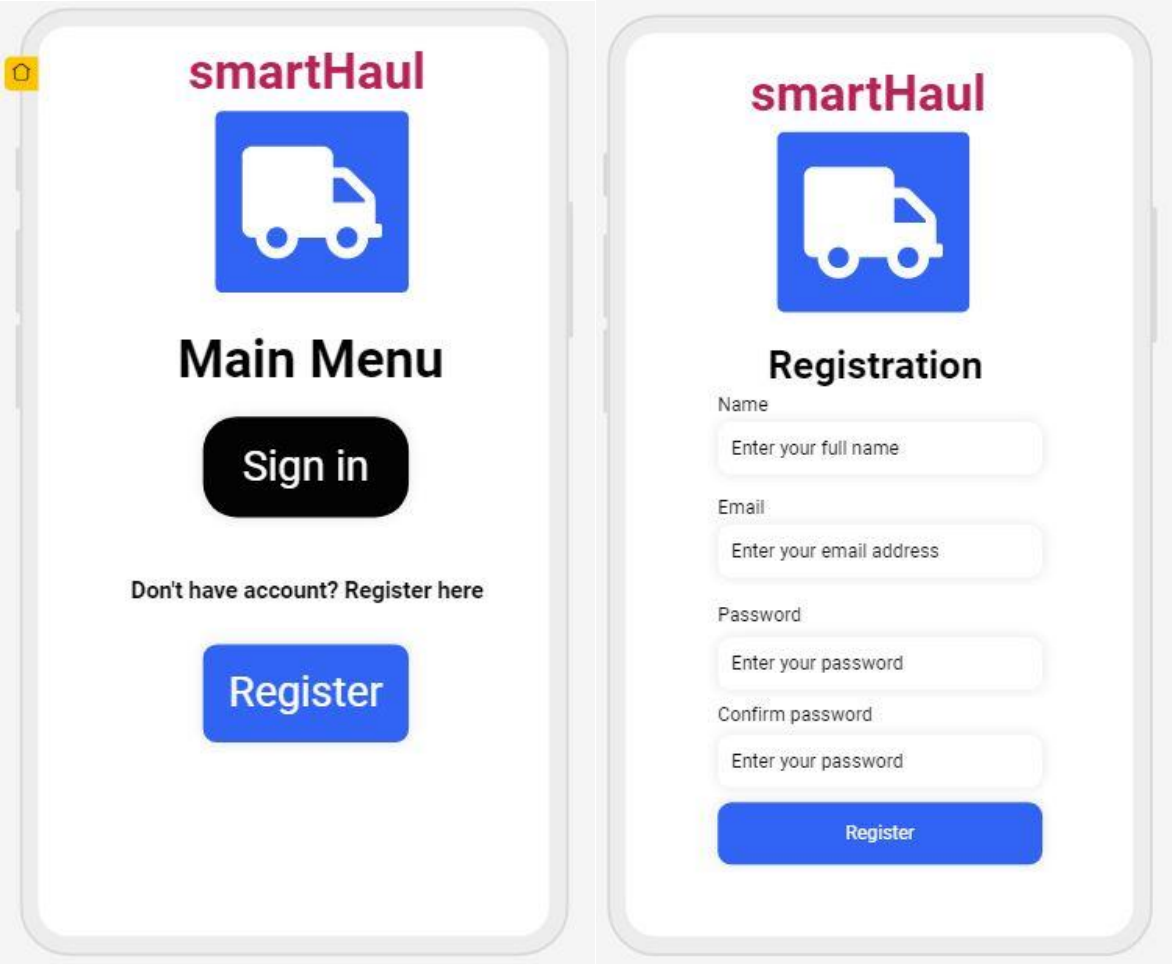
After some reflection I began to think the Defence Forces might not be the best organisation to design a solution for because we as an organisation who are not motivated by profit are forced to strike a balance between efficiency and utility i.e. not the just the right vehicle for one task but sometimes a vehicle that is capable of many different tasks and more robust for the environments we work in. I turned my attention towards logistics firms who often large fleets, are motivated by margins and also is a much larger target market. I believed they might also suffer the same loss of data that we in the Defence Forces do in terms route data, duration and load factor. Research revealed that vehicle telematics market is rapidly growing with major players such as Amazon developing their own solution to this problem.

My idea is for an application which seeks to uncover factors and provide actionable data for firms. The data will be collected by means of a telematic enabled device and a possible manual questionnaire by the driver to ensure a robust information collection strategy is maintained. The data will then be analysed to highlight opportunities for the business to enhance logistics efficiency. For example this could be the upsizing of a delivery vehicle model on a particular route to better reflect the average load factor which reduces the occurrence of secondary delivery runs to the location. A manual questionnaire might reveal that a particular delivery tasking is being subjected to anti-social behaviour like stone throwing which is a risk to employee health and company property.

5. User application flow

The users of this application must have internet enabled device e.g. smart phone or tablet in order to access and the below mock ups show what the web application will look like to a great extent.

#1 #2



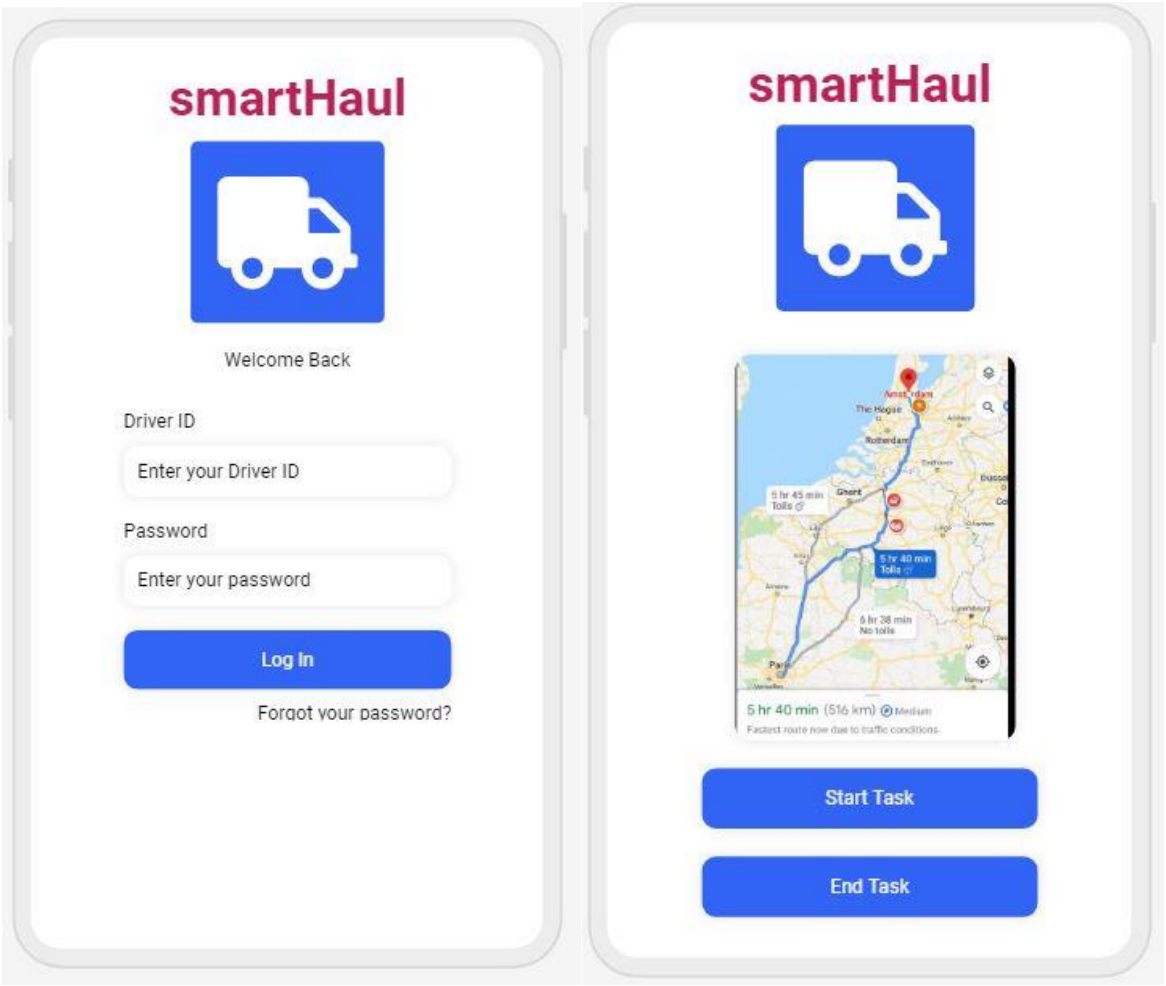
#1 Main menu

The user once they open the application will be brought to the main menu where they can sign in or register their credentials for taskings.

#2 Registration

The user must provide their email address and password for their login.

#3 #4



#3 Sign dashboard

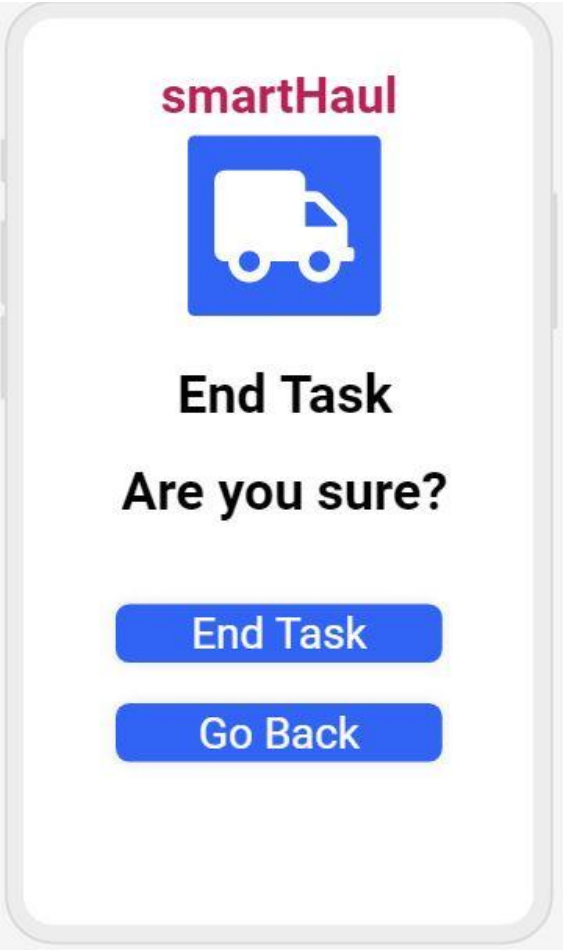
The user will enter their unique driver ID which is provided by the company and their personal password to sign in.

#4 Map tasking dashboard

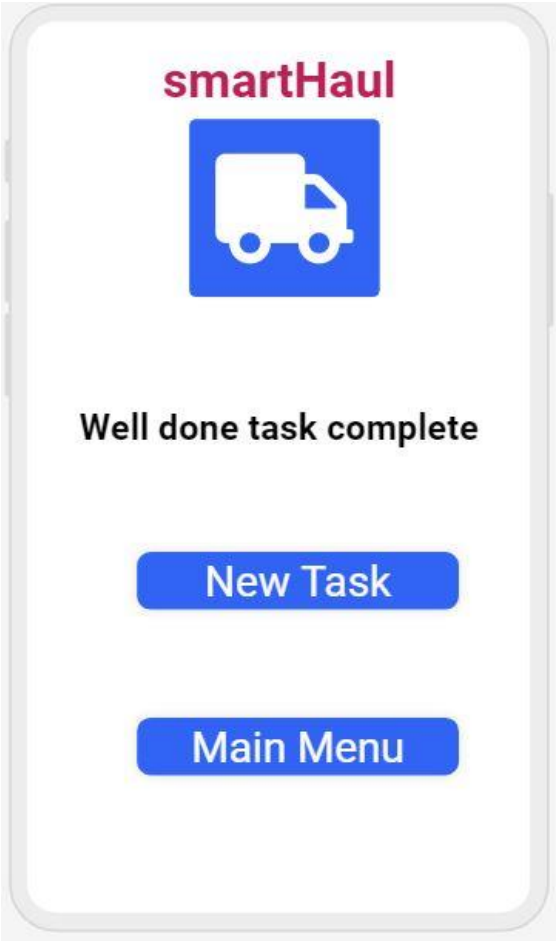
The map tasking page will include a Google Maps plug in and the user may utilise the directions features for navigation purposes.

Buttons will likely be present to begin the tracking process and to end it once the vehicle and relevant cargo has reached their destination.

#5



#6

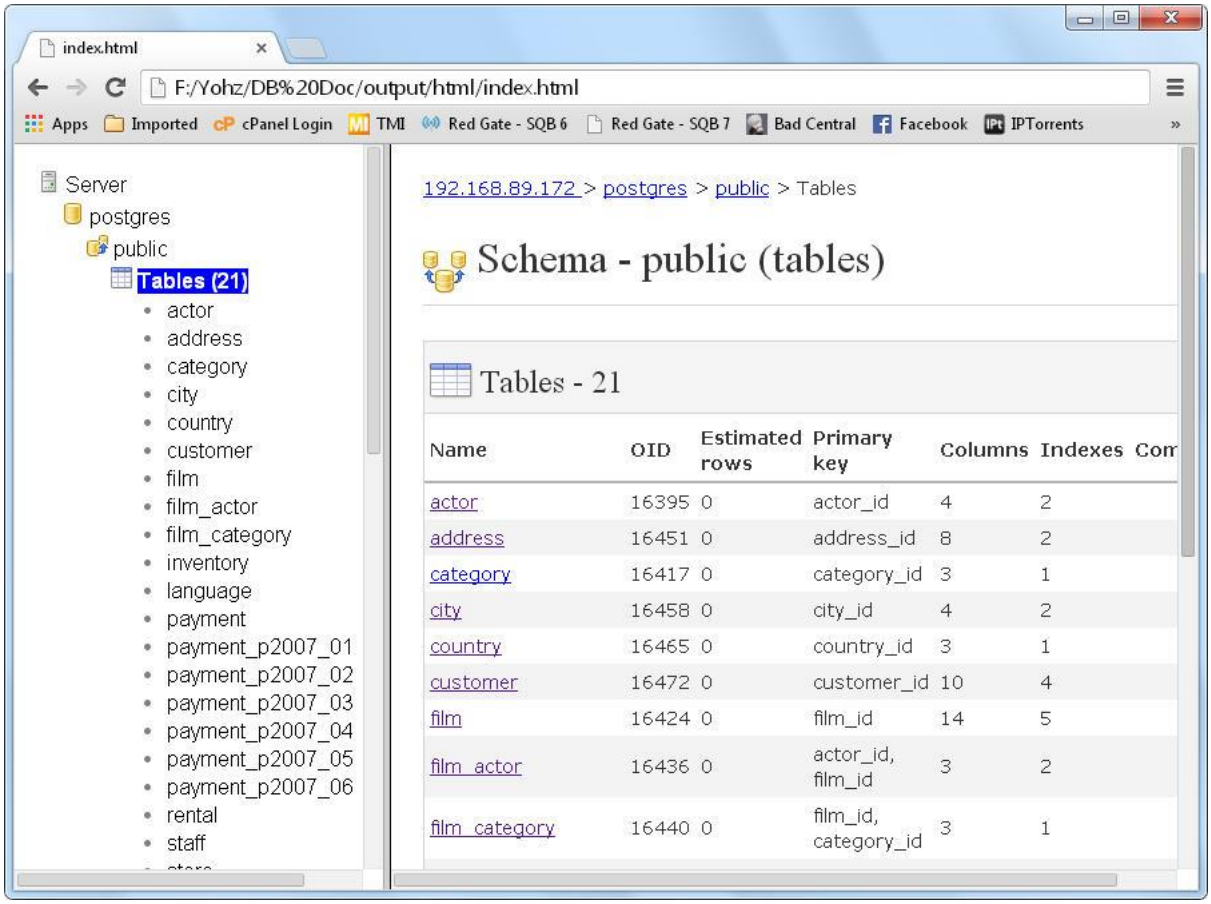


#5 Task end confirmation

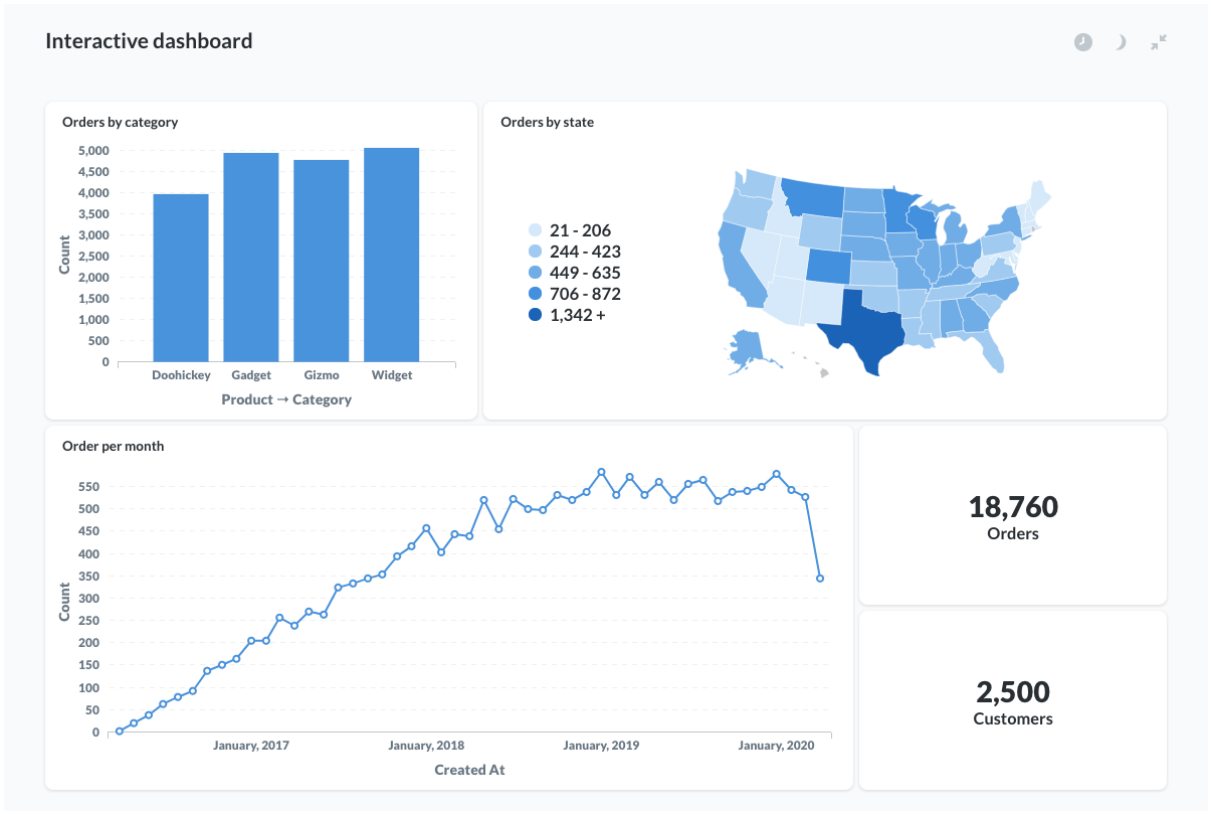
In the case the user accidently clicks the end task button a fail-safe feature is present to ensure that delivery tracking process is not ended prematurely.

#6 End menu

The user then has the option to begin a new tasking or to sign out and be returned to the main menu shown in #1.



Sample of a database to which delivery tasking data will be persisted.



Metabase dashboard sample

6. Project Design

There are several facets to the design of this application. Firstly the application which will be on the internet enabled device used by the driver of the vehicle in this case. I made use of Uizard, an application design tool to visual the work flow of the application which will mainly be mobile devices from main menu, registration and the tracking page to ensure the design was intuitive and easy to use. Secondly from my previous experience in the military and also work placement with Manna.aero I believe it vital to have a means of displaying the relevant information to non-technical members of the team in particular senior managers. For this purpose I aim to utilise Metabase which is an open source data visualisation tool that I used with Manna to display flight and customer review data which was stored in a relational database.

The data will be drawn using a plug in from google maps which will influence the means of data collection. Google provides an intuitive development platform to help users implement to fullest extent Google Maps functionality however it is naturally biased towards recommending it's own services such as Firebase for hosting and data storage.

7. Technologies & Implementation

Platform

I firstly considered the development of a mobile application e.g. android as a means of tracking the driving data since the majority of drivers would normally utilise this service on their mobile phone anyway either in their professional or personal lives. However upon further research I discovered that it very common for delivery drivers to have laptop and tablet devices in their vehicles. Tablet devices in particular are used for storing electronic manifests and checklists. As a result I will design a web application to ensure the widest possible target market is catered for. I have previously developed a food delivery application like JustEat and found it worked very well with plenty of material available to aid in the process. Metabase will be platform used by management to view data collected.

Programming Languages

I envisage Java be the primary language used in the backend of this project. It is my primary programming language and the language which I used when parsing data on my placement with Manna. I also however see other relevant skills in web development i.e. Javascript, Html and CSS being incorporated as part of building the web application. Finally For handling data I will be implementing an SQL database or variant of same such as Postgresql.

Version Control

To facilitate orderly version control I will be making use of GitHub as throughout the computer science course and my industry placement I have been exposed it to a large extend. I will ensure that my project supervisor Dr Seamus Hill will easily be able to review my progress and suggest changes in real time. Finally should something go wrong it will then

be possible to revert back to a stable working version from which I can continue to build from. Github is used industry wide so I stand to benefit from gaining experience manging a project in it.

Hosting

I envisage Google Firebase being used to host my web application for continuity purposes given that I will be utilising Google Maps functionality and I have worked with service previously. As well as hosting it possible to use Firebase database functionality and user authentication. There is also Github integration and other services such as Testlab, a sandbox testing environment which can contribute to the project's development going forward.

Project Management

From discussion with Dr Hill my project supervisor we have decided that the scrum methodology would be an appropriate means of ensuring the project stays on track. I have been exposed to this both from a theoretical and practical standpoint. Trello boards I find to be an effective means of managing tasks or sprints and associated deadlines and so I will make use of this software again throughout this project. Since the timeline for the project has not been fully fleshed out it is not possible to include it in this report.

Sources :

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https://aws.amazon.com/iot-fleetwise/

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