Information Systems Development & Management

Developing an Information System

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Word Count: 4,441

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1.0 Executive Summary

The goal of this project is to deliver a fully functioning online presence for 'Horizon Motors ltd' to automate the business and establish a Web presence, to have an information system that lists available new and used cars, commercials and rentals, along with the services available. All information on the number of seats, doors, engine capacity, power, range, speed, price, tax (on purchase and annual), etc., will be available to prospective customers. Rentals will also be displayed with the terms of the contract such as duration, required deposit, and so on.

The system will collect buyer information such as preferences, the price range that they can afford, and personal information (name, address, etc.). Preferences include size, style, power, and the like. Staff can generate reports from collected data to make informed decisions regarding the business in the future.

This system will be able to match buyers' preferences with new cars available, or sellers' offerings and, if it cannot find an exact match, the system will offer the closest matches. The system will be able to assist buyers and sellers alike.

If buyers from other locations need help in choosing a local service agent, the system will provide a list of competent mechanics complete with personal information such as name, phone number, and credentials. Sellers may contact the 'Horizion Motors ltd' tea, for advice on setting the price, marketing the car, selling the car and closing the sale through the system.

The system will be secure, reliable, and fit for purpose.

This project will start with a background into 'Horizion Motors Ltd' with proposed costs for our solution, along with an alternative option. The project will then move into a justification for the methodology approach used and why it would be best suited to this system.

Following on, the project will give an overview of the visions, goals, constrictions, and assumptions of the system, it will then give an outline of the project plan.

To Finish, the project will list the functional vs non-functional requirements, the system specifications with the help of a use case diagram, a sequence diagram, and a class diagram

2.0 Background and Preliminary Research

'Horizon Motors Ltd' are a successful garage operating in North Dublin City Centre, with their workforce of 20 employees, the company has many faithful customers who return to buy, sell, trade in or service their cars. However, currently Horizon Motors are using a paper- based filing system which is causing a high rate of duplicated information. This is also impacting their business as it is affecting their performance by absorbing a large amount of time and giving inaccurate reports leading to suboptimal decision-making.

James from Horizon Motors is aware of the need to improve the service his company can offer by developing an information system. One which will drive the growth of the company by keeping his faithful customers and attracting new ones.

IDK Solutions has done some background work with James and the business to conceptualise at an overview level what the information system will look like. IDK incorporates a team of designers, cloud developers and front-end developers and can best utilise these resources by building James a customer-based web app which will allow customers of Horizon Motors and 3rd parties to become users of his services online. By hosting an IS on the web, we can allow for user generated content and accounts that can scale by itself and become an established web presence for Horizon Motors over time. All routes can point to this information system through marketing, social media, email comms and in-person transactions meaning that James can begin to transition his business online. A database which will support this can become the new and improved place for Horizon Motors to keep record of their customer base and the inner workings of the business, as well as supporting all features of the website and its online service area.

The web has become an even more improved place for apps and Information Systems in recent years and IDK solutions has projected that in this instance as customer feedback and growing with change is important to James – building a scalable solution on the web is the best approach to take.

2.1 Costing Structure of Project

In order to utilize the most cost-effective solutions, this project will focus on hosting the system in the Cloud and using a cloud management platform, in doing so, 'Horizon Motors Ltd' avoids the cost of buying and setting up servers, as well as, avoiding the risk of buying a surplus or insufficient servers. By utilizing a cloud management platform, 'Horizon Motors Ltd' will be able to pay for what they need, when they need it.

As part of this proposal, 'IDK solutions' have compared the option of using Azure VS AWS vs DigitalOcean to host the database used. It is crucial the right cloud service provider is chosen to optimize results and reduce costs.

The following instances would be used for each scenario.

- AWS - EC2 instances
- Azure - VM instances
- DigitalOcean - Droplets

Figure 1 – Database Hosting Comparison

Monthly Database Hosting Costs
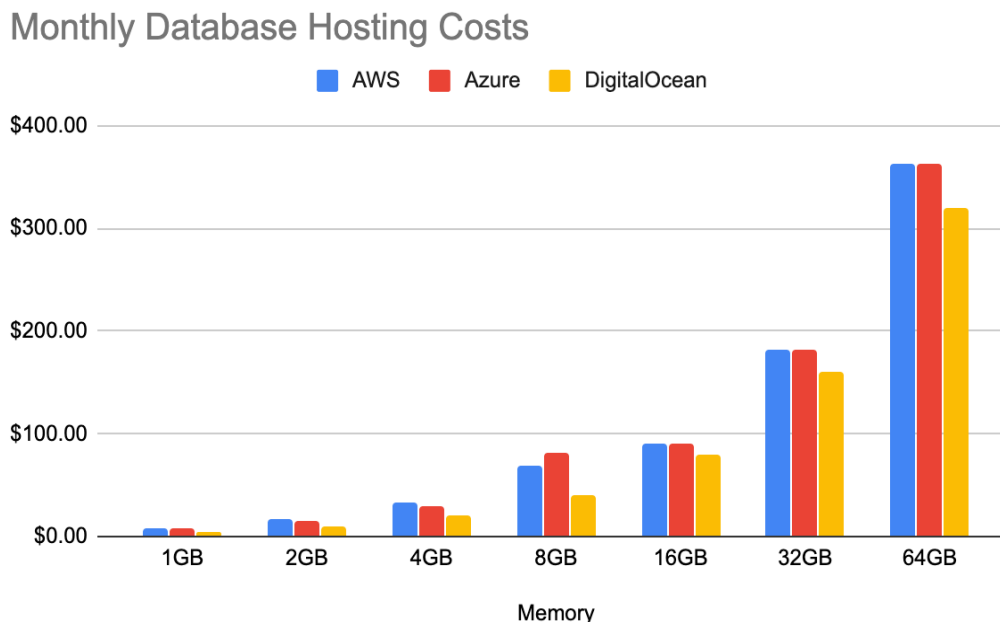
(Scalegrid.io, 2020)

As can be understood from figure 1, DigitalOcean instances work out on average 26% less than Azure and 28% less than AWS. If we use Digital Ocean's price calculation, seen in figure 2 below, for a price comparison, we can see huge savings.

Figure 2 – Monthly Hosting Cost Comparison

Although DigitalOcean would not be considered an Amazon or Microsoft competitor, as its target market is small developers and small businesses, it makes it perfect for 'Horizon Motors Ltd.' DigitalOcean is best suited for small businesses that want to start up a high-performance instance. Another advantage would be DigitalOceans clean, easy-to use interface which has less features than AWS or Azure. In this scenario, the few features would be an advantage to this sized project which does not require the extra features and can avoid the extra costs of using a provider which has the option.

Other costs that will be examined are OpEx and CapEx costs, OpEx stands for operating expenses which refers to the costs associated with the everyday running of Horizon ltd. CapEx stands for the capital expenses which refers to the long term purchases which will benefit the business. This can be overviewed in figures 3 and 4 below.

Figure 3 – Capex vs Opex Expenses

Capital Expenses vs Operating Expenses

CapEx	OpEx
Purpose: Assets purchased with a useful life beyond current year	**Purpose:** Ongoing costs to run a business
When Paid: Lump sum up front	**When Paid:** Monthly or annual recurring
When Accounted For: Over 3-10 year lifespan while asset depreciates	**When Accounted For:** In the current month or year
Listed As: Property or equipment	**Listed As:** Operating Cost
Tax Treatment: Deducted over time as asset depreciates	**Tax Treatment:** Deducted in the current tax year

bmc

(BMC, 2020)

Figure 4 – Capex vs Opex Expense Breakdown

OpEx Costs	Daily Rate	Days	Estimated Cost
Project Manager	€210.00	45	€9,450.00
Scrum Master	€210.00	45	€9,450.00
Backend Developer	€315.00	38	€11,970.00
Frontend Developper	€245.00	38	€9,310.00
UX/UI Designer	€245.00	15	€3,675.00
Tester	€105.00	15	€1,575.00
Subtotal			€45,430.00

CapEx Costs	Monthly Rate	Months	Difference
Cloud Infrastructure (DigitalOcean)	€60.00	12.00	€720.00
Maintenance allowance	€60.00	12.00	€720.00
Subtotal			€4,800.00

Due to the lack of a technical team at Horizon Motors, a maintenance allowance of €60.00 per month has been included to allow for tools such as monitoring, backups and team management which can be provided by DigitalOcean.

2.2 Alternative options

A cheaper alternative for the company would be to use existing online marketplace such as Done deal, Car zone and Facebook Marketplace. Although these alternatives already provide a lot of the functionality required by the system such as stock management, dealer insights and the costs are considerably low (€9.99 per car)

There are quite a few cons to consider, with using an online marketplace, you are faced with direct competition from not only other dealerships but also the public. 'Horizion Motors Ltd' would also lose out on any income which would accumulate from sellers listing their motors with 'Horizion Motors Ltd', rental system and any services provided through the system.

3.0 Proposal

3.1 Strategy

IDK have strategized to first understand the requirements of the customers, and from these requirements the team will develop a plan of how to meet these requirements in a specific timeframe. As part of the strategy the team will factor in that perhaps the customers do not fully know their own requirements, and therefore, an in-depth analysis of the project plan will be discussed. IDK will then determine what is needed to meet the project needs and indeed what is feasible.

3.2 Vison

The company wish to integrate all their systems, such as documents, car database, customer database etc., into one unified and digital information system. The vision is to leverage the information system to grow the business and be more competitive.

3.3 Goals

·   Create computer-based database of customer and car information

·   Prevent duplication of data

·   More accurate business performance reporting

·   Website presence to interact with buyers and sellers

·   Online advertising service for sellers

·   IS being secure, reliable, and fit for purpose of business

·   Integration with cost effective cloud services for day to day operations

3.4 Stakeholders

·   Shareholders (company is a partnership)

·   Staff

·   Customers

·   Sellers

· Mechanics (third party)

· Insurance companies

· Financing companies

3.5 Constraints & Assumptions

· Budgetary constraint – budget is modest, cost is a factor for what system is implemented

· Assumption of no technical expertise – need outsourcing support for IS use and maintenance

· Assuming sellers sell cars and services through the company and its website, and profits from sales are divided between host company and seller

4.0 Project Plan

According to several writers, all information systems are built on a basic framework involving communication, planning, modelling, construction, and development. Furthermore, the writers emphasize that to develop an information system it is necessary to describe the sequence of activities needed in a process methodology. IDK decided to research various different process models and ascertain which would make a suitable framework for this project (Ashishdeep, Bhatia, & Varma, 2015).

4.1 Proposed System Methodologies

This section aims at researching several process models to consider for the project strategic approach to planning. Then from in depth analysis of each process the team could ascertain the most appropriate model to choose for this project.

4.1.1 Waterfall

Linear sequential model which has a step by step approach to the SDLC. It is simple to use yet not flexible to changing requirements. Each phase must be completed before next begins, no overlap.

Pros	Cons
Simple to use	Difficult to respond to changing requirements
Easy to Manage	Very limited user engagement
Works well for smaller projects	Expensive post implementation if any requirements are missed
	High risk and uncertainty

Although lack of technical expertise is not an issue due to maintenance and support from third parties, lack of user engagement and potential high costs and risk are not what James is looking for. Therefore, waterfall is not a recommended process model.

4.1.2 V Shaped Model

Like the waterfall model except all deliverables of the project are tested, thus mitigating risks. However, if there are moderate risks of requirement change it is not a good process model. James has modest budgetary constraints which may lead to requirements changing due to budget limitations. For this reason, the v shaped model is not recommended.

4.1.3 Incremental Model

 Each cycle is a mini waterfall cycle as each increment goes through requirements, design, implementation, and testing process. Each iteration produces software which customers can interact with and is finely tuned each iteration building from the previous one. This process though mitigating risks and good for requirements less defined, is a lengthy process which could be costly too. James has a 20 staff SME company and therefore this process seems too complex, and overkill, for such a project. Therefore, this model is noy suitable.

4.1.4 Agile

Combination of iterative and incremental. Tasks are divided into time boxes for delivery of specific features. Consists of iterations involving a process of planning, requirements analysis, designing, building, testing and last between 1 – 4 weeks. There is customer collaboration throughout the process (which James wants with our team).

Pros	Cons
Realistic software development	Depends on customer interaction (wanted by James though)
Promotes teamwork	Required SCRUM master (another stakeholder involved – more cost)
Good for changing requirements	Strict delivery management which dictates scope (we need to consider a larger scope before the project)
Easy to manage	
Requires little documentation	

Agile (Agile SCRUM specifically) seems most suitable due to good management of risk because we can adapt to new requirements. Dependency on customer interaction is good for us as James wants continuous feedback and advice from the team. The fact that initial requirements remain in the first sprint is good as any new requirements just get pushed to the next sprint. Suitable for the company as the company will be able to adjust to the new system more through each sprint, as they are small and not very technical this is ideal.

4.2 Chosen Process Methodology

IDK solutions have identified Agile method to be the best course of action for following the project plan in developing the IS system for Horizon Motors Limited. An Agile approach allows for a combination of iterative and incremental process models. We will be making use of SCRUM and Kanban process models as part of our project plan.

Scrum is an iterative, incremental model that provides a highly prescriptive way in which work gets completed. The team will have defined processes, roles and ceremonies such as sprint planning (4.4) and retrospectives.

Work is broken up into Sprints, set amounts of time in which tasks must be completed before the next Sprint begins. A sprint can be any length of time, although two-week and 30-day sprints are among the most common. IDK will also be using a 3-week sprint for sprint 1 to cover tasks that are needed to set the agile workflow in motion.

Scrum rituals and prioritization meetings are led by the scrum master. A Scrum Master is a person on a Scrum team who is responsible for ensuring the team live by the standards set by Scrum methodology.

Kanban can be customized to fit the processes and work systems the team and James already has in place. Tools like Kanban boards and project forecasting tools to help manage projects, workflows and processes in a way that works best for everyone and the team will use a Kanban board in a tool called Trello which will allow us to visualize progress and collaborate on project management during the sprint. This board will also be used at daily scrums to change status such as in progress, to do and blocked and give updates on the tasks themselves - and to keep a backlog of work which will inform upcoming sprints.

Kanban can be applied to visualize and improve the flow of work, regardless of the methodology being used to do the work but especially works well for agile.

4.3 Agile Manifesto for Horizon Motors

4.3.1 Individuals and interactions over processes and tools

Given James' budget and our small team of focused designers and developers we believe agile will be the right method to allow our team to feel empowered to project manage themselves and feel responsible for their own pieces of the project. We will be making use of a SCRUM master to facilitate workshops, daily scrum meetings, retrospectives and sprint planning sessions but ultimately, we feel that if the team on an individual and small group level is focused on tasks this will allow for a more effective outcome to development cycles.

4.3.2 Working software over comprehensive documentation

We believe that a scalable solution built for the web in 2020 always needs to be kept optimized and working to a high standard during the course of a project given the many changing ways in

which web content is now delivered (various devices etc.). Given the wealth of cloud tools available for collaboration our developers and designers can capture a form of documentation by keeping track of sprint backlogs, code repositories, UX and design tools and any other cloud software that will allow us to iteratively document changes and learnings to the solution as it is developed in the real world.

4.3.3 Customer collaboration over contract negotiation

This is relevant as James is customer focused. He wants to attract new customers and keep old ones with him. The solution we will build for James will also be a customer focused website involving customer accounts and user generated content. To this effect we believe that customer feedback informs tasks that will make sprint back logs to develop the site and improve the IS going forward.

4.3.4 Responding to change

As this is the first time James will move into the online space, he may learn more about his business and new customer base as he operates in this new market. It is important that we are flexible enough to respond to the growing changes that this may present.

Figure 5 – Agile Methodology Overview

The agile way
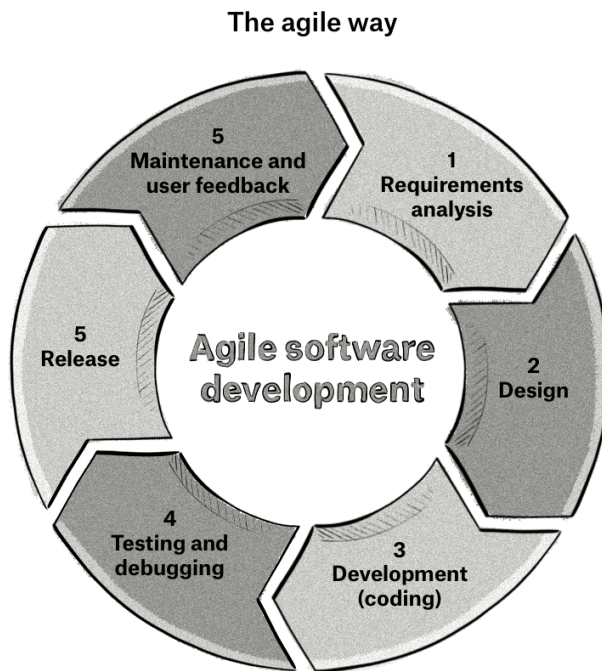
(Sweeney, 2020)

4.4 Sprint Planning

In sprint planning, the team agrees to complete a set of tasks. This agreement defines the sprint backlog and is based on the team's capacity and the length of the sprint. The Sprint goal gives the team some flexibility regarding the functionality implemented within the Sprint, hence adhering to an Agile way of working. As the Development Team works, it does so with the Sprint Goal always in mind and the length of the sprint. The first sprint is defined with several initial tasks needed to get the project life cycle off the ground and so the sprint goal is defined through UK research and initial cloud development.

4.4.1 Sprint Planning Session

For an initial build – the site will incorporate James and other stakeholders to work with UX Designers and developers from IDK and establish initial design, customer journey architecture and cloud infrastructure for the site. This will be done by having a scrum ritual between stakeholders and members of the IDK team to gather requirements, define a project backlog and

then out of this hold a subsequent sprint planning session where tasks will be broken out between designers and developers to populate the first 3 week sprint.

A sprint planning session was held to define the project tasks divided out between the development and design team. The team joined the project manager and a SCRUM master to hold a session where we defined each of our tasks that we think are achievable in the first 3-week sprint. We then as a team decided whether we thought each of these tasks was achievable within the first sprint by scoring them based on an agile scoring system called Story Points – this way we were able to measure effort by impact to gain a list of priorities.

Facilitator:

SCRUM master

Stakeholders define requirements:

James

Project Manager from IDK

Team define tasks:

Developers (Front end | Cloud)

Designers

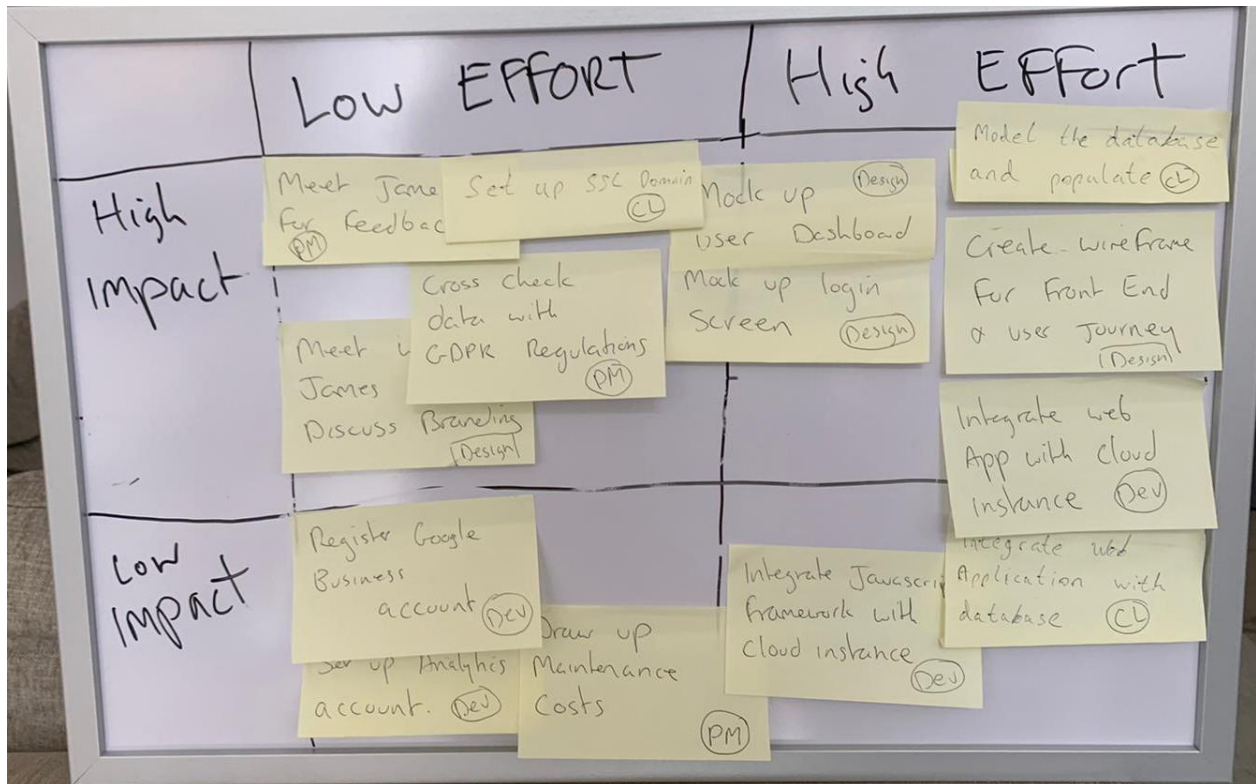| Point(s)	Estimated Effort
1	X-Small
2	Small
3	Medium Large
5	X-Large
8	XX-Large
13	XXX-Large
21 +	(New Epic?)

Team Decide priorities:

Team gives priority weight to tasks

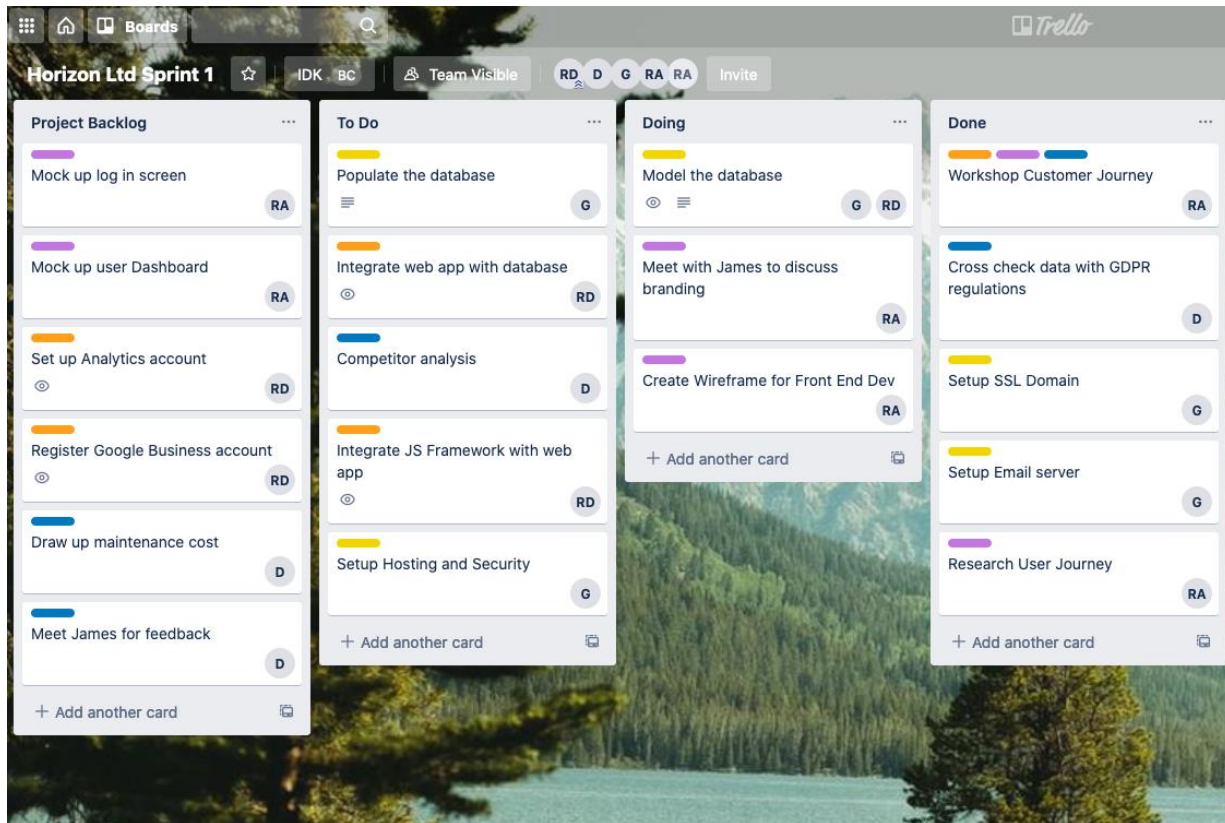Stakeholders and team define project backlog out of priorities:

Compile Kanban Board in Trello

Figure 6 – SCRUM Planning Board

Sprint planning board was compiled in a sprint planning session by the team members who defined their tasks and then as a team produced priorities by defining its effort / impact.

Figure 7 – Sprint 1 in Trello

The tasks from the priorities defined in sprint planning were compiled into a Trello board by the SCRUM master to kick off the sprint. On retrospect the SCRUM master was able to further breakdown some tasks to give a better estimation of work completed. Some tasks that were decided may be too broad or work load to big from the sprint were also put into the project back log as being defined as low effort but low impact at this moment in time such as Analytics setup and Register Google Business account. It was decided that other priorities were in place for now and so as not to overload the team with work for the first sprint and avoid scope creep these can be brought in to the project at a later date so the team can remain flexible and work on tasks as the other dependencies become available.

After this the project will incorporate further sprints of different length depending on deliverables and backlog. A Scrum Master will be in place to manage communication between stakeholders, hold feedback sessions, retrospectives and facilitate sprint planning.

Figure 8 – Sprint Calendar

Epics	Responsible	Start	End	Days	Status
Sprint 1		1/9	22/9	21	In progress
Cloud setup	Cloud Dev	1/9	9/7	21	In progress
Wireframes & UX Research	Designers	1/9	9/12	14	In progress
Web setup	Front End Dev	7/9		7	Not started
Liasing with business	Project Manager	1/9	9/13	4	In progress
Sprint 2	Jacob S.	28/9	12/10	14	Not started
Cloud tweaks	Cloud Dev	28/9	12/10		Not started
Mockups & Concepts	Designers	28/9	12/10		Not started
Web Dev	Front End Dev	28/9	12/10		Not started
Sprint 3	Shari W.	12/10	26/10	14	Not started
TBC	TBC	12/10	26/10		Not started
TBC	TBC	12/10	26/10		Not started
TBC	TBC	12/10	26/10		Not started

Once the initial project development has been complete – the team will incorporate feedback from customers and ongoing requirements from stakeholders into a Kanban board and work through tasks in phased sprints to keep priorities in development and avoid scope creep. The scrum master will help the team stay grounded but ultimately the project will be in hands of developers and designers at this point to improve the functionality and usability of the site.

This approach will always keep James and his team involved in the growth of the project and keep him close to the developing needs of his customers in this new space.

5.0 Requirements Specification

Sunner & Bajaj state that for successful requirements engineering understanding functional and nonfunctional requirements is needed. The writers further state, that functional requirements lean towards products and services whereas nonfunctional pertains to emergent properties needed in the system (Sunner & Bajaj, 2016). With this is mind, IDK will identify the functional and non-functional requirements for this project.

The requirements are to define the basic system behavior. Basically, they are what the system does or must not do and can be thought of in terms of how the system responds to inputs.

The input is the set of business requirements that motivate the application development and all the available information on the technical, organizational, and managerial context.

Below is an outline of the initial user requirements:

5.1 Functional system requirements

The system should be able to collect and retrieve information such as:

- Collect buyer information such as preferences, the price range that they can afford, and personal information (name, address, etc.). Preferences include size, style, power, and the like.
- In case of rentals, system should be able to calculate the terms of the contract such as duration, required deposit, and so on.
- System should be able to recommend to users interested in buying a car:
- Available new and used cars, commercials, and rentals, along with the services available.
- Details on the number of seats, doors, engine capacity, power, range, speed, price, tax (on purchase and annual), etc.
- New cars available, or sellers' offerings that matches the customer's preferences and, if it cannot find an exact match, should offer the closest matches.
- Finance, choosing a car, making an offer, getting insurance, and closing the deal.
- System should be able to assist users from other locations interested in buying a car:
- With choosing a local service agent.

- List of competent mechanics complete with personal information such as name, phone number, and credentials.

- System should be able to assist users interested in selling a car:

- By providing the advertising service.

- In listing the car through the company as a dealer – In which case, they should be able to an option to get the car serviced and checked by the company, for an additional commission

5.2 Non-Functional system requirements:

- Website should have an SSL certificate.

- User account should lock after 5 failed login attempts.

- Search results should return within 2 seconds.

- Privacy of information, the export of restricted technologies, intellectual property rights, etc. should be audited.

- The payment process should be PCI DSS compliant.

6.0 Use Case for Project

6.1 Use Case Narrative

According to Jacobson et al, use cases area central component in designing systems and understanding all requirements needed with the system (Jacobson, Spence, & Kerr, 2016). This is useful for this project in which IDK need to clearly list all the system requirements, the actor, and all stakeholders. From this use case IDK can then define what is needed to fulfil the information system requirements.

Use Case Name: Buy a car

Use Case ID: UC-17

Scope: Electronic Point of Sale Management System

Priority: Medium Priority

Description

- Customer browses available cars
- Customers can set preferences
- Available cars are displayed
- Customer clicks on requested item to see more information including price
- Customer clicks on "place order"
- Customer is prompted to log in or create an account
- Customer enters card details
- Card details are verified by bank
- Customer receives an order reference on their email receipt which they can show to Horizon motors ltd to collect their car

Level: User Goal

Primary Actor: Customer

Supporting Actors: Bank – verifying payment

Stakeholders and Interests

Company

- A working system ensures less frustrated customers who will possibly turn into returning customers / recommend the company.

- Generate reports referring to the performance / profits of the business.

- Ensure correct tax is paid.

- Manage stock levels

- Data for targeting sales and marketing campaigns

Customer

- Wants accurate sales and invoice receipt.

- Invoice emailed to them to use as proof of purchase for guarantees.

- Payment details stored securely

Preconditions

- The bank system must be functioning to verify the customer has the funds in their account

Success Guarantee (or Post-conditions)

- Stock displays on user interface

- Price calculated correctly

- Payment verified

- Order receipt provided to customer

- Stock inventory updated

Minimal Guarantee

- Cars match the description on the website

- Price and availability are accurate

- Customer is charged the correct amount

- Customer's data is secured safely

Trigger

- · "Place Order" would trigger the log in/ create account page
- · If customer is logged in "Place Order" would bring up the payment page

Main Success Scenario

A successful transition of the use case from start to finish

Extensions (or Alternative Flows)

1. Card payment verification fails
2. Notification displaying the cause of failed e.g. insufficient funds

Assumptions

- Customer has a debit or credit card
- Customer has sufficient funds on their card
- Customer is computer literate

A visual representation capturing the elements of the use case can be seen below in figures 9 and 10, use case diagram and class diagram, respectively. Figure 9 is a use case diagram showing how all required action interact with the staff, buyers, and sellers. Figure 10 shows how all these actions and interactions will look in a database storing all the data.
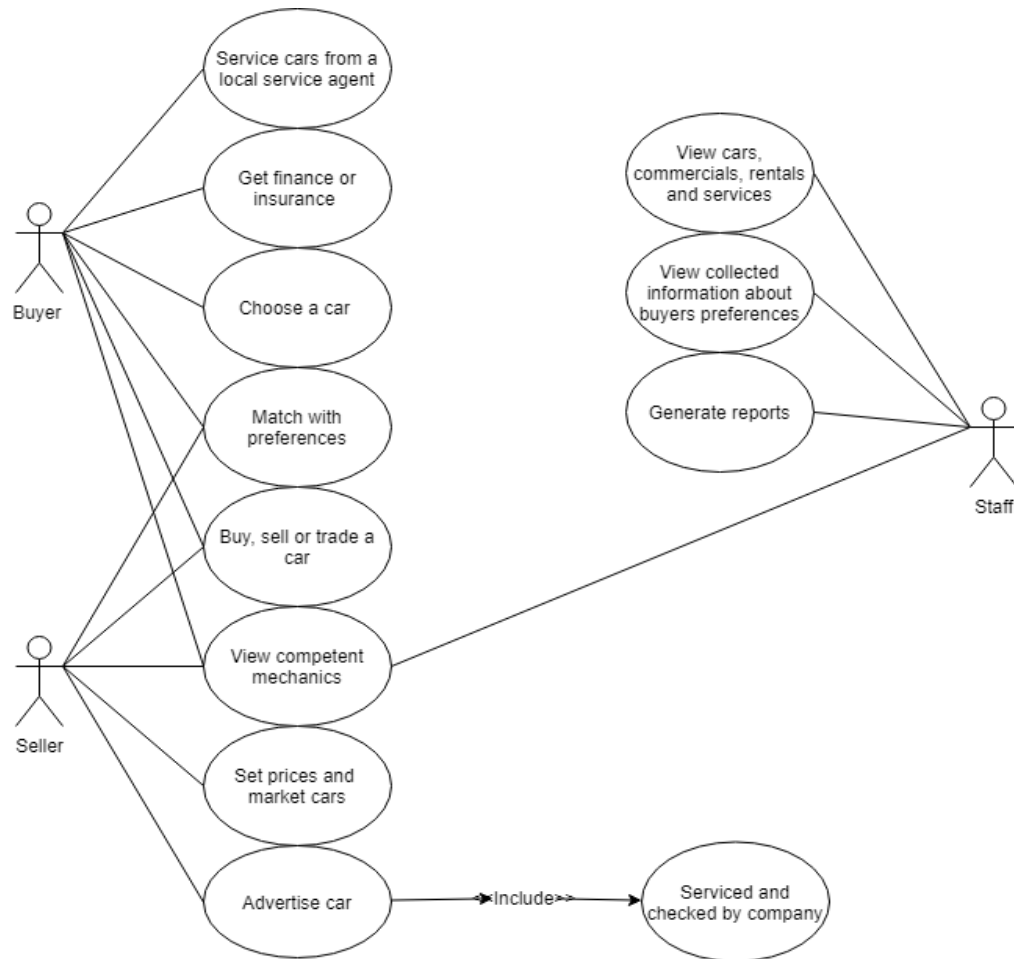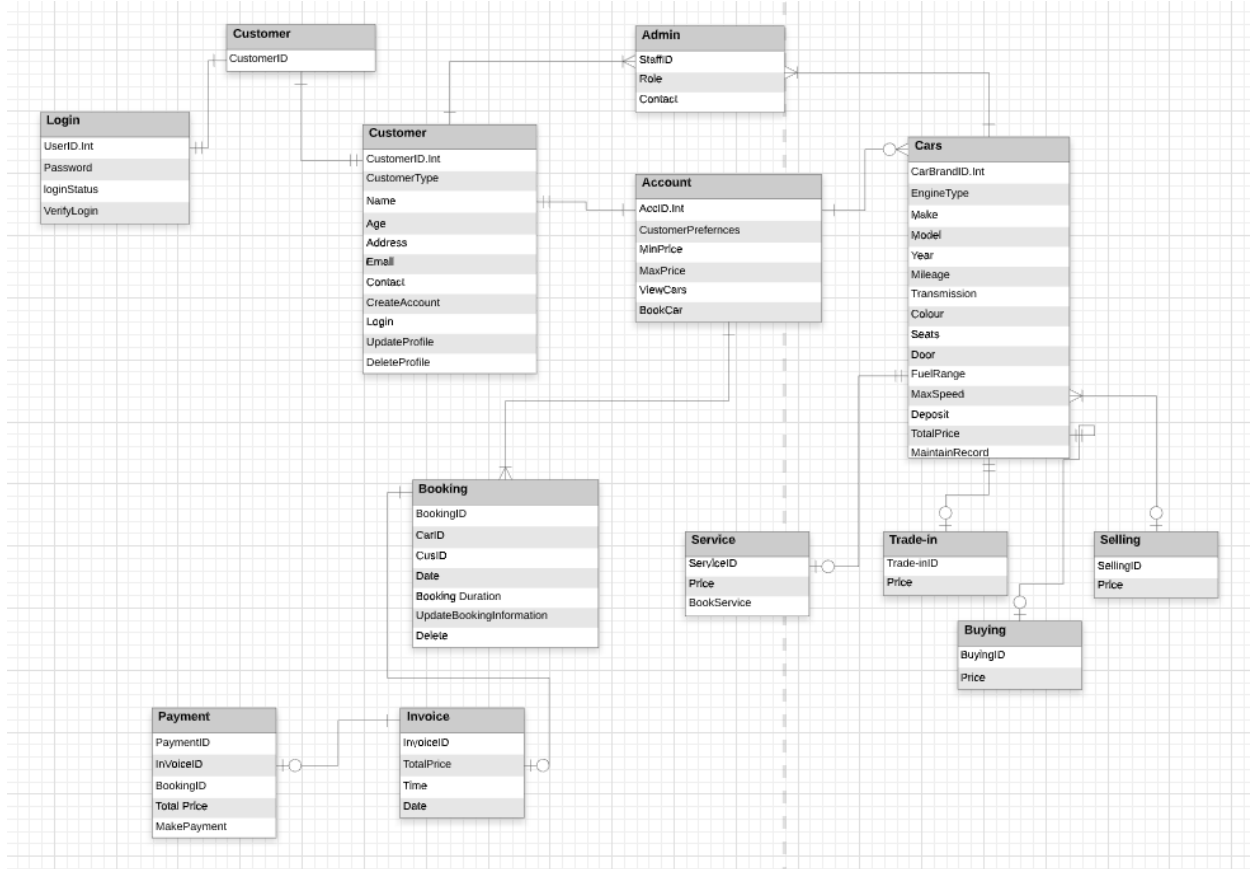
Figure 9 – Use Case Diagram

Figure 10 - Class Diagram

7.0 Sequence Diagram of Project

Below, figure 9, can be seen the sequence diagram for the project. The customer is outside of the system and is therefore an 'actor'. The website, database, hosted cloud server, and sellers are objects in the system.

The customer begins by logging into their account and if the account is verified the stem logs the customer in. If the account is not verified the system requests sigh up. The database updated and synchronises with the cloud.

Upon logging in the customer can browse and choose cars or services to purchase. This is checked against the stock available in the database, which can also be updated by the seller, and if there is stock a payment is requested. When there is no stock the customer will be informed in the website sale is unavailable. The database is again updated to any changes and synced with the cloud server which backups the data.

Finally, the customer inputs their payment details and if they are valid the payment goes through, and the seller receives their cut of the sale. Where the payment details are invalid the payment is rejected.

Figure 11 – Sequence Diagram
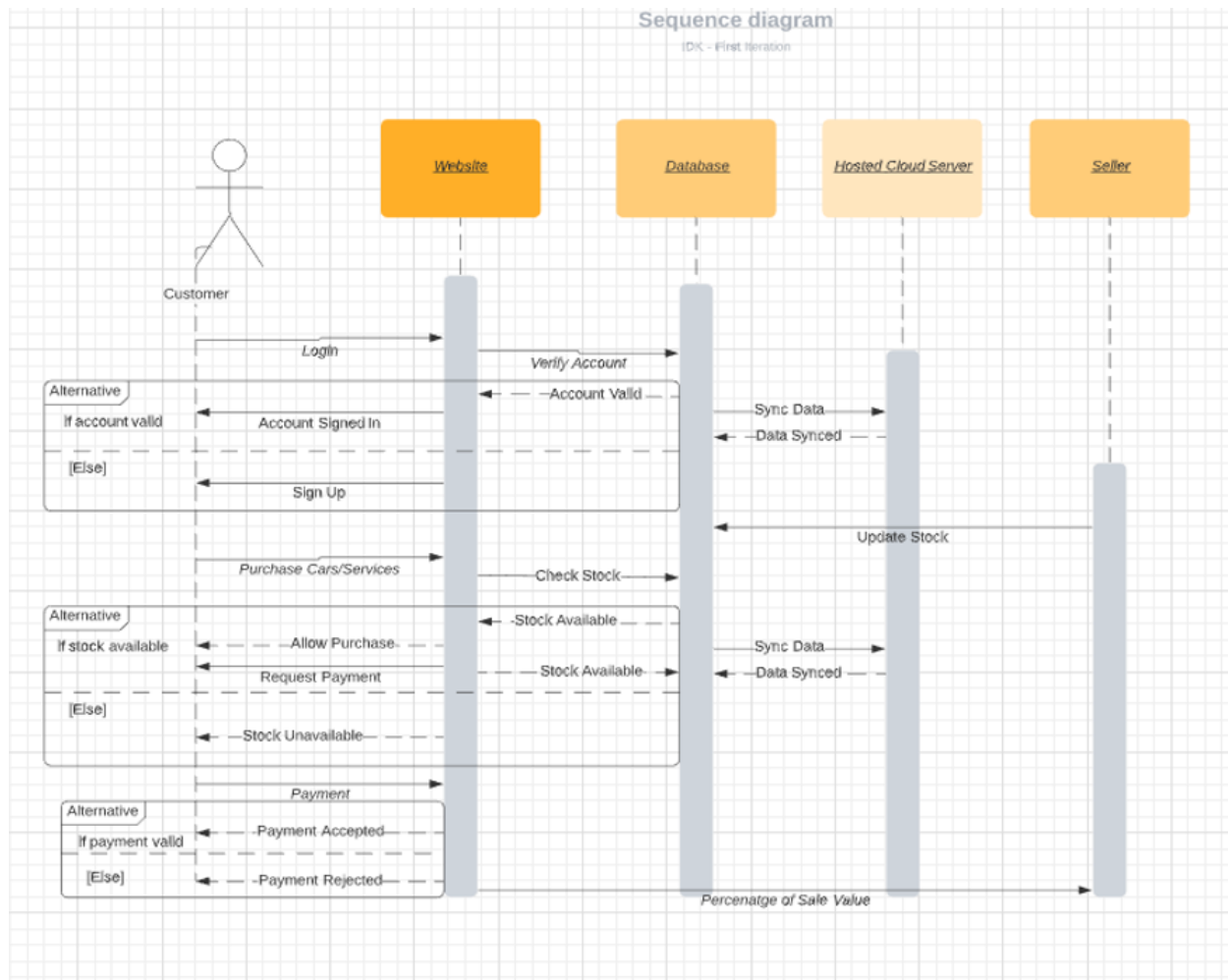
8.0 Conclusion

In Conclusion, this project aims to deliver a fully functioning information system that will automate the business and establish a web presence. The information system will list available new and used cars, commercials, and rentals, along with the services available. This system will be able to match buyers' preferences with new cars available, or sellers' offerings and, if it cannot find an exact match, the system will offer the closest matches. If buyers from other locations need help in choosing a local service agent, the system will provide a list of competent mechanics complete with personal information such as name, phone number, and credentials.

This project will follow an Agile approach based on the good management of risk as IDK solutions can adapt to new requirements due to continuous customer interaction with James and the team at Horizon Motors Ltd. The agile approach will allow for a combination of iterative and incremental process models, this will be done by making use of the SCRUM and Kanban process involving stakeholders, developers, designers and customer feedback.

The most cost-effective solution was to hold the system in the cloud as this will reduce the costs concerned with the setup and maintenance of an on-premise server. This project has identified hosting the database on DigitalOcean to be the optimum choice, due to a combination of the limited budget for the project, DigitalOceans' easy-to-use, clean interface, and the tools DigitalOcean can provide such as monitoring, cloud firewalls, and team management. All of which, can be provided at a competitive price without compromising quality.

Looking forward, DigitalOcean also allows Horizon Motors Ltd to scale and tailor in conjunction with their specific requirements as they grow. Other long-term possibilities for the project would comprise of transforming the system into a mobile application.

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