University of Bedfordshire

ASSIGNMENT TOP SHEET

Faculty of Creative Arts, Technologies & Science

Department of Computer Science & Technology

Student Ref. No **1506910**	Unit Code: **CIS017-3**
Unit Name: **Undergraduate Project**	Deadline for Submission(s) **Friday 18th May 2018**
Student's Surname Early	Student's Forename James

Unit Leader's Name: **Enjie Liu**	Supervisor: Dr Mohammed Bahja

Assignment Details: **Assessment 2: Final Report**

Instructions to Student:

Please note: Work presented in an assessment must be the student's own. Plagiarism is where a student copies work from another source, published or unpublished (including the work of a fellow student) and fails to acknowledge the influence of another's work or to attribute quotes to the author. Plagiarism is an academic offence.

Work presented in an assessment must be your own. Plagiarism is where a student copies work from another source, published or unpublished (including the work of another student) and fails to acknowledge the influence of another's work or to attribute quotes to the author. Plagiarism is an academic offence and the penalty can be serious. The University's policies relating to Plagiarism can be found in the regulations at http://www.beds.ac.uk/aboutus/quality/regulations. To detect possible plagiarism we may submit your work to the national plagiarism detection facility. This searches the Internet and an extensive database of reference material including other students' work to identify. Once your work has been submitted to the detection service it will be stored electronically in a database and compared against work submitted from this and other universities. It will therefore be necessary to take electronic copies of your materials for transmission, storage and comparison purposes and for the operational back-up process. This material will be stored in this manner indefinitely.

I have read the above information and I confirm that this work is my own and that it may be processed and stored in the manner described.

Signature (Print Name): James Early   Date: 17/05/2018

Extension deadline

CAAS agrees that the assignment may be submitted _____ days after the deadline and should be marked without penalty.

CAAS confirmation...

James Early

1506910

A Social and Business Tool to Enhance the Tattooing Industry

BSc (Hons) Computer Science

Undergraduate Thesis Report

Department of Computer Science and Technology

Dr Mohammed Bahja

AY17/18

Abstract

This report explores the attempt to unify the tattooing industry with the use of a mobile application. The projects primary goal is providing the tools to potential users which makes connecting with artists both fun and effortless. It's to provide a singular platform where users and artists alike congregate for all tattooing requirements.

There is also a demonstration on what mechanisms I have employed to give users the ability into finding artists within their area. We will see exactly how the algorithm is applied by taking an in-depth look into what makes the formula operate. Market research findings are also examined to see whether this application provides a technological contribution on today's app stores.

It also presents the project realisation techniques and methods in which are administered to solve the current market shortage. The stages of development and implementation into making the application are also discussed. A dissection into how the project was managed overall will also be critiqued and analysed.

Acknowledgements

Dedication

I am going to dedicate this project to my mother and step-father. They continuously supported me both financially and emotionally throughout my entire University life. Without them, I don't know where I would be.

I'd also like to include my Grandmother. At the young age of 99, she still is there to bring a smile to my face.

Keywords

Social Network

Business Tool

Locational Services

Tattooing Platform

Geolocation

Contents

Chapter 1 - Introduction

Chapter 1.1 Project Concept

For the final year, project TattWho will be the undergraduate project which will revolve around the planning and designing of a mobile application. The app will feature as a social network and provide business services for various facets of tattooing. The project will be documented thoroughly from the ground up. The initial thought about choosing a suitable project was clear. The ability to combine the fundamentals of Computer Science and tattooing was too much to blunder.

Mobile apps are rapidly becoming more popular each day due to their efficiency and convenience therefore deciding to produce one in the current generation of technology seemed more appropriate than other potential project ideas. Streamlining with the popularity of mobile apps is the increasingly fashionable concept of tattoos. "One in three young adults have a tattoo, and some have several, but the trend is only going to get bigger." (The Telegraph, 2018) We live in an age where old traditions and fads are making a comeback, almost as if time was going backwards. As a result, this has created an opportunity to not only create a mobile app but also devise one that revolves around the appreciation of tattoos.

Essentially there will be 3 users to the application – the customer, artist and guest. All 3 users will acquire access to a separate set of tools that help them satisfy their tattooing urges. Being in the tattooing industry can be challenging especially for start-up artists who are looking to gain a positive reputation to form a reputable business. This also applies to existing businesses who are looking for customers. In today's

market, there is no specific platform to accumulate new clients due to the fact that most advertisement is done via a conjunction of different mobile apps therefore the project will fundamentally centralise the tattooing market. There is also a substantial lack of methods concerning the communication between the client and artist thus creating another useful feature opportunity.

The application will contain a variation of features that will predominantly aid users into finding and connecting with artists in their local area. One of the key concepts the app will be based on is a matching system called 'TattMatch'. Upon app sign-up, this feature will initially ask customers what type of tattoo they're seeking whether it's colour, black & white, tribal, realism or other unique styles. Once logged in, a collage will be presented containing pieces of different artist's work. The customer then has the ability to swipe left or right depending if they admire said portfolio. In the case that the current exhibited artist can cohere to the customers preferred style, a match will be made. After being matched, the user is then exposed to several tools assisting them into connect with the artist further. Tools such as the ability contact the artist, book consultations/appointments, view the portfolios in detail along with many more. This will keep the design and functionality very simplistic yet giving the customer a smooth feel when working with the app.

Chapter 1.2 Project Goals

The foundation of any project is to have goals that are both clear and realistic. These could be seen as the two main conditions that allow for an achievable outcome. The project has potential into producing a useful product that will provide a completely new approach into the world of tattooing. The project will possess many goals however conclusively the main acumen of the project is to essentially administer a platform that will abetment users into getting a tattoo. To achieve this goal, there are many other goals that need to be initially identified thereafter reached.

Project TattWho orbits around the standard of quality. The goal is to constitute a sense of this classification from the beginning to the end of the entire project. Some projects have the habit into falling behind or losing sight of the end result which can lead to a poor end product. As a consequence, parts of projects are eliminated in order to make up for any time lost. For this project, every aspect will exude quality, from the research and planning to the designing and developing. This will also reflect in the mobile

application as the goal is to make users subliminally feel the quality and effort put into building it.

You can never be perfectly equipped when it comes to working on a project or according to Dr Keith Mathis, founder and CEO of The Mathis Group - "There is no such thing as a perfect project." (Project Smart, 2018) This typically means that all projects will inevitably encounter multiple hurdles at some point therefore you must use all available resources and knowledge to overcome them. For project TattWho the biggest hurdle would be learning the concept into how mobile applications are developed. This will generally include aspects such as new coding languages and development frameworks. Since the amount of experience in these particular areas is minimal, major research will need to occur in order for the app to be successful. Primarily, the goal is to learn this entirely new concept whilst advancing the project which inescapably will inhabit a challenge in itself.

At the heart of project TattWho the goal is to work towards a strict timeframe and eventually possess the confidence to release a stable version of the mobile application. The app will need to be fully functional and act in ordnance to the project plan. This will show that the project has followed a methodical path that was set from the beginning thus demonstrating an understanding of project management and more importantly, working to a deadline. It's easy to get carried away with setting an unrealistic timeframe as many projects have unreasonable scope expectations. In terms of project TattWho, the goal is to have a working product by the end of May/June. This timeframe will align accurately with my project plan therefore giving a rational schedule to work with.

Chapter 1.3 Project Realisation Techniques

When it comes to attaining what type of project to commence, there are many stages that effect the involved process. For project TattWho the inarguable inaugural stage is to conjure up an idea that would be enjoyable. This is the most important stage but could possibly be disputed by various project managers however working on a project that is subject to a personal academic passion means that naturally the enthusiasm and excitement of completion will drive the project forward. In conjunction with the enjoyability are the aims and objectives. To realise what project is suitable, a fundamental question to consider is, are the aims and objectives achievable? Many incredibly useful projects look pragmatic on paper but have completely unrealistic

aims. This could be in the form of impossible deadlines, unreasonable budgets or even inadequate resources. Project TattWho is working in alliance with a project plan which will avoid any issues with deadlines. It is also provided will all the resources needed such as research materials, specialist software, access to academic journals, computer equipment etc. Both of these aspects allow the project to be more manageable.

"Quality = time + cost." (Harvard Business Review, 2016) This equation provided by the Harvard Business Review outlines that the more time and money you invest into the project, the better quality the result will be. It also states that "if any of these variables change, so will the outcome." (Harvard Business Review, 2016) One of the main advantages with project TattWho Is that the time invested into working on it will be substantial in comparison with the cost. This is solely down to the fact that the only expenditure towards the project will be the physical and intellectual effort. All resources are provided meaning no additional cost for the equipment or software required. This also means that the less cost there is, the more time can be invested.

One of the most substantial reasons alluring to the initiation of the project was the blatant absence of anything like the app on the market. Judging by the market research undertaken, it's clear that there is a considerable gap which could be filled if the app was designed effectively. Not only is there an evident void, there is clearly a demand for the app. This is due to the fact that tattooing has always been advertised via a combination of ways therefore by creating a unified platform will solve a real-world problem. Also, as discussed before, the popularity inflation of tattooing and mobile apps will surely propel this project into being a success which conjointly adds to the seductive lure into launching project TattWho.

Along with the realisation of what project to choose are the problems that could potentially come with it. Identifying these issues is one of the initial thoughts that will determine if the project is feasible. Understanding the issues before starting the project is extremely important as you will have to address these early as they can change the project outcome. Deciding on project TattWho was realised by the scarcity of issues that came adjacent with it. The only real issue existent is the lack of knowledge into how mobile apps are built. The difficulty of overcoming this issue is subjective and solely will result into how much effort is contributed. Project Accelerator backs this idea up by saying "The bad news is that project managers appear to lack basic skills

like communications, quality and scope management or technical know-how. However, the good news is that the right training can remedy these deficiencies." (Project Accelerator, 2017)

Chapter 2 – Literature Review
Chapter 2.1 Introduction
In this literature review there will be an in-depth discussion into various aspects revolving around the subject of mobile applications. It will identify any areas of concern with these topics with the intention of finding and applying a solution. It will comprise of a comparison of the latest technologies and conclude on what's most useful in the chosen area. It's important that this review analyses the most current approaches towards the selected mobile application topics and critically evaluates them. The scope of this entire review will constantly be related back to project TattWho. It will provide and fully justify the comparisons between the latest technologies to the approaches taken to realise the project.

The literature review will be directly related to the project as the key focus is understanding the void between the previous work completed compared with the research of project TattWho. The main topic to discuss is the relevance in how mobile apps are used for business purposes. As the project is an application that essentially turning the tattooing industry into a mobile business, it's convenient that previous research is analysed thoroughly exposing any issues that could potentially arise. Another matter to explore is the affectability of advertising using mobile applications. Many businesses are now using social media apps to advertise their products. This is due to the volume of people using these types of apps every day. Even without reading this review, it's clear to comprehend that the direction many organisations are heading down is utilising the productivity of mobile apps. Not only due to the popularity of them but simply down to the sheer convenience of using one.

By studying the recent papers of companies who have failed or succeeded into the reasoning and implementation of advertising using mobile apps, will give an insight into whether this could be a possible strategy for project TattWho. Most applications today have access to multiple parts of your smartphone. Whether it needs identification of the user, the telephone contacts or even knowing the exact location which brings up the question, is privacy even considered anymore? Apps today require this type of

entry to fulfil some form of functionality of the application. One of the key features of TattWho will enable users to find artists in their area however before implementing this component, extensive research needs to be concluded in order to see if it's truly safe.

Ultimately, the objective of this chapter is to understand the previous tools used and analyse what went wrong. It's an opportunity to learn the techniques from others and find a way to not only implement them into project TattWho but also find a method in which to better that technique. Doing this will show that the project hasn't just been conjured up but the research paving the foundation has been thoroughly justified. The aim is simple, to prove that the project has found a gap and is willing to satisfy it whilst simultaneously relishing in the hope to better it.

Chapter 2.2 Review

Mobile applications are getting more powerful by the day. They are constantly being developed giving user's further functionality. Mobile phone giants are steadily moving every aspect of a human's life online. In the early days when computers where first created, people couldn't possible comprehend the amount of power that they were capable off at their fingertips. They had a machine competent of unleashing the upmost complex computations. Now we live in a mechanical world where that amount of power has been tamed allowing it to be compacted into our jeans pocket. Overrun by this, people have slowly acquired the title of 'users' not consumers of technology. The line has become increasing blurry between allowing technology to help us and accepting technology to become us.

Smartphones have been running our everyday lives without us even knowing. It doesn't take an academic to notice that mobile phones have the functionality to almost assist us in everything we do. From waking us up in the morning to showing online tutorials into completing the simplest tasks. It's almost come to a point where we are incapable to think for ourselves therefore we will let our 'trusted' companion 'Siri' to make a decision for us. Which draws the alluding question – do we rely on technology too much? A recent survey was conducted on Debate.org asking this very question and unsurprisingly the results were 81% said yes and 19% said no. The author of the article added "Technology is depended on so much that it's scary. Try this: stand still in a public place, somewhere like a mall or a train station, and watch the people. Most of them will probably be holding their cell phones. Look at the people with the small

children. They let them have iPhones and iPads and all sorts of things to shut them up! I think that's horrible, because when I was their age, I didn't have anything like that." (The Debate, 2018.)

At the beginning, mobile phones had the basic tools needed in order to carry out the simplest functions. This included sending text messages and making phone calls. There was the odd enjoyable feature such as playing games or even creating your own ring tone. These days have since gone as now smartphones can accomplish so much more whilst somehow still impressing by creating novelty through playing a remastered version of the classic snake. With the introduction of smartphones, came the ability to surpass the narrow-minded functionality of older phones by giving users a first taste into the world of mobile applications.

Mobile applications or 'apps' are small pieces of software devised to be compatible with the smartphone. They are designed to provide helpful tools to enable users to carry out different tasks to make lives easier. Initially, apps were created to represent some of the more major technology advances of the time. For example, large organisations such as Facebook and Twitter were amongst the first to produce an app. Overtime, the popularity grew tremendously rendering an app for almost everything on the market. Due to the increase in the number of users, more and more apps were appearing each with its own idea of productivity. As technology advanced, so did the capability of these apps meaning not only did the software become more complex but also did the hardware to support them.

Along with the minor aspect of technological world domination, comes the topic of privacy. Everyone on the planet enjoys having their own privacy. Whether it's online or offline, we naturally quarantine our personal information from others in the fear it could possibly be used against us. It's understandable to go great lengths to protect your online identification as you can never really know who might be watching. Mobile applications are no exception when it comes to protecting your data.

Mobile applications, especially more current ones, require a certain level of entrance to the user's device. Typically, this includes the access to the user's identity, phone contacts, email address and even bank details. These are only to name a few as certain apps need various information over other apps. The most alarming requirement they demand is the ability to know the location of the user. The initial thought of this

concept sounds incredibly intimidating as providing that amount of trust into a so called 'smart' phone can be terrifying. There have been many issues regarding this concept as many users have felt exposed which as a result creates a form of reluctance of use towards any form of modern technology.

There are many published papers that delve deep into this aspect, exploring the very meaning of the question – are we really alone? It's a very broad subject as being able to know exactly where the user is at all times, seems to be the direction phone companies are heading. The reason for this can be comprehended differently to different people. Most organisations use this location feature in order to provide the user functions that can only be obtained according to the user's location. The most standard example of this would be when you ask the iPhone companion Siri, where the nearest restaurants are. It then uses your location to search for restaurants in comparison to the user's vicinity.

This feature comes as standard with most iPhones dating backing to the iPhone 3 model which can cause concern pondering how long have we been tracked for. Most mobile applications are now beginning to integrate this location-based feature as part of their application. An appropriate example on the market to discuss would be dating applications. These apps solely rely on the user's location as essentially it searches for potential matches in the area. The user is then able to customise the radius of the feature in which they wish to search. Using this tool seems harmless but subconsciously makes you wonder, how powerful the feature really is.

As the project will require the location of the user, it's important to see if there are any concerns regarding the topic. It's also crucial that an understanding of the current procedures and algorithms used into locating the user. This will provide the knowledge into how to implement the strategy into the project but also could give the opportunity to perhaps improve it. According to Puttaswamy and Zhao "Location-based social applications (LBSAs) rely on the location coordinates of the users to provide services. Today, smartphones using these applications act as simple clients and send out user locations to untrusted third-party servers. These servers have the application logic to provide the service, and in the process collect enormous amounts of user location information over time." (Puttaswamy and Zhao, K.P, B.Z, 2017.)

It's clear that there is already an issue with the current set-up as using 'LBSA's present multiple security breaches. The biggest issue is that our private information is being sent to untrusted third-party servers. These servers have the capability to then return the function requested by the user but at what cost? Location data is then stored on the servers for a period of time administering a bonanza of information relating to the user's position. Puttaswamy and Zhao then add "This design, however, is shown to be susceptible to large-scale user privacy compromises even if several location cloaking techniques are employed" (Puttaswamy and Zhao, K.P, B.Z, 2017.)

This is a serious issue as Puttaswamy and Zhao have proved that even with 'cloaking techniques' the privacy of a user is still at risk. For project TattWho, a large part of the application will involve the functions of a LBSA therefore it's imperative that a solution is found. In the paper, an explanation regarding a resolution has been proposed – "the untrusted third-party servers are treated simply as encrypted data stores, and the application functionality be moved to the client devices. The location coordinates are encrypted, when shared, and can be decrypted only by the users that the data is in-tended for." (Puttaswamy and Zhao, K.P, B.Z, 2017.)

At first glance of this solution, it exudes the feeling that it could be a potential fix to the security breaches interpreted. Although in theory it's a pragmatic idea, there are some restrictions to this strategy. The biggest drawback is that by storing all the user data onto the servers pose a huge hardware risk meaning the company storing the data will need to ensure there is enough capacity in which to do so. Another issue is that moving the functionality to the client side reduces potential threats however creates the issue of mobile capability. Decrypting data on a mobile may require a substantial amount of power therefore without the ability to do so renders this method obsolete. Other than these issues, the whole idea of encrypting the data sent to the server and can only then be decrypted on the client's device is extremely advantageous over the current procedure in place.
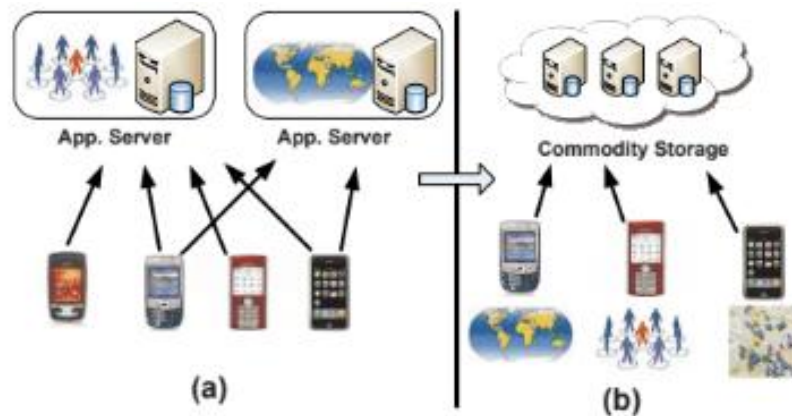
Figure 1. Functionality being transferred to client-side (Puttaswamy and Zhao, K.P, B.Z, 2017.)

To illustrate the proposed solution, the image describes the transition of the functionality being moved from the third-party servers onto the client side. Applying this solution into the application will be beneficial as it will allow users to better adopt the location-based function if we can ensure them that their location data will be protected.

Moving on from the technicality of LBSA's, another paper was published exploring the combination of teenagers and the privacy surrounding mobile applications. A recent survey was taken of teenagers in America, "58% of American teens have downloaded an app to a cell phone or tablet. More than half of teen apps users have avoided an app due to concerns about sharing their personal information—and girls are especially likely to take steps to protect their location data." (Madden, M, M, 2017.)

These statistics prove even teenagers are afraid of downloading certain apps due to the possible leakage of their own personal identity. This poses a real issue with the project as the majority of users who could download the application will be between the ages of 18 – 30. Even though these aren't teenage years, according to the market research for the project, mostly people of a youthful age are attracted to having tattoos. According to the survey, 46% of users take the time to turn off the location-based function on their phone due to the concern that this data will be given to third party companies. "Close to half of teen apps users have turned off location tracking on their cell phone or in an app because they were worried about other people or companies accessing that information." (Madden, M, M, 2017.)

This concept was proved by the paper Puttaswamy and Zhao published stating that currently, locational data is being store on third-party servers with no sort of protection algorithm. "the location coordinates reveal sensitive location information about users, and the untrusted servers can easily leak this data in large amounts due to software bugs, operator errors or due to active attacks, thus compromising location privacy of thousands of users en masse" (Puttaswamy and Zhao, K.P, B.Z, 2017.) The data concluded by the survey is worrying as more than half of teenagers are likely to turn off the location feature excluding a big part of the application functionality.

Looking at the conclusive results of the survey proves that a solution to this issue needs to be resolved quickly as advancing the project with the current statistics could result in a substantial loss of potential users. A solution to this issue could be an approach into finding a method where users of all ages can use an application without the anxiety of wondering if their identity is safe or not. We will discuss the permission mechanics that are involved into the technology provided by iPhone and Android devices.

At present, the procedure that comes with downloading an application on the Android store involves the declaration of privileges by the user. This means that before the app is even downloaded, the user must accept or deny the apps request into gaining access to various sensitive information. This is very different when it comes to the iPhone. By default, the iPhone automatically has access to the entire mobile and only notifies the user when it needs to access their location. The below image illustrates this operation.
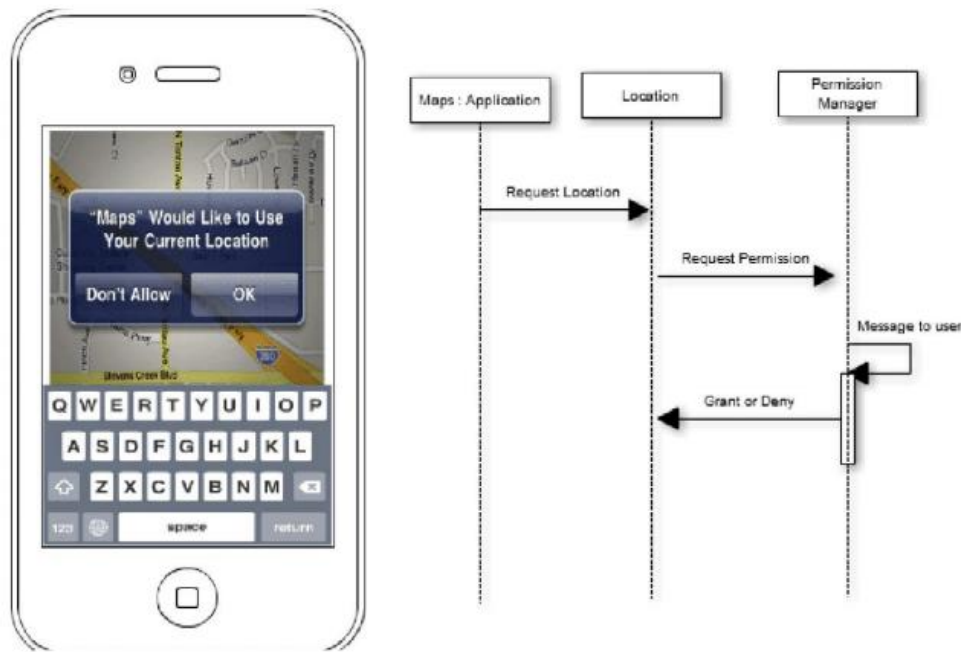
Figure 2. Permission notification being asked to give users location **(**Elkhodr, M, E, 2012.**)**

This method gives the user the ability to choose whether or not to allow the access to their location however completely excludes the control of passing over other personal information. "Beside, notifying a user for every possible application permission request will end up in a large number of messages presented to the user. This will impose much of the administrative burden on a user." **(**Elkhodr, M, E, 2012.**)**

Judging by the research on this particular subject of permission mechanics, it seems that not only does the iPhone have more leniency towards the exposure of personal information but also lumbers the user will unnecessary compulsory messages. On the other end of the spectrum, Android users are provided with a more rigid security procedure "in order to access certain data or capabilities on the mobile phones, an application requests some access permissions when the application is being installed. Its application framework enforces the permission-based security policy that only allows installed applications to access other parts of the system when they are explicitly permitted to do so." **(**Elkhodr, M, E, 2012.**)**

In other words, the application can only gain access to the location of the user if they decide to give it permission during the initial installation process. Once the app has been installed, some permissions can only be granted if the user chooses to do so. These explicit requests involve the capability of using the systems functions such as

the internet, the user's location and even access to their text messages. There are mainly two types of location services that's require permission. One is GPS and the other involves extracting data from the mobiles phone network.

"There are 22 different permissions that an application could obtain in the Android platform. Permissions are enforced by Android at runtime, but must be accepted by the user at installation time." **(**Elkhodr, M, E, 2012.) This statement proves that Android have taken a more rugged approach into the security of their OS over the iPhone. By having this many permissions, it allows the user to fully decide what type of information they choose to disclose via the downloaded apps. Some may feel that that is an excessive amount of permissions to determine however this demonstrates a distinct advantage over the iPhone permission mechanics.
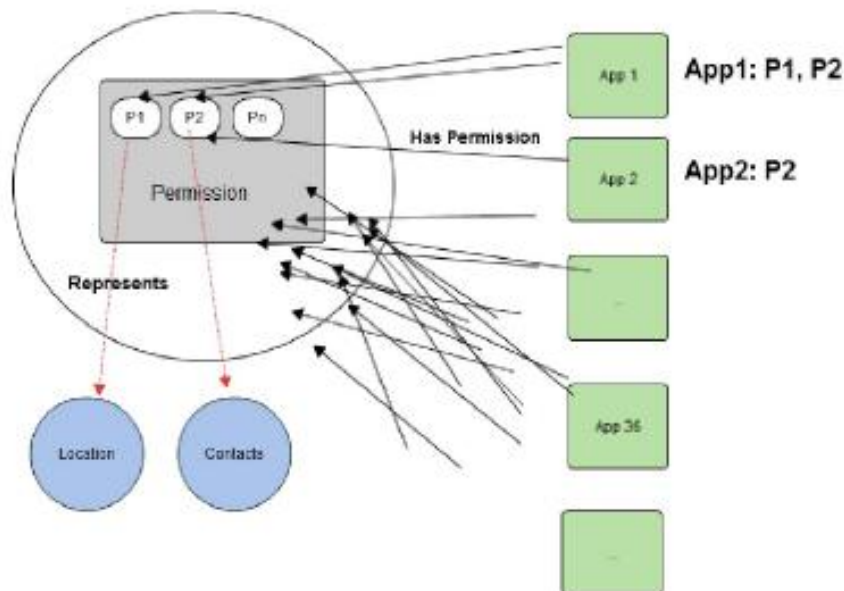

Figure 3. Different Apps requesting locational permission **(**Elkhodr, M, E, 2012.)

As discussed before, the iPhone automatically allows permission to any information already stored on the phone where when compared with Android, only minimal permissions are initially granted meaning the user can establish what information they feel comfortable in sharing. This is a major concern for the project as we have already seen that many young users feel threatened by the fact that many mobile applications have the ability into sharing a user's location therefore by analysing the research found, it's clear that the only effective solution it to minimise the amount of personal information given. This could be by turning off location services in the system itself

however this doesn't solve the issue regarding the cease of functionality of the projects app.

In terms of the project, the most effective way to subside the fear of personal location data being shared is to simply release the application on Android first. Releasing it on Android won't stop the fact that the location services need to be switched on to use the features on the app however by becoming accustom in the permission mechanics already in place will hopefully ease any negative feelings users potentially could have regarding the misuse of their personal data. When it comes to the release of the application on the iPhone, another study will be conducted to identify if there consists of any technology available in reducing any potential security risks and make LBSA's a more worry-free experience.

Chapter 2.3 Conclusion

What was noticed with the existing research was that it's an incredibly broad topic to discuss. Many published papers seem to contain aspects that are subjective in the sense that there was no clear definition of what the consensus was. Another major issue that was discovered was that all the papers reviewed didn't have a clear solution into solving the issue stated. They provided a clear description and analysis of prominent issues in today's systems however when it came to administering an effective answer, the papers completely lacked the knowledge or procedure into how to do so.

After all the papers analysed, it's clear to see that one of the major issues with location based mobile applications is security. The research carried out in the project will first identify the main concerns then attempt to address them by creating new resolutions to not only be applied to the project but hopefully act as a guide for others to learn upon. One issue this research will attempt to solve is neutralising the negative stigma around sharing location data. The project believes that using mobile apps should be about enjoyment and productivity not having the shadowing fear that your personal information could be leaked online. The project will try and contribute to this just cause in the hope to eradicate the restrictions by creating a new way into sharing your location data in a more careful and safe way.

Chapter 3 – Market Research

Chapter 3.1 Current Market

To get a better understanding of the current apps being advertised today, the most effective tool to use would be to create and undertake the process of market research. Market research can come in many forms but essentially is used to gather data to conclude whether the project will fill a prominent gap. Mobile apps in general are becoming more popular than the traditional software found on a desktop. This is mainly because a lot of the world's population have smartphones that have the capability into downloading and using applications.
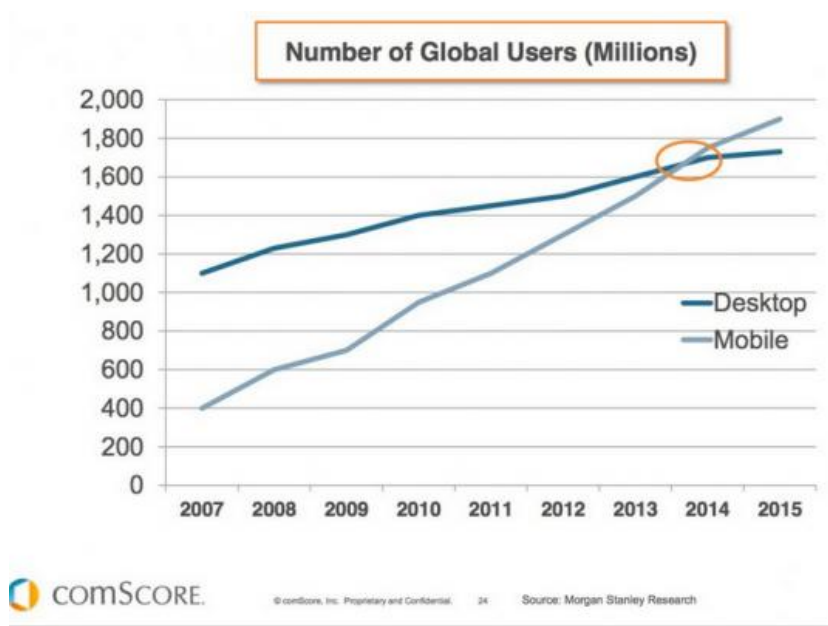

Figure 4. Chart to demonstrate the increase of mobile app users (Smart Insights, 2018)

This image backs up the statement as it's clear that mobile application users have been on the up-rise since 2007 and have already surpassed the total amount of users compared to desktop.

The tattooing industry has adopted the mobile application market considerably, as it's used as their grounds for most aspects of advertising. The hooking point for customers into choosing whether an artist is suitable is being able to see their previous work. Various apps allow tattooing businesses to show their work for free which saves them advertising costs. Apps such as Instagram and Facebook seem to be the most efficient place for artists to advertise as not only is it free, these apps are used by millions of users per day.

The tattooing market has never really had a standalone mobile application as artists only really look for a way to advertise their work rather than basing their entire company online. A disadvantage to this is that artists seem to use multiple apps for their advertisement meaning that customers are having to search for them in numerous places. This in itself can cause a problem for some users as this means downloading different apps. Since 2007, tattooing companies have yet to discover a more effective way into showing their work to the world.

Currently, the majority of tattooing apps on the market revolve around the concept of allowing users to superimpose tattoos onto parts of their body. The whole idea behind this is marvellous as it gives users the potential into seeing how the tattoo will look before they purchase it. Though this is a good notion, these applications have very basic functionality and lack the features that project TattWho has to offer. Other apps on the market provide general advice about tattooing such as aftercare, the history and various other information however don't present any form of tattooing social network or services.

Chapter 3.2 Artefact Contribution

The main contribution that the application will provide is essentially a way for users to come together and form a mobile community that never existed. As discussed before, getting a tattoo is becoming increasingly popular among users of all ages and the trend will only inflate over the coming years. Now is the perfect time to create a platform that will unify all tattoo enthusiasts by constructing a stage where everyone can gather to converse, socialise and utilise the services that project TattWho will provide.

One of the fundamental issues that the current market lacks is the methods to connect with one another. Not only with the application provide a way to obtain a tattoo but will also give users the opportunity to socialise and 'show off' their new tattoo. The project is looking for a way to develop a type of social network that will give users the ability to post their thoughts and ideas for others to see. Once the user base is large enough, the hype and popularity revolving around tattoos should naturally rise meaning putting the whole concept of tattooing into a positive light therefore attracting more users into downloading the app.

From a business point of view, a goal of the project is providing the tools companies need in order to grow. During the market research, it's clear that at times it's hard for tattooing businesses to acquire new customers. This can be typically be due to the time of year. For example, customers are less likely to spend money over the Christmas period or prefer to stay indoors because of weather conditions. Project TattWho will allow for businesses to automatically acquire new customers as users will have the ability to view and contact artists via the app turning users into potential customers.

The same concept applies to solo artists. Many solo artists especially ones that are new to the tattooing industry often find it near impossible to find customers due to the competition of the larger companies. Project TattWho creates a level 'playing field' for all artists meaning that customers will be able to find solo artists just as easily as large tattooing businesses. This in turn will mean the more customers solo artist's trade with, their reputation will naturally increase which will generate more business. This could be aided by one of the features TattWho provides such as the rating system. After the user receives a tattoo, they have the option to rate the artist work meaning if rated highly, will place them above other artists on the app.

Chapter 3.3 Research Analysis

The main objective of market research is to conjure up various strategies to find out more information about the current market. On this occasion, the market research carried out was to gather as much data as possible on the present applications that relate to project TattWho. To get the most accurate statistics, the best approach would be to conduct both primary and secondary research. Primary research is the procedure in which involves the data collection of various areas in the current market. It also includes the notion of manually acquiring this data via different means. One of the most popular strategies is to use surveys and questionnaires. These are a list of short specific questions that aim to provide data that is then used to help identify the requirements of the project. There are many other primary research methods in which to collect this data such as interviews and observations however the best preferred method for project TattWho was to use surveys.

The market research for the project roughly took 2 weeks to fully complete. The main goal was to give the survey out to a variety of different people meaning the data received will be vast. This will provide the ability to see different results allowing the app to be defined further. The key on doing this was to give the survey out to as many

candidates as possible resulting in diverging data sets. There were two types of surveys given out, one was for the artists to complete, the other was to potential users of the app. The artists survey gave an insight into the various aspects of their current advertising strategy whereas the customers gave an understanding on how they currently search for a tattoo if desired.

The results from both surveys are staggering. They both prove and disprove some theories had about the tattooing industry and administer a real vision into how project TattWho can make a difference.

What is your main advertising platform for your services?
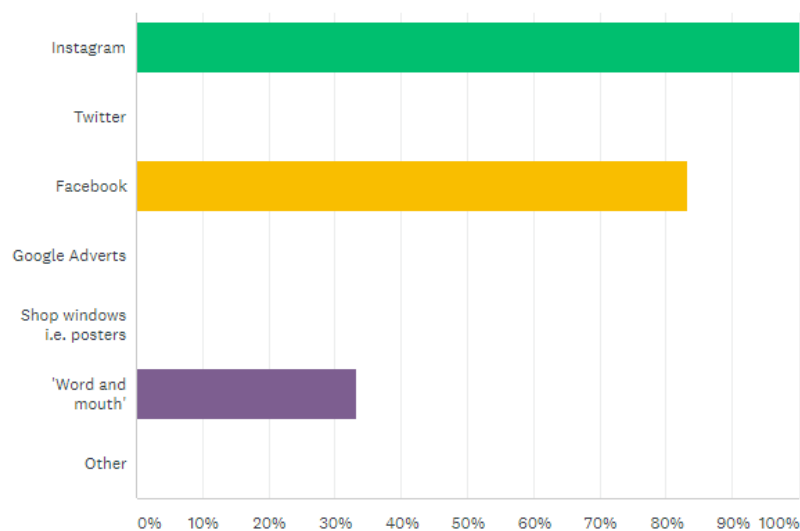
Answered: 6   Skipped: 0

Figure 5. What is your main advertising platform for your services? (Survey Monkey, 2018)

The artist survey was conducted on 6 businesses. It isn't the most substantial number of candidates desired however it's enough to acquire the data needed. The question in the image above is one of the most intriguing in the survey. It shows that astoundingly all 6 candidates use Instagram for their main platform to advertise with Facebook coming close at 85%. This proves that there isn't a specific platform in which artists use to advertise. Evidentially it's a combination of multiple apps.

Which of the following features would you be most beneficial to you?
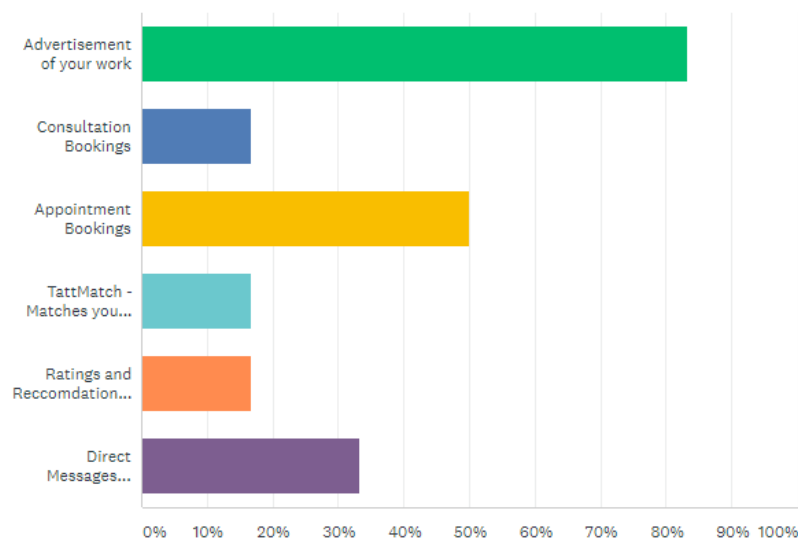
Answered: 6   Skipped: 0

Figure 6. Which of the following features would be most beneficial to you? (Survey Monkey, 2018)

This question asks the artists what features would be of most use to them in the application. These are the main tools available to the artists whereas there is the potential into adding more if required. As the results suggest, all features would be of benefit to the artists but the most would be the ability to advertise their work. This will be the selling point for the artist as essentially this will determine if their style is what the customer is looking for.

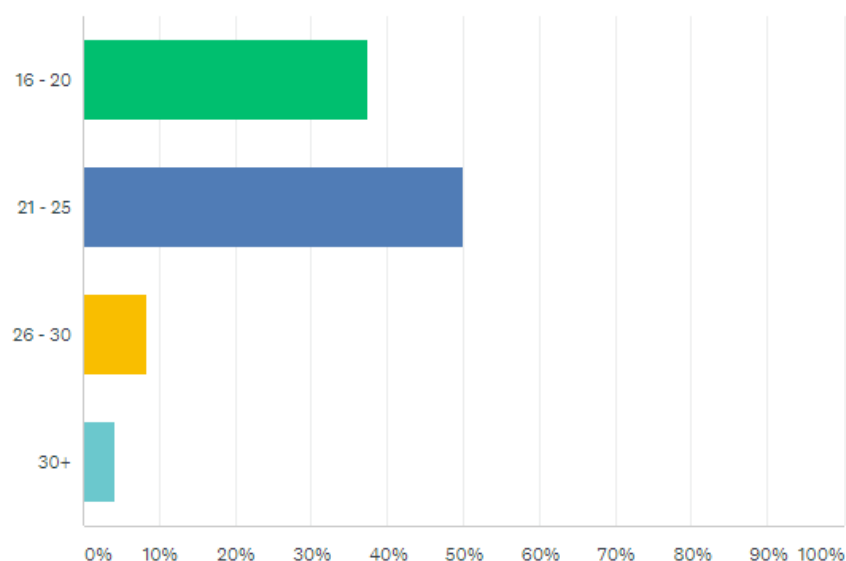## How old are you?

Answered: 24   Skipped: 0

Figure 7. How old are you? (Survey Monkey, 2018) (1)

The first question asked to the users of the app was their age. This was to get a better understanding at the potential age ranges that could use the app. The number of candidates for this survey was 24 which is substantially more compared to the artist survey. Also, it's important to note that the candidates that took part were a mixture of people. Some were friends of friends some were mutual acquaintances therefore any form of bias was eliminated. The results show that the age range is vast meaning tattooing isn't just popular among young people.

Do you wish to have tattoos in the near future?

Answered: 24   Skipped: 0
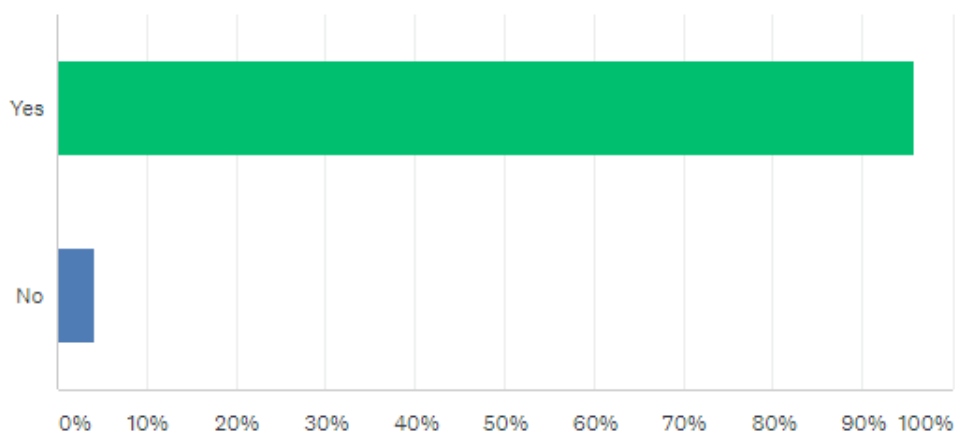
ANSWER CHOICES	RESPONSES	
Yes	95.83%	23
No	4.17%	1
TOTAL		24

Figure 8. Do you wish to have tattoos in the near future? (Survey Monkey, 2018) (1)

Responses on this question are incredible. As the results show, the amount of people who wish to get a tattoo in the near future are 95% with only 5% not wanting one at all. This simply proves that tattooing is unbelievably popular and is in demand amongst users of different ages. It also justifies the call for appeal into the kind of app project TattWho will provide.

Where would be the first place you look to find tattoo artists?
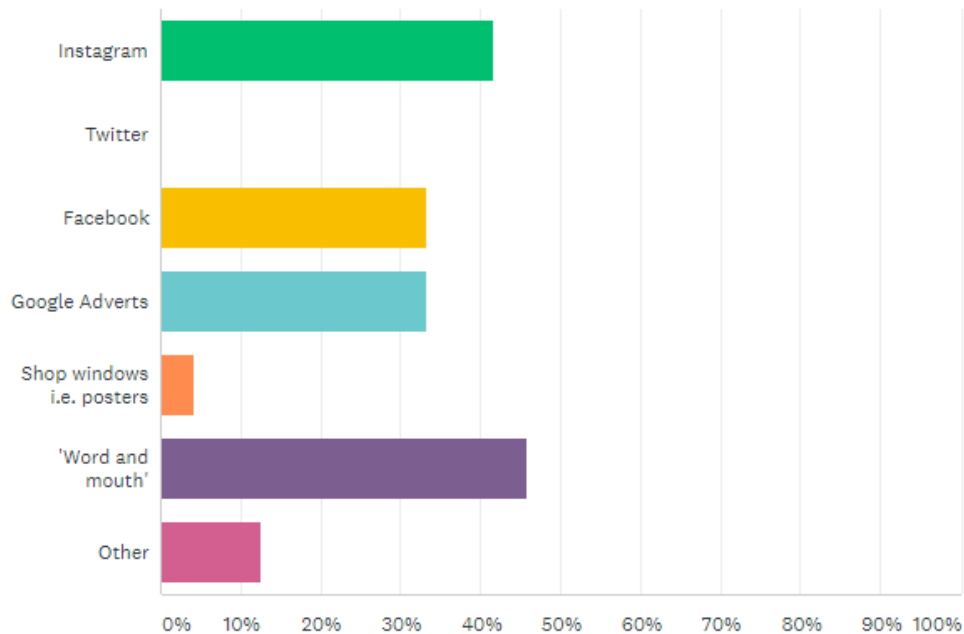
Answered: 24   Skipped: 0

Figure 9. Where would be the first place you look to find tattoo artists? (Survey Monkey, 2018) (1)

When it comes to searching for an artist, most users seem to use a combination of different approaches. In this particular question, the majority of users are referred to an artist by a friend which comes under the 'word and mouth' method. There is a pattern involving the apps Instagram and Facebook as both seem to be the most popular platform when it comes to searching for an artist. Judging by the results of both questionnaires, it's clear that there is nothing on the market that successfully caters for all aspects of tattooing in one solitary app.

Secondary research involves the investigation of existing products on the market. For this particular project, it's imperative to know the competition. This is so a comparison can be made between the project being developed and the leading products on the market. By analysing the differences will enable the project to make improvements which in effect, can then make the app better than its competitors. Carrying out this type of research also gives an insight into what features other apps include which can then be used to promote ideas that could be integrated into the project.

App Name	Pros	Cons
Tattoo My Photo 2.0	• Allows users to superimpose photos as tattoos onto their body • Gives the user an idea before getting a tattoo • Simple and Easy design layout • Functionality of integrated camera and photo albums	• Very basic concept of app • Theme and design straightforward • Features and functionality minimal
Tattoo Designs HD	• Enables users to create new tattoos from shapes and patterns • Users can superimpose tattoos onto body using camera • Save designs into camera roll for later use	• Image quality poor • Basic app design • Features and functionality minimal
Instagram	• Very large user base • Over 23m downloads in October • Allows users all over the world to connect and share photos • Users are able to directly message each other • Like and comment rating system • Provides a way for users to advertise brands • Inbuilt photo editor for adapting photos before sharing • Simple yet effective design of menus and buttons	• Lacks business tools • Target audience may not be on Instagram • Only provides one link in bio there self advertising is hindered • Can be hard for users and business to get noticed due to volume of overall users
Pinterest	• Very large user base • Over 8m downloads in October • More of a social network than Instagram • Allows users to combine photos found to create their own "Board" • Keeps users up to date with the latest trends in all aspects • Easy to use design layout and search functionality • Users are able to share their own "Boards" with friends in the app • Direct messaging system for users to comment and connect with one another	• Lacks advertising tools • Not appropriate for B2B connections • 300 million "Boards" dedicated to fashion • 180 dedicated to food and drink • Attracts a very specific audience • Rivals with Google as they are released a similar app

The table shows the proof that secondary research has been completed. Leading mobile applications on the market have been analysed and compared In order to get more information about the pros and cons that come with the apps.

Chapter 4 – Artefact Design

Chapter 4.1 Front-End

From the very moment I conjured up the concept of my artefact, my mind naturally began to wonder on the possibilities of the design. Devising the layout began during the foundation stages of the project. The process I started with entailed the viewing of other applications on the market and the production of notes on the various aspects about them. This would include observations such as e.g. colour theme, button layouts, ease of use and many others. By doing this, it allowed me to analyse the most effective

design trends and dissect from each the possibility of implementing them into my own application.

The next approach I took was deciding on the type of theme. It's important to have an appropriate theme as I needed one to represent the overall purpose. I began by writing down keywords that are associated with the tattooing industry. As the whole concept is very subjective depending on the individual, the general perception normally links with words such as painful, dark, taboo, demonic and many more. Taking these words into account, the theme of my application began to unfold.

After many variations of the theme, the final decision started to become more obvious. I liked the concept of tattooing being dark and mysterious therefore I decided to work with those words. The next step involved creating a few template html documents that would demonstrate the different themes that I had finalised. The prototype I had created was dark as it included very dull colours and exuded a shadowy atmosphere.
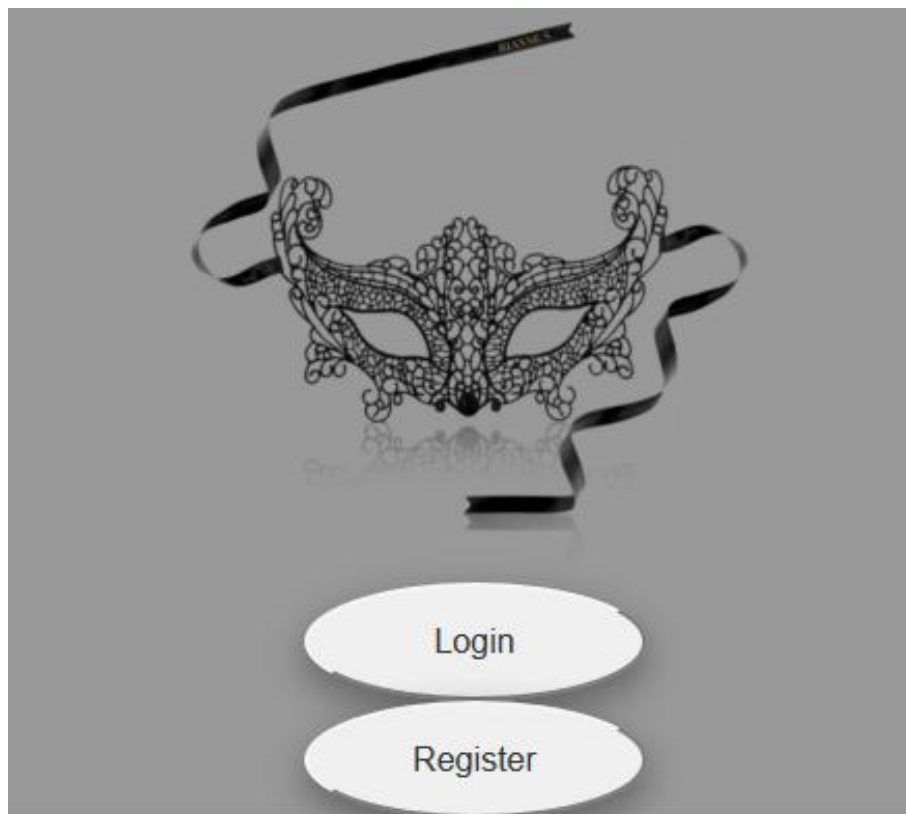

Figure 10. Original 'Home' Page

This is the index.html page which served as a 'home screen' the users would be greeted with upon opening the application. I also decided to include a logo that represented the mysterious side of tattooing hence the masquerade mask. Personally, at this stage,

the theme is too dark as I feel some users may want a variety of colours. To confirm this, I asked a few potential users of the application whether they would change it and all subjects agreed.

Considering these results, I proceeded to adapt the colour scheme. My goal was to keep the mysterious factor however compromise by creating a brighter version.

Figure 11. Improved Login Page

As you can see, the overall ambience looks more polished as I have kept the logo in addition to creating a brighter and almost cleaner effect. I have applied the same colour scheme throughout the application to keep each page layout continuous.

An essential tool used in mobile app development is the implementation of CSS. As I was new to the language, it proved problematic into understand how to apply it to my application. After learning the basics, I then realised how useful it was when creating

the front-end. The structure of my CSS entails a document for each type of function in my application. To give an example, the different registering pages use the same font formatting and div tag positioning therefore I would create a singular CSS page containing the rules for both. To illustrate this further, here is the architecture of my style sheets.

Figure 12. CSS file structure

This CSS code states that the class "buttonRegister" has its own set of attributes that are then applied to the registration buttons. As all types of users registering are going to using a similar form then for efficiency, I put the required CSS in one file. Doing this not only separates your CSS code from your HTML but it also reduces the amount of code needed.

The next step when designing my front-end was adding the components to hold the data. Predominantly, most of my application will contain aspects that require some type of functionality to produce an outcome. For instance, the majority on my forms requires input from the user to send and retrieve data from the server. This also applies to other components such as the navigation bar or slideshow. To effectively execute this, I decided on implementing Bootstrap into my application. During my learning period of web development languages, I discovered the incredibly helpful tool called Bootstrap.

In short, it is an open source front-end framework used to aid in HTML and CSS designs. It provides templates as well as an extensive range of components to help deliver a professional looking application. In terms of my project, using Bootstrap was a tremendous help as it presented me with the templates needed to quickly create a

working app. As I developed my artefact, using bootstrap also catered for my requirements. It allows for responsive layouts that enables the screen to adjust in size according to the device being used.

Figure 13. App being run on an Android Emulator

To fully taking advantage of this functionality provided by bootstrap, there are scripts and CSS to be imported into your HTML documents as demonstrated below.

<link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/css/bootstrap.min.css">

<script
src="https://ajax.googleapis.com/ajax/libs/jquery/3.3.1/jquery.min.js"></script>

<script
src="https://maxcdn.bootstrapcdn.com/bootstrap/3.3.7/js/bootstrap.min.js"></script
>

Now that I have the necessary libraries linked with my application, I can start building a more responsive front-end. To give users an improved customer experience, I added a simple navigation bar that provides the ability to freely move around the app from any page they may be on. I utilized bootstrap even further by also using panels to contain various html components. Using panels was the perfect solution for my layout

issues during this project and not only are they responsive, they also effectively organise my content.

Figure 14. Confirmed Bookings Bootstrap Panel for Customer

The shell of my application had now been designed. My next task was to ensure functionality throughout the application. The-front-end development process also included the designing of functions that gave the HTML and CSS meaning. To achieve this, I needed to first think the outcomes and implement Javascript code to reach them. Javascript played a vital role as it was responsible for all the computations behind the functions of the application.

Similarly to my CSS, I kept my Javascript code separate from the HTML as this was good practise and kept my structure organised. When it came to coding, I had to take a different approach as most of my functions required data from the back-end. Developing a hybrid application had its restrictions and complications when it came to communicating with the server however with the use of AJAX, scripting my client-side functions didn't pose an issue.

The purpose of AJAX in my application mainly involved having the ability to retrieve data from the server without having to refresh the web page. For my front-end design, this proved incredibly useful especially for my forms as the sole purpose was to

display data in an organised manner. For example, my customer bookings was simply a form with buttons that when clicked, would send an AJAX request to the server to then display the data in the relevant text fields. More of AJAX in later chapters.

Overall when designing my front-end, a good strategy to have was to always keep in mind how I would want my users to interpret the application when using it. Most mobile apps today have a very simplistic design which enables the user to easily navigate through the interfaces. I also wanted to take a similar approach when designing the front end of my artefact.

Chapter 4.2 Back-End

It was important to keep in mind that I was essentially a full stack developer therefore distributing my time evenly between the front and back-end was imperative. The back-end of my application predominantly included the implementation of a database. As the app is essentially a gateway of data exchange, it is vital that I designed a database that was capable of storing a vast amount of information of diverse types.

The most appropriate option to support the back-end was to deploy a MySQL database. Deciding on having this type gave myself a range of tools to use in order to structure and maintain my data effectively. I feel that having a relational database allowed me to manipulate the data in many ways which has a distinct advantage over other database engines such as NOSQL.

An extremely beneficial strategy was to design the back-end first during the initial stages of the project. By taking this approach gave me various insights into how I would then structure my front-end. For instance, by designing my database gave me a good indication on the type of functions needed. I.E. having a login page would require a login table. I applied the same theory when it came to deciding the different types of potential users of my application.

The design of the database changed dramatically almost on a daily basis. This was due to the adaptation of both the requirements and the addition of new features. It was important that the design was simple as MySQL databases can become increasingly complicated as more tables are added. I especially refer to linking primary and foreign keys between tables as its easy for MySQL to throw errors if anything is incorrect such as the syntax or even if the data types do not match.

To define the foundation of the database structure even further, I used the procedure of normalisation. Using this tool allowed me to hone down the essential tables needed to create an effective database. By going through the 1st, 2nd and 3rd normal form provided me with the potential relationship types by identifying the primary and foreign keys between tables.
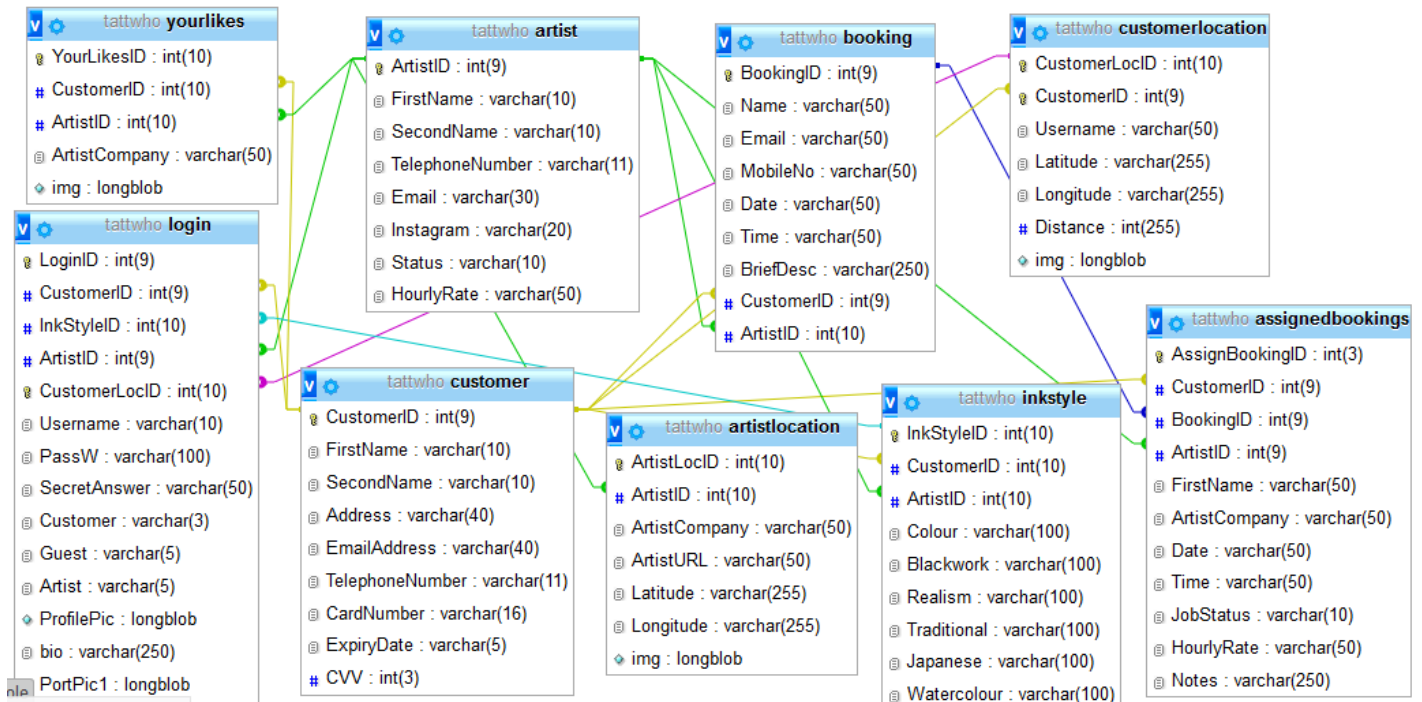
Figure 15. Entity Relationship Diagram to illustrate back-end design

The image above presents an Entity Relationship diagram. This is to provide the reader a clarification into how I designed my back-end database. Producing this diagram is pragmatic as it essentially gives in detail all concepts regarding the structure of my database. Important aspects such as table names, column content, data types and the most vital, relationships between keys are illustrated. It's also important to understand that my database runs on the storage engine of innodb as this support the easy manipulation of foreign keys.

One of the most imperative factors of designing a back-end is ensuring I had the correct security in place to protect the user's data. The database will be storing a substantial amount of information of different types therefore securing it is key. Not only will it store a vast quantity of data, but extremely sensitive details will also be recorded. This includes areas such as the names, addresses, telephone numbers, bank details and even locations.

Shielding the database itself can be done using the correct protocols on the physical server machine however protecting the raw data from within requires additional security measures. I wanted to design the database in a way that allowed the user to feel safe when submitting their details to the server. The method I desired was to use a MD5 encryption algorithm that would hash the most sensitive data provided by the user.

MD5 is essentially an algorithm employed to hash data of my choosing. It runs the hashing function to encrypt any information by creating a 128-bit value that makes it harder to crack in the event of an attack. At the time of designing, this algorithm suited the needs of my requirements perfectly as it will serve the purpose of protecting my data.

The algorithm was mainly implemented during the registration process of the application. As this stage asked the user to give information about themselves, it was vital that I applied the encryption to defend the most delicate data. My design at first was to hash the password however towards the end of the project, I decided to implement the same algorithm to the 'secret answer' field that was used for password reset.

```
$PassW = md5($PassW);
$SecretAnswer = md5($SecretAnswer);
```

Username	PassW	SecretAnswer
jim	5e027396789a18c37aeda616e3d7991b	5e027396789a18c37aeda616e3d7991b

Figure 16. MD5 hashing algorithm applied successfully

The consensus of the above images illustrates how I've applied MD5 to both the password and secret answer field. The top image demonstrates how the function is hashing the string $PassW and $SecretAnswer to then be passed into the database. The second image shows the 128-bit value being store successfully. It's imperative to hash data that could be used against a user as essentially my application will need to abide by legislations such as GDPR.

One design flaw I discovered towards the end of the project was that MD5 hashing is becoming depreciated. This is mainly due to security issues as its been proved that by using malicious methods such as the brute force attack, hackers will easily penetrate

the MD5 encryption. As a result of this, the next algorithm to use would be the PHP built in function simply called password_hash() which creates a one-way stronger encryption. I was unable to implement the changes due to time restrictions however this is useful knowledge to have as I will take this approach when ensuring security on any apps I work on in the future. As the application grows in popularity so will the database therefore making it even more important to focus on security.

Chapter 4.3 Native Vs Hybrid

One of the initial stages of mobile app development is to decide if it's necessary to build your application in a native or hybrid environment. It essentially relies on the requirements of the overall project and what type of audience the product is intended for. There are pros and cons for both environments therefore it narrows down to what allows you to reach the project goals the quickest.

Developing in a native environment substantially restricts the platforms in which your app will be compatible on. This in turn will hinder the potential number of users that will be able to use the application. As my artefact is largely a social network, it was vital that I built my application to support as many users as possible. That being said, from the very first stages of development, it was clear that building a hybrid app was the correct approach.

One of the distinct advantages of designing a hybrid application is that I was able to use almost any web development IDE to begin coding my UI's. This included any IDE that has HTML, CSS and Javascript capabilities. Whereas developing in a native environment only allows for certain programming languages to be used. This also can restrict progress as this forces the developer to learn new languages which puts an element of pressure on the project.

There are copious amounts of IDE's available on the internet. How do I decide which one was most appropriate for my skill level? My knowledge in web development was extremely limited at the time of design, therefore I felt a beginner IDE was adequate for my requirements. After extensive research, I found that the IDE Brackets was the most satisfactory for my development needs.

In comparison to the ease of developing a hybrid app, there are the IDE's that only allow for the developer to code in the native languages provided. A good example of this would include Android Studio. This is an efficient development suite that allows

the user to build professional applications using its easy-to-use tools however it completely isolates the programmer to develop applications compatible on an android device.

Languages such as XML and Java are the main two used to develop Android Studio applications. The benefit of Android Studio being native to these languages is that Java is widely used in the software industry therefore not a lot of learning will be required from more advanced programmers. The development suite also makes the HTML and CSS aspect of designing incredibly easy. With hybrid applications, I was required to write the code from scratch, designing each aspect of the components whereas Android Studio provides templates that only need to be programmed to perform a function using Java.

On the other hand, building hybrid applications also has its own disadvantages. As discussed before, taking a hybrid approach opens the choices of the different programming languages to implement however forces the developer to build the application from the very foundations. This essentially means I was required to produce the HTML, CSS and Javascript from scratch to create a working application. This could be seen as a benefit, as if my knowledge of these languages was extensive, it would enable me to provide more customisation involving the design of the overall app.

One of the main attractions that drew me to the development of a hybrid application is that once you build the app you have the ability to deploy it across multiple platforms. It's one code base holds the compatibility potential to be used on almost any device. To put it simply, hybrid apps have all the characteristics of a website however its coated in a mobile application wrapper. However, if I decided to build an app on a native platform then later decided that I wanted to convert it into a hybrid, I would have to recode the majority of the project.

Chapter 5 – Implementation
Chapter 5.1 Mobile Application Languages, Scripts and Frameworks

The designs of my application lay the foundations for the overall artefact. Now comes the next step of implementation. Developing a mobile app inevitably warrants the thought of what type of languages will I use in order to build a successful app. There

is a fine line between 'will' use and 'need' to use as depending on the purpose, the app will require certain languages to operate.

As discussed in the previous chapter, I made the decision on designing my application in a hybrid environment therefore as a result of that choice, it unavoidably narrows my path in terms of languages to use. Any hybrid application built, will require some form of HTML, CSS and Javascript however coding in those languages relies on the type of framework implemented.

A framework is used in conjunction with mobile app development as its purpose it to give the programmer the ability to produce one code base to then be deployed onto any mobile platform bypassing any compatibility issues. The function behind the frameworks includes wrapping the HTML and Javascript in a container to be used natively on almost any mobile device. Coding a hybrid app also allows the access to the device's hardware capabilities meaning in comparison to a website, the device offers the utilization of functions such as using the camera, touch sensors, facial recognition etc.

Implementing a framework for my application was no easy task. With a variety to choose from, I needed to understand what each framework had to offer in comparison to my projects objectives. My supervisor suggested the use of the framework Cordova. He explained to me in detail the pros and cons of using it and upon discussion, it was clear that I implemented it for my application.

Using Cordova was essential for my application over any other frameworks. This became apparent as due to the fact my application was developed using website-based languages such as HTML, CSS and Javascript, all that I needed was to implement the framework to covert my website into a mobile application. I feel now that this was the reason my supervisor and I agreed on the implementation of Cordova.

Another approach I could have taken was using the popular SDK Ionic. Ionic is also used to build applications in a hybrid environment and is seen to be the next best framework in collaboration with Cordova. The mobile app industry is slowly integrating towards the use of Ionic as it provides the tools to make hybrid app development effortless. The framework is built on top of Cordova which makes deploying the application even easier.

However, there are some disadvantages involving Ionic which aided in my decision to implement Cordova. If I did take the approach into using Ionic, I was subjecting myself into learning new languages such as AngularJS and TypeScript. For a beginner such as myself, allotting time to learn these on the schedule I had, was unrealistic if I wanted to achieve my project goals.

Even though I avoided learning the new languages that came with Ionic, I was still forced to learn new concepts of mobile app development. Half way through building my artefact, my supervisor brought to my attention that my current development implementation had some issues. When coding my application, it was vital that I separated the server and client-side to avoid any compatibility issues with Cordova. This is due to Cordova only being able to wrap client-side aspects such as the HTML, CSS and Javascript.

My supervisor then discussed the need into converting my PHP into restful API's. The API's contains all the functions that were originally included in my HTML code but now has its own API interface that it communicates with. Essentially, the API keep the server-side functionality separate allowing the client-side to make requests to the API which returns data.

```php
// Gets all users from the customer table - test
$app->get('/api/test', function(Request $request, Response $response){
    session_id('TEST');
    session_start();#

        $sql = "SELECT * FROM customer ";

    try{
        $db = new db();
        $db = $db->connect();

        $stmt = $db->query($sql);
        $stmt->execute();
        $result = $stmt->fetchAll(PDO::FETCH_ASSOC);

        echo json_encode($result);

    }
    catch(PDOException $e){
        echo '{"error": {"text": '.$e->getMessage().'}';
    }
});
```

Figure 17. API example

This image shows a simple API function that runs a MySQL query that communicates with the database.

After the MySQL query is executed, the results are then gathered using a PHP method called PDO. PDO acts as an access layer that is used to retrieve data from the database using its fetch method. There are multiple fetch methods however for this MySQL statement, I wanted to extract all data from the table 'customer' therefore using the fetchAll function seemed appropriate. There are many instances in my API's that I only wanted a singular abstract of data returned thus using the fetchColumn() method was a better choice.

Now that the data is returned, I now needed to find a way to convert it into a usable object. To do this, I needed to understand the concept of using JSON. JSON is a data format used in API's to convert data sent and retrieved to the server via only text-based responses. The data returned is stored inside an JSON array to then be passed on for further processing.

```
[{"ID":"1","fname":"James","sname":"Early"}]
```

Figure 18. JSON Array Example

To give an example of what the JSON array contains, here is a test API response used to get all customers from a MySQL table. You can see that the response comes back in valued pairs meaning you can use this as an object identifying each element by the column name.
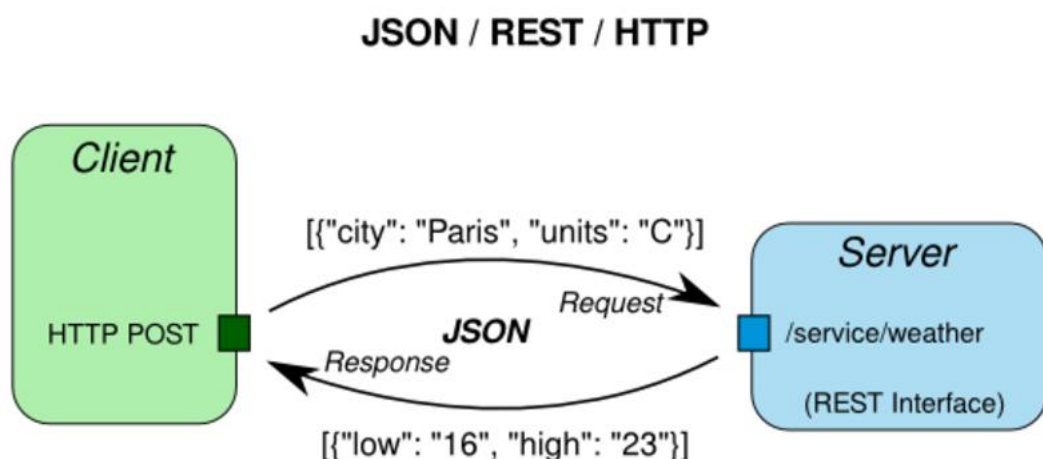

Figure 19. JSON explained (University of Bedfordshire, 2018)
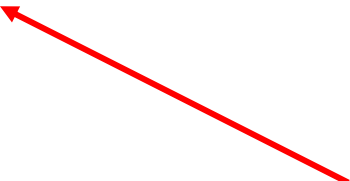
Here is a technical interpretation of the data exchange between the client and server.

There was one last implementation issue regarding programming languages I needed to understand. Throughout the application are forms that require information to be displayed to the user. I have already acquired my data in a JSON format, I now need to transfer it to the client side.

The best method to accomplish this task is to use jQuery's AJAX. It was very late in the implementation stage that I discovered the need of this tool however once I applied it to my forms, I quickly realised how crucial it was to the functionality of my application. The purpose of AJAX is to enable data to be exchanged between the server and client without the need to refresh the entire web page. This is extremely useful in creating dynamic web pages. Applying this tool to my forms in particular, allowed multiple sets of data to be displayed. For instance, when the customers want to view all their bookings, I have created a form that cycles through the data retrieved using an AJAX call without the need to refresh.

```
// Used to Cycle through bookings linked to a customer
$(function () {
  var images = [],
    index = 0,
    count = 0,
    max = 0;
$.getJSON("http://testing/api/getbookingname", function(data1) {
    images11 = data1;
    count = images11.length;
    max = count - 1;
});
$('#next').on('click', function()
  if (count === 0) {
    return;
  }
  if (index === max) {
    index = 0;
  } else {
    index++;
```

AJAX GET call to retrieve to the booking name

```
        }
        var remove1 = (images11[index].replace(/\"/g, ""));

        $('#HTMLBookingName').val(remove1);
});
```

Removes the JSON quotes

Displays results into HTML form

This code demonstrates my explanation of showing all the bookings made by one customer using AJAX.

It was incredibly intimidating at first to accumulate the knowledge of these different languages. Not only was I forced to understand in detail how each of these concepts worked, I also had to study how they complimented eachother. I had an attitude going into my implementation stage of thinking all I had to code was HTML, CSS and Javascript therefore taking a laidback approach. Upon reflection, it would have been beneficial if I had researched the different frameworks and languages required before any form of implementation. On the other hand, I haven't seen learning these languages as an issue as I will enable me to transfer these skills later on in a potential work place.

Chapter 5.2 Locational Services Technologies

The whole concept of tracking a user's location has always been seen as a grey area. Many users feel that having their phone knowing exactly where they are at all times warrants the argue of a breach in privacy. When first exposed to the idea, it's understandable that users feel this way as technology has reached the potential of tracking our every move.

Not only do apps have the hardware capabilities to track us, it also possesses the ability to record and send personal data. This is also a very controversial subject as users don't feel that their sensitive data is safe or even 'personal' anymore. You can see this type of debate almost on a daily basis. We've seen recently that Facebook are undergoing criticism in terms of their safety measures they have in place.

Storing information from users is perceived to have a negative impact on ethics however I believe with the correct security procedures, users shouldn't have to feel anxious whenever they venture outside their house. There are a lot of advantages of using a customer's information that pose no threat to them personally however given the chance, users will jump at the opportunity of blaming organisations for potential data leakages.

Most apps on the market today actually store incredibly sensitive information with the user's consent. This isn't intended to be sold to third parties, instead improve the overall experience. Take Amazons app for example, it not only stores your login credentials but also stores your address and bank account details. Without this sort of application capability, users will inevitably begin to feel frustrated as this will force them to repeatedly input their details every time they make a purchase.

Having this mentality in mind, the approach I took when implementing these sorts of features in my application was different. One of the main goals of the project was the security of customers data at all times. As discussed before, for the login system, I used an MD5 encryption algorithm to hash user's passwords and secret answers. This renders their credentials safe however I needed to think how I will secure the rest of the app.

A large part of my application involves recording the user's exact location in the globe. There are three features that captures this type of the data. The first is called TattMatch. This feature allows customers to find artists in the area based on their current location. The second function, UserMatch, similarly carry's out the same procedure of finding other users in the area. The last function, CustomerMatch is available for the artists to find customers in the area.

Both features utilize the locational hardware and software of their mobile device to aid in finding their exactly position. When choosing how to extract that type of information seemed like a daunting task at first as I had no real experience in this field of programming. When searching for a possible method to attain this data, I needed to be careful to select a method which preserved the customers ethics as much as possible.

After extensive research, I came across the concept of Geolocation. Geolocation is used for the identification and graphical positioning of a device. It uses real-world mapping to pin-point exactly where the object is. In terms of a mobile device, it abstracts data from the GPS service to ascertain the current location of the user. This also applies to anything with a Wi-Fi connection however instead of using GPS services, it uses the IP address to determine where you are.

For functions such as TattMatch, using Geolocation seems to be the perfect solution into implementing my locational based feature. Using this method gives me the ability

to extract multiple aspects of where the user is, such as their country, region, postcode etc. The data I decided to gather was their latitude and longitude as this will enable me to get an idea of their current location. Accumulating this type of information is incredibly useful into making my features more accurate.

Before implementing Geolocation, I needed to ensure I had the correct files imported to give me access to its capabilities. The file required was simply a Javascript document containing the functions that gave me admission to the latitude and longitude data I desired. It works by the browser contacting the Geolocation server and returning the data it needs. If there is no Wi-Fi available, the device would contact the GPS service to attain this information.
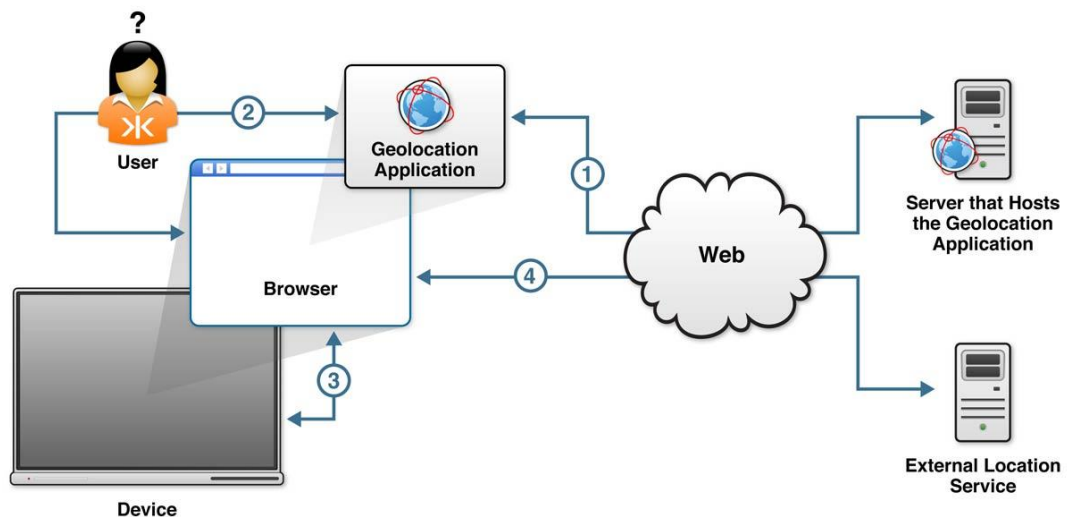
Figure 20. Geolocation Explained (Jensimmons, 2018)

To give a clearer idea, here you can see the different processes involved between the user and Geolocation servers.

$(document).ready(function(){

    navigator.geolocation.getCurrentPosition(handle_geolocation_query,handle_errors);

function handle_geolocation_query(position){

var $Latitude = position.coords.latitude;

var $Longitude = position.coords.longitude;

$.ajax({

type:'POST',

dataType: 'json',

url: 'http://testing/api/updatelocation',

←	Assigns the Lat and Long to variables
←	POSTS data via AJAX

```
    data: {
    'Latitude': $Latitude,
    'Longitude': $Longitude
    },
  });
    }
  });
```

The Javascript function contains the '*navigator.geolocation*' class that makes a call to the Geolocation service to gather the latitude and longitude data. It's then passed onto the API using an AJAX POST method to be inserted into the database based on the current user.

The integration of using this data in my features proved to be incredibly difficult as the purpose was to find a way in locating artists in the vicinity of the user. I had the crucial data from the customer, I now needed the real-time position of the artists. The approach I took was to hard code the latitude and longitude of the artists location as essentially it will be static. As artists tend to work from their studios, it was sensible that I inputted their data manually. Maybe in a future version, I can create dynamic artists so customers can find ones who are mobile.

For testing purposes, I took various studios from around the UK both locally and afar to see If I could get the feature working to its full potential. To implement the feature, I was required to find an algorithm that executed the calculations into making TattMatch functional. There are many mathematical equations that achieve the outcome I wanted however finding the right one that worked in conjunction with my artefact was troublesome.

It was clear that the most suitable formula to apply is the Haversine algorithm. This is because it provides a simple calculation that computes the distance between two sets of location parameters. In this occasion, we use the latitude and longitude of both the customer and artist then compare them to see if they are within distance of each other. Its process contains the math into searching the radius of the user which can be either increased or decreased depending on the users input.
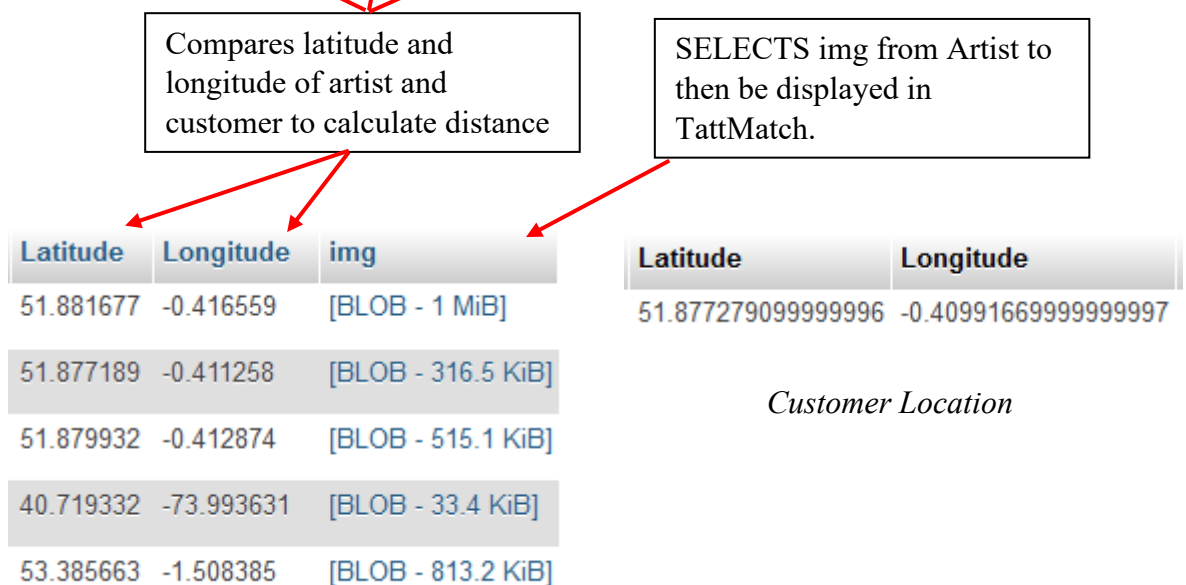
$$d = 2r \arcsin\left(\sqrt{\sin^2\left(\frac{\phi_2 - \phi_1}{2}\right) + \cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right)$$

Figure 21. The Haversines algorithm (Ryan Duell, 2018)

Here is the simplified Haversine algorithm that outputs the distance of two inputs.

To make this function work, it requires the relevant locational information which is provided by the users. To do this, I needed to implement the algorithm into a MySQL statement that retrieve the latitude and longitude from the current logged in customer. As we discussed before, the data is recorded into the database when the customer first logs in therefore I already had the information I need.

*$sql3 = "SELECT img,(3959 * acos(cos(radians('$Latitude')) * cos(radians(Latitude)) * cos(radians(Longitude) - radians('$Longitude')) + sin(radians('$Latitude')) * sin(radians(Latitude)))) AS distance FROM artistlocation HAVING distance < '$Distance' ORDER BY distance LIMIT 0 , 20;";*

Compares latitude and longitude of artist and customer to calculate distance

SELECTS img from Artist to then be displayed in TattMatch.

Latitude	Longitude	img
51.881677	-0.416559	[BLOB - 1 MiB]
51.877189	-0.411258	[BLOB - 316.5 KiB]
51.879932	-0.412874	[BLOB - 515.1 KiB]
40.719332	-73.993631	[BLOB - 33.4 KiB]
53.385663	-1.508385	[BLOB - 813.2 KiB]

Latitude	Longitude
51.877279099999996	-0.40991669999999997

Customer Location

Implementing this function was simple in comparison to other aspects of my project however there are a lot of issues that pose a threat to the potential compromise of locational data. You can see that the latitude and longitude is stored as raw data inside my database with no sort of protection. If it was breached, hackers will have access to the locations of all users connected with the application. To solve this, I would implement as strong hashing algorithm to prevent any security breaches.

Choosing to share your location is completely up to the user. I have implemented a way that upon sign-in, the user will have a choice into sharing their location. If they don't, the functionality of the app will suffer however by giving this choice will allow the user to feel safe when using the app.

Chapter 5.3 Design Specification and Requirements

One of the most important aspects during the implementation stage of my application was to analyse my requirements and ensure I have met their criteria. It's vital that I keep checking what requirements are in place on a daily basis to ensure I am following them correctly. It's easy to go off track as aspects such as designing creates a lot of opportunity to change the requirements without the intention of doing so.

With a project like mine, following the requirements is especially important as a large section of the application records sensitive data therefore I need to take this into consideration when setting them. This also applies to the social network aspect of the app. Users will have access to each other's information, therefore it's imperative I follow requirements to ensure this is implemented using the correct approach.

There are two types of requirements I needed to consider, functional and non-functional. Functional describe the internal workings of my application such as the calculations, processing and data manipulation. These are mainly set to reiterate how the user's expectations are to be met. On the other hand, the non-functional requirements. These apply constraints while designing my application or effect how the implementation is done, for example aspects such as performance and quality standards.

Req No.	Functional /non-functional	date	Requirement	Met
1.0	TattMatch	-	-	-
1.1	Functional	01/04/2018	Haversines Formula will retrieve Artists in the radius of user	Yes
1.1.1	Functional	01/04/2018	Function will display artists img via image tag	Yes
1.1.2	Functional	07/04/2018	Function will display Artist Company	Yes

1.2	Functional	08/04/2018	Link will appear that allows users to visit current artists page	Yes
1.3	Non-Functional	20/04/2018	Hash locational data using encryption	No
1.4	Non-Functional	20/04/2018	Buttons applied to allow users to play TattMatch. Textfield also provided to allow user to change radius distance.	Yes
1.5	Non-Functional	15/03/2018	Bootstrap panel applied for responsive layout	Yes
1.5.1	Non-Functional	15/03/2018	Applied CSS to buttons to ensure design theme relevance	Yes
2.0	Booking System	-	-	-
2.1	Functional	20/04/2018	SESSIONID set to enable the retrieval of bookings of the current user	Yes
2.2	Functional	20/04/2018	AJAX GET method that allows multiple bookings to be displayed	Yes
2.3	Non-Functional	21/04/2018	Bootstrap panel applied for responsive layout.	Yes
2.4	Non-Functional	21/04/2018	Interface will provide buttons and textboxes to navigate through bookings	Yes
3.0	Login/Register System	-	-	-
3.1	Functional	01/03/2018	HTML forms to capture users data	Yes
3.2	Functional	05/03/2018	Form calls API function to input users data successfully.	Yes

3.3	Non-Functional	05/03/2018	Bootstrap applied for responsive layout	Yes
3.4	Non-Functional	05/03/2018	Textfields, checkboxes and buttons allow for efficient user input	Yes
3.5	Non-Functional	10/03/2018	MD5 hashing to encrypt passwords and secret answer	Yes
3.5.1	Non-Functional	09/04/2018	Implemented the change to using Password_hash() to strengthen password encryption	No

To give you an idea on my artefacts requirements, above are the main functional and non-functional requirements that kept the project on track. It's important to understand that most of my requirements have been met however some were unable to be completed. You will notice that I encountered a few issues regarding the security of the user's data. I was unable implement the change from using MD5 to Password_hash() as I discovered far too late the potential weaknesses found in using MD5. It's vital to appreciate that at this stage, my artefact is still essentially a prototype therefore I would not release it before addressing these crucial security issues.

Creating requirements not only aids in defining the scope of the overall project but also gives me the ability to outline the specification of the artefacts design. In software development, it's important to plan the requirements before developing the application as they give you an understanding of what the user and any stakeholders are expecting.

It also allowed me to use tools such as UML to build diagrams that are based off the requirements. UML is essential to any developer as it gives anyone involved in the project an insight into several aspects regarding the software. Creating UML diagrams was carried out during the designing stage of this project therefore this section will enable us to see if the implementation has followed the diagrams.

The initial diagrams include a user case, sequence and activity. These show the bare minimum design of the overall application. This is because during the first stages of planning, the requirements for my artefact were very little. This is also shown in the functions suggested by the UML diagrams. Overtime, I added more features therefore it was inevitable the diagrams rapidly became outdated.
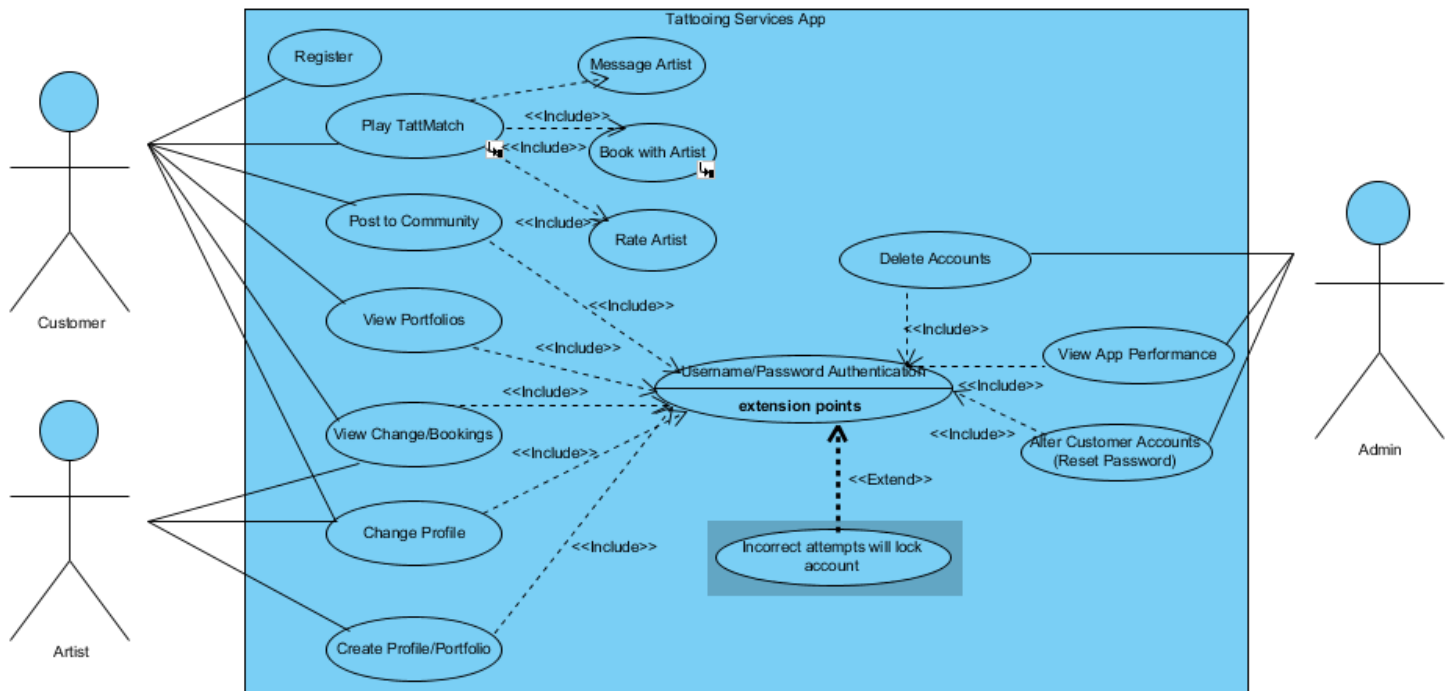

Figure 22. Use Case Diagram for proposed system

This was the original version of my Use Case diagram. It was constructed during the pilot stages of planning and has considerably changed as the development progressed. You can see that my application has 3 distinct types of users. This has changed as now the Admin user has been converted into a guest account. My future plans will include the accessibility of an admin user however the prototype will not feature this type of account.

Various use cases have also been adapted and some even removed from the system entirely. For instance, users are unable to post to the community or rate artists however I added a new feature that allows them to search for other users in their area. Similarly, artists are unable change their profile but now have a new dashboard. There are some features I had the intention of keeping which had the potential of boosting the applications capability but unfortunately due to my lack of time and manpower, I was unable to implement them.

You may also notice that artists don't have permission to the registration page. I had the strategy of if an artist wanted to be a member on my application they would need to contact me directly and request an account. This approach worked nicely with my database as I will be able to input their location information manually as this would represent their static tattooing studio. Also, this would allow for easy account management from the back-end if an artist decided to change their details.

Another advantage of implementing this setup is that it will also stop regular users from creating an account as an artist, which potentially prevents the issue of fake identity. There are ways round this sort of scenario as for example, I could have implemented a system that if you were a genuine artist wanting to register, an email containing a code could be used to become a member.
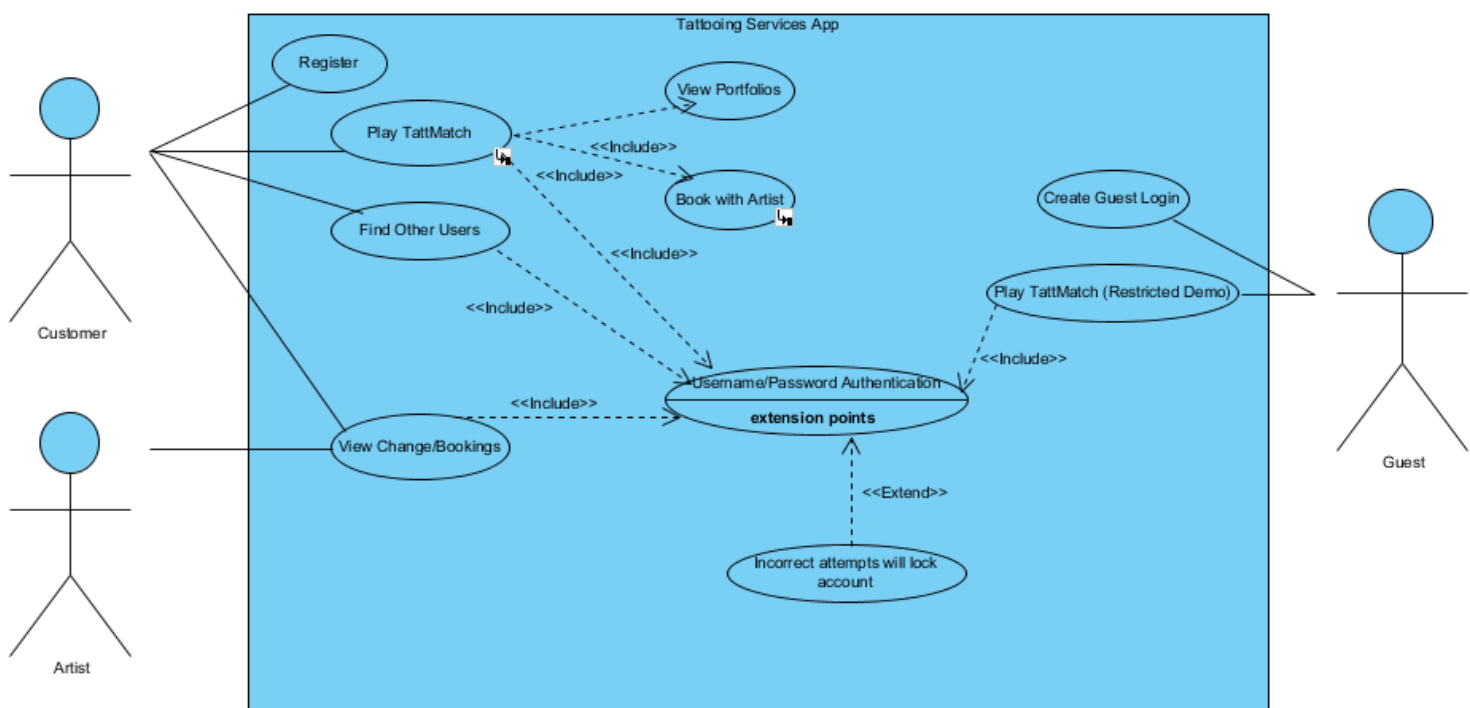
Figure 23. Use Case Diagram for prototype system

As it stands, here is the Use Case of my current application in its prototype form.

Chapter 5.4 Methodologies Utilization

Starting the development process of any application requires an approach that allows the project to continuously move forward. Without any sort of structure to my project, it would be vulnerable to a large amount of issues and inevitably become a failure.

Especially in software development, it's wise to apply a methodology that enables the project to follow a path to reach the overall goals and objectives.

It essentially depends on the type of software being developed however for the IT industry in general, there are a few popular methodologies that ensure the success of a project. It was important to choose one that supported the development of my artefact and gave it the ability to achieve its goals. There are some methodologies that are designed for projects who are on a strict time frame allowing them to produce working software rapidly.

Deciding on what methodology I should apply was discussed in detail with my supervisor during one of the initial meetings. He explained to me the benefits of implementing one and a verdict on which one was right for my project. He explained that due to the time frame I had, it was crucial that my project followed the Agile methodology.

Agile is a cluster of different methodologies that collaborate under one umbrella. The different sub categories of Agile all provide their own benefits that aid in software development. The main issue with my artefact was the constant pressure of completing it on time. The entire project needed to be planned, designed and implemented over the space of a few month therefore Agile seemed the perfect methodology to use.

My supervisor and I utilized Agile by meeting up at least once a month to discuss the progress of my artefact. This allowed us to structure our meetings by going through the lifecycle and setting targets to reach by the next meeting. For this project, using this methodology seemed most appropriate over other approaches such as SCRUM as due to the timeframe I had, Agile allows me to quickly create working versions of my application to then be presented to my supervisor.

The feedback given in the meetings was incredibly helpful as it allowed me to analyse my own performance and understand what my mistakes were. It's was important for me to take the negative feedback just as much as the positive as the key to an efficient developer is having the ability to convert the criticisms into strengths. For example, during the market research stage, my supervisor suggested that I changed how I structured my survey questions to suit the needs of the client more. I applied his instructions thus creating a new, more accurate questionnaire. Being open and seeking

new ways into refining my work was an essential attribute to possess which allowed me to improve my overall project management skills.

We also took the same approach when refining my application. Each meeting I would demonstrate my progress to my supervisor showing him any new features I've implemented. We would critically analyse the growth of the artefact and suggest any improvements to be made to both my application and personal learning. Once the meeting had concluded, I was able to integrate the feedback given into my next iteration of the application.

A good example of this would involve the division of functionality between the server and client side. My supervisor advised me to change the structure of my application to avoid any compatibility issues with Cordova as covered in chapter 4.2. I acted upon his advice, implementing the changes before out next meeting. These procedures were carried out in line with the Agile framework meaning I could produce quick working releases of my artefact. Even though this was a university project, it's clear that this sort of scenario would occur in the workplace.

Using Agile for this project had a distinct advantage over other popular approaches available to implement. If I were to take the waterfall approach, this would instantly have a negative impact on the outcome of the artefact. This is because waterfall is designed to support projects that develop over extended periods of time rather than in quick successions.

Agile provided the flexible to change requirements at any time. This is another reason why I implemented the methodology as I was able to utilize this attribute by reflecting the new requirements in the next release of the application. The traditional approach contrasts from this as it has a rigid set of stages that need to be followed and only once they are complete, a version of the project is released. This contradicts the Agile approach where each lifecycle iteration is almost a project in itself.

Chapter 6 – Development and Testing
Chapter 6.1 Artefact Development
The development of my artefact was executed in stages. The initial approach I took was to divide my time into coding the different features of the application. This enabled me to manage my project effectively by analysing what features would take the most time and dedicate my effort accordingly.

The first stage I took was the development of the login and registration pages. As it was the initial page the user is greeted with, it was important that I conveyed a positive impression which would entice them to explore further. Designing this page also allowed me to configure CSS that will provide the theme and responsive layout for the other pages. The HTML acted as a type of template that was used for similar pages throughout the application.

Coding the functionality of the system was straight forward as I applied similar logic from previous systems I have built. Both signing-in and registering communicate with the database to either POST or GET the required data. For the login feature, the credentials are provided by the user which are then compared to the data stored on the server. It's done by using an IF statements to differentiate between the types of users. The strategy I took was to separate each user by a column that contained the word 'yes' that was used to identify that particular account.

$sql8 = "SELECT Customer FROM login WHERE Username= '$Username' AND PassW='$PassW' LIMIT 1";

$sql5 = "SELECT Artist FROM login WHERE Username= '$Username' AND PassW='$PassW' LIMIT 1";

$sql7 = "SELECT Guest FROM login WHERE Username= '$Username' AND PassW='$PassW' LIMIT 1";

Stage 1: MySQL statement that SELECTS the column that contains the word yes for each user type

if($result8 == 'Yes'){

$_SESSION['Username'] = $Username;

$_SESSION['CustomerID'] = $result2;

$_SESSION['InkStyleID'] = $result3;

$_SESSION['CustomerLocID'] = $result4;

header("Location: http://localhost/testing/dashboardv2.html");

exit();

}

Stage 2: Embedded IF statements that compares the results of MySQL query to identify account type

if($result5 == 'Yes'){

$_SESSION['Username'] = $Username;

$_SESSION['ArtistID'] = $result6;

header("Location: http://localhost/testing/artistdashboard.html");
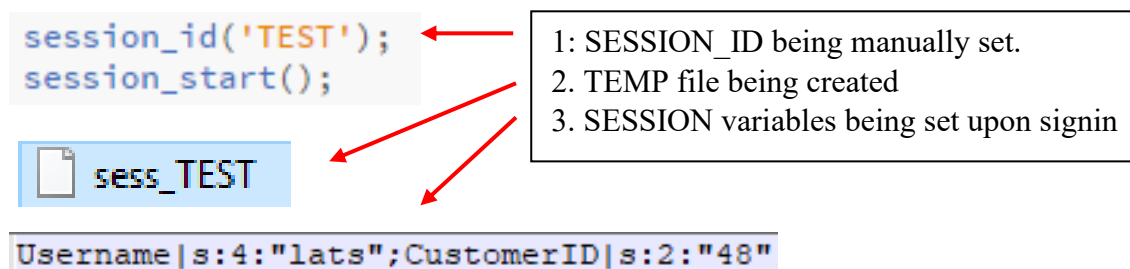
```
    exit();

    }


    if($result7 == 'Yes'){

        $_SESSION['Username'] = $Username;

        $_SESSION['CustomerID'] = $result2;

        $_SESSION['CustomerLocID'] = $result4;

        header("Location: http://localhost/testing/guestdashboardv2.html");

        exit();

    }
```

> Stage 3: Diverts user to appropriate dashboard based on credentials given.

SESSIONS were also set during the login stage of the application. SESSIONS are temporary data extracted from the current user logged it. Its purpose is so I can use this data between all pages of the application. In this instance, the customers SESSION is most important as I need information such as their *CustomerID* and *CustomerLocID* for functions such as TattMatch to operate

One major issue I encountered regarding the SESSIONs involves the inability to transfer the data between pages. In a working scenario, SESSIONs are meant to be created automatically using a unique ID specific to the current logged in user. The automatic SESSIONs were being created however the temporary files were empty. After an extensive period of time, I was unable to resolve this issue therefore in the best interests on the projects progression, I have manually set the SESSION's ID to 'TEST' as demonstrated below.

```
session_id('TEST');
session_start();

sess_TEST

Username|s:4:"lats";CustomerID|s:2:"48"
```

> 1: SESSION_ID being manually set.
> 2. TEMP file being created
> 3. SESSION variables being set upon signin

The strategy I applied to my project was to ensure I had the main features of the application operational before working on the smaller aspects of the artefact. With this approach in mind, I decided to dedicate a substantial amount of time developing the

locational based features. This mainly included the function TattMatch as I knew I had to learn an extensive set of skills to make this feature a success.

I always had the vision of making a type of slide-show that contained the collection of artists in the area to be viewed. I designed a type of carousel that gave the user the ability to scroll through each artist found in the area and have the option to like the current work being displayed. The image exhibited represents the artistry skills which essentially should persuade the user to either skip or reveal what artist the image belonged to.

Implementing this type feature proved to be both incredibly time consuming and intellectually stimulating as not only was I forced to retrieve the image from the artist but had to gather other data such as the artists name, URL and ID. The hardest challenge of doing this was being able to maintain the synchronization of scrolling through each collection of data gathered involving the specific artist currently being displayed. For example, if a user enjoyed the work of the artist being displayed then revealing the artists name had to also match with the image on screen.

Before displaying the data on the client-side I first needed to retrieve it from the back-end. The approach I took was to create multiple API functions to retrieve different sets of data that I needed. A good method I adopted was to ensure I had one function working before I moved onto the next. This was good practise as it allowed me to slowly build a working application by utilising the process of elimination if something didn't work.

To implement this function successfully, it was obvious that an array needed to be used to store the data for further processing. Each API function contained a SELECT MySQL statement that applied the Haversines algorithm to extract different information regarding the artist. The data was then passed into an array to be encode into JSON format.

```
$sql3 = "SELECT ArtistCompany, ( 3959 * acos( cos( radians('$Latitude') ) * cos( radians(
Latitude ) ) * cos( radians( Longitude ) - radians('$Longitude') ) + sin( radians('$Latitude')
) * sin( radians( Latitude ) ) ) ) AS distance FROM artistlocation HAVING distance <
'$Distance' ORDER BY distance LIMIT 0 , 20;";

  try{

    $stmt3 = $db->query($sql3);

    $data = array();
```

This API SELECTS the ArtistCompany

```
    while($result3 = $stmt3->fetch(PDO::FETCH_OBJ))

    {

        $data[] = json_encode($result3->ArtistCompany);

    }

    echo json_encode($data);

 }
```

Creates an Array and encodes to JSON format

This is an example API that retrieves the ArtistCompany from the database. I applied the exact same logic to each API to gather the different information I needed. Its important that I implemented AJAX into this function as this will enable the scrolling effect without having the refresh the page.

Coding the Javascript function was an enormous challenge as I was required to find a way into creating a method that was able to retain the information received from the back-end to then be converted into HTML form. Using resources online as a guide, I was able to develop a procedure that was capable of fulfilling my requirements as shown below.

```
$(function () {
   var images = [],
    index = 0,
    count = 0,
    max = 0;
$.getJSON("http://testing/api/getimg", function(data) {
    images = data;
    count = images.length;
    max = count - 1;
});
$.getJSON("http://testing/api/geturl", function(data2) {
    images2 = data2;
    count = images2.length;
    max = count - 1;
});
$.getJSON("http://testing/api/getid", function(data) {
```

Function variables that store the array attributes such as the contents (index), number of elements (count) and total number of elements (max)

The different AJAX calls the retrieve the required JSON data provided by the back-end

```
    imagesid = data;

    count = imagesid.length;

    max = count - 1;

});

$.getJSON("http://testing/api/tattmatch", function(data) {

    images1 = data;

    count = images1.length;

    max = count - 1;

});

$('#getimg').on('click', function() {

    if (count === 0) {

        return;

    }

    if (index === max) {

        index = 0;

    } else {

        index++;

    }

    $('#HTMLBox').attr('src', 'data:image/png;base64,' + images[index]);

    $('#HTMLArtistC').hide();

    $('#contact').hide();

});

    $('#btnLike').on('click', function() {

        var aurl = (images2[index].replace(/\"/g, ""));

        var aurl2 = (images1[index].replace(/\"/g, ""));

        var artid = (imagesid[index].replace(/\"/g, ""));

        var artimg = (images[index]);

        $('#HTMLArtistC').show();

        $('#contact').show();

        $('#contact').attr('href', aurl);

        $('#HTMLArtistC').html(aurl2);

        $.ajax({

        type:'POST',

        dataType: 'json',
```

On button click, changes img tag src to the artist image acquired from the back-end

Reveal artist function: uses the relevant data retrieved by the AJAX calls above to change attributes of HTML tags.

Changes the href URL to artist URL

Shows the ArtistCompany

```
    url: 'http://testing/api/addlike',

    data: {

    'ArtID': artid,

    'ArtImg': artimg

    },

  });

});

});;.
```

To see this function in operation, here is an image demonstrating its design and capabilities:

The last milestone reached was completing the development of the booking system. The system allows the user to be able to book appointments and consultations with artists they find during playing TattMatch. A simple feature like this will be an asset

the tattooing industry as currently all scheduling are paper based. Integrating this onto a mobile app will allow for better booking management and overall organisation.

The booking itself is made via the form when visiting an artist which is then inserted into the database. The artist the booking was made with will be able to see that booking on the dashboard of their account. Tattoo artists can be very busy during peak times over the year therefore I wanted to give artists full control over what they do with their bookings.

Here is the panel the artist will be greeted with when logged in. It contains 4 buttons that give the artist multiple options into how to deal with the received bookings. Just like with TattMatch, it uses the same logical function to navigate through the bookings made with that artist.

There are essentially two Javascript functions that occur. The first is executed immediately when the artist signs in to retrieve any bookings made. It uses an AJAX call to communicate with the back-end to query the database to see if there are any new bookings. This is done by SELECTing any records found in the bookings table using the ArtistID found in the SESSION file as user verification.

```
$(document).ready(function() {
    // Gets the booking to displayed on artist dashboard
    $(function(){
    var $AXBookingID = $('#HTMLBookingID');
    var $AXBookingName = $('#HTMLBookingName');
    var $AXBookingEmail = $('#HTMLBookingEmail');
    var $AXBookingMobile = $('#HTMLBookingMobile');
    var $AXBookingDate = $('#HTMLBookingDate');
    var $AXBookingTime = $('#HTMLBookingTime');
    var $AXBookingBrief = $('#HTMLBookingBrief');
    $.ajax({
        type:'GET',
        dataType: 'json',
        url: 'http://testing/api/getbookingartist',
        success:function(getinfo){
            $.each(getinfo, function(i, order){
                $AXBookingID.val(order.BookingID);
                $AXBookingName.val(order.Name);
                $AXBookingEmail.val(order.Email);
                $AXBookingMobile.val(order.MobileNo);
                $AXBookingDate.val(order.Date);
                $AXBookingTime.val(order.Time);
                $AXBookingBrief.val(order.BriefDesc);
            });...........
```

(document).ready allows this JS to be executed when HTML is loaded. JS file has to be referenced in header of HTML.

Variables created linking to the ID's of the HTML textfields

Upon success of AJAX call, set HTML textfields the results of the MySQL query.

The other contains a series of AJAX calls that communicates with unique APIs to gather all the required data needed to be able to navigate through available bookings.

As discussed before, it uses the same logic for TattMatch as it inserts all data into separate arrays to then in turn be displayed in the appropriate HTML form textfields. As the code for this function is extensive, I have included in the references below the URL to a GitHub that will demonstrate this. (GitHub, 2018)

The booking system was also applied to the customer side of the application. The approach I took was to allow customers to see what bookings they have made and also ones that have been confirmed. This gives the artist time to reject the booking if they choose to do so. It also gives the customer the ability to cancel their booking. The functionality was identical to the artist booking system as the foundation is based on the TattMatch function.

I feel that the approach I took into the development was wrong. The attitude I pursued was to develop the main features of my application first then work on the smaller functions towards the end of the project leaving less time to into creating an MVP. By doing this hindered the quality of the MVP which I should have been more focused on. In the future, I will ensure I have created a working protype with all proposed features operational.

Chapter 6.2 Testing Environments

Throughout the development of my artefact, I carried out various tests that allowed me to analyse the functionality of my application at different stages. I took the most crucial features of my application and assessed it based on a method of my choosing. By doing this, it provided me with an insight of the overall progression of my project therefore enabling me to ensure everything was working. Below is a table containing the tests I carried out.

Test Description	Method	Reason	Pass/Fail
Navigation Bar links open to the correct pages	Ensured href links were pointing to relevant pages	Avoid different user type pages crossover	Pass
Bootstrap panels are responsive	View as a mobile app on Chrome to check if panels and buttons resize.	Ensures all data can be seen on a mobile device and not stretched.	Fail
TattMatch, UserMatch and CustomerMatch images being displayed correctly	Ensured the img tag src is being changed via AJAX	To exhibit current artists work	Pass

TattMatch, UserMatch and CustomerMatch href links being altered successfully	Checking AJAX 's response via Chromes Inspect to see if correct data has been passed.	Ensure user is redirected to the appropriate page	Pass
Login/Register Forms POST/GET required data	Checking the relevant SQL tables to see if the users data has been inserted.	Users are able to register and login successfully	Pass
MD5 algorithm has been applied successfully	Checked SQL database to see if credentials have been hashed	Provides security to user login details	Pass
Geolocation Latitude and Longitude has been acquired from user.	Created an alert popup that displays users locational details	To ensure the Geolocation function was working.	Pass
Jumbotron and Buttons followed the same theme throughout application	Relevant CSS and Bootstrap Javascript files linked inside HTML header	Creates user friend and responsive design for mobile devices.	Pass

Developing mobile applications that support the functionality of API's opens up the possibility into using various tools to help solve any problems that may arise. I utilised a tool that allowed me to run the API functions to determine if there are bugs present. The tool Postman provided an interface that was capable of running the API functions included in my artefact without the need of physically executing my applications code.

Using this tool, especially during the implementation stage allowed me to communicate with the back-end which provided me with results to my API functions in my application. I used this tool daily for testing purposes to see what type of response I received from the sever. It also provided me with error codes and messages that gave me the ability to debug my application effectivity.

Test Description	Method	Reason	Pass/Fail
Image from Artist needs to be displayed	Test relevant API function from Postman	Required to encode image to Base_64 then to JSON for HTML displaying	Pass
Arrays created to store booking information	Call API function to ensure array contains required data	To be passed into AJAX for further processing	Pass

Join SQL tables to display data	Call API function to ensure its outputting the correct data	Test if tables have been joined correctly	Pass

Here are the most essential tests carried out using the Postman tool.

Chapter 6.3 Reoccurring Bugs and Errors Encountered

Developing software of any kind will inhabit the constant flow of errors. There is no perfect programmer that can build an application without encountering some form of bugs along the way. For my project, there wasn't a session of coding that didn't end in frustration due to the sheer number of errors that were thrown. The key to an efficient developer is to analyse the errors and find a solution whilst bettering the code.

For me personally, I was new to both learning website languages and mobile application frameworks therefore the probability of bugs occurring was almost a guarantee over the more experienced programmers. Initially, I took the attitude of these errors as being a nuisance and would find the quickest solution or even a work around to move the project forward. Overtime, this began to change as I saw the bugs as a form of learning curve to enhance not only my debugging techniques but also my coding abilities.

I encountered bugs on a daily basis however I will mostly cover the analysis and solutions for the more major bugs found throughout my project. The first and most stubborn was the 'No Access-Control-Allow-Origin' error. This was persistent during the majority of my project lifecycle as I was unsure how to solve the error. It caused a major issue as I was unable to carry out any AJAX functions using the standard version of Chrome. A temporary workaround was to use the browser in a 'disabled security' version which fixed the issue. This error was unavoidable and needed to be resolved urgently for the matter of security and functionality of my application.
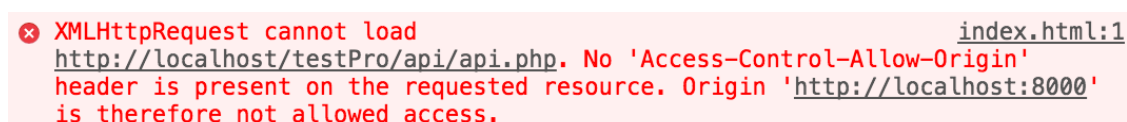
```
⊗ XMLHttpRequest cannot load                                    index.html:1
  http://localhost/testPro/api/api.php. No 'Access-Control-Allow-Origin'
  header is present on the requested resource. Origin 'http://localhost:8000'
  is therefore not allowed access.
```

Figure 24. No Access-Control-Allow-Origin Error demonstrated (University of Bedfordshire, 2018) (1)

Upon discussion with my supervisor, he explained to me in detail the nature of the error and provided a fix in which to apply. The reason for the error is because Chrome was unable to access the origin of third-party content which resulted in an error being

thrown. To solve this, I needed insert code into the header of both my HTML and PHP to open the door for cross-origin access as shown below.

HTML:

```
<meta http-equiv="Content-Security-Policy" content="default-src *; style-src 'self' 'unsafe-inline'; script-src 'self' 'unsafe-inline' 'unsafe-eval'">
```

PHP:

```php
1    <?php
2    header('Access-Control-Allow-Origin: *');
```

Figure 25. HTML and PHP tags to resolve the issue (University of Bedfordshire, 2018) (1)

TattMatch was also a platform for many issues. This error was particularly troublesome to solve as it didn't throw any sort of error message that could be used to debug. Instead of being a syntax issue, it was more finding the correct method of executing my goal. The problem was that I needed to transfer the image stored in my database, to an img tag on a HTML page.

The concept of carrying out this task seemed simple enough however it took myself around a week of extensive research using resources such as Stack Overflow to resolve this issue. As discussed before, taking this amount of time on something so little had a negative impact on my projects progression. Storing an image inside my database isn't the same as storing text such as a name or address. It was stored as a filetype known as a BLOB which can't easily be retrieved especially for someone such as myself who was new to mobile app development.
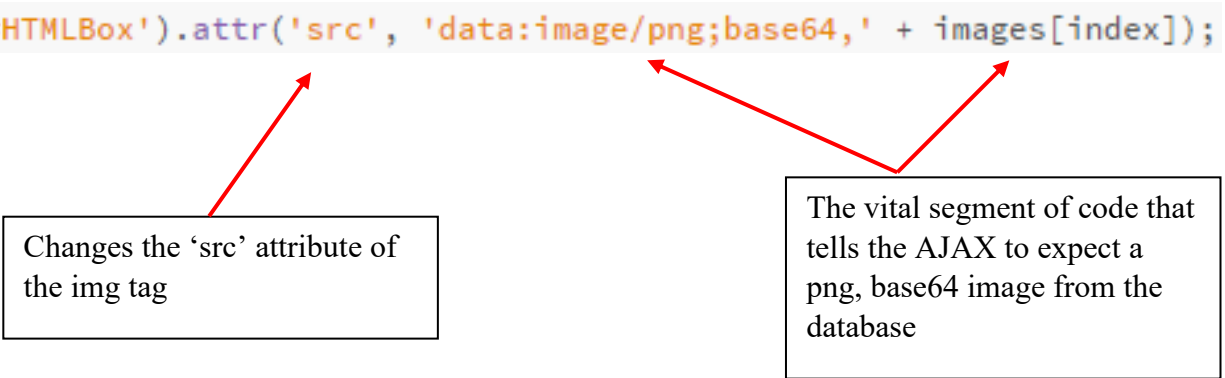
To display a BLOB inside my HTML, I first needed to encode the image using the Base_64 method. This is because JSON can only send text therefore sending an image without encoding it wouldn't work. Not only did I have to encode each image inside an array, I was also required to encode the whole array as JSON format to be sent to AJAX. Carrying out this part alone was incredibly difficult as using tools such as Postman didn't produce error messages if anything went wrong.

Once the JSON was sent, I needed to find a way to replace the src attribute of an image tag to match the Base_64 encoded image gathered from the server. AJAX was used for the implementation of displaying the images in the array however I needed to tell the img tag I was trying to display a Base_64 image. This detail was unknown

to me as I tried repeatedly to insert the Base_64 code inside the src attribute which essentially just resulted in an incorrect img file path.

After researching the solution, I found that I had to manually tell my AJAX function to display a Base_64 image. It was also important to know that I was required to input the type of image that was being transferred.

```
$('#HTMLBox').attr('src', 'data:image/png;base64,' + images[index]);
```

Changes the 'src' attribute of the img tag

The vital segment of code that tells the AJAX to expect a png, base64 image from the database

Chapter 7 – Evaluation of Results

Chapter 7.1 Expectations Vs Results

When I wrote the proposal for my artefact, my mind filled with all the possibilities of what to include within the application. I had many exciting features that would provide a substantial benefit to the tattooing industry. I had mentally created a plan of how the application will look and feel when using it. During the early stages, I feel that I let my enthusiasm take control over the feeling of reason.

It was important when proposing my application that I kept realistic into what was feasible and what wasn't. It was clear that I had become too focused on producing features that seemed viable on paper however I didn't take in account the amount of time It would take to implement this type of technology.

My productivity was also a huge factor in terms of creating expected results. The skills and experience I possessed was very limited therefore I had to integrate a certain amount of time to build my knowledge base to produce the features I had vowed to give. Unlike other students, I had the mammoth task to not only learn web development languages but also understand how mobile applications worked from scratch.

A lot was expected of me, both personally and the results I produced. When speaking with various tattoo artists in person and over email, it was clear that my app has a place

on the market. I created a form of hype revolving around my application which put pressure on me to guarantee the delivery of my end product which I seemed to of indirectly promised.

Many features that were expected in my final version of the application have since been removed. This wasn't due to the redundancy of them, it was simply having the lack of intellectual swiftness or time management skills to both learn then implement the feature into the application.

Throughout the lifecycle of the project, I have continuously tried to follow the features I have stated in my proposal. As this document is one of the initial files that describe the purpose and deliverables, it was important to use this as a guide into what expectations are to be had from the project. Looking back at my proposal, its clear that the features have changed dramatically. Below is a table stating the expected features that I originally wanted to implement. It also shows if I decided to keep these in the definitive version.

Proposed Feature	Implemented	Altered/Improved	Why it was removed
Search local area for artists (Google Maps Integration)	Yes	Used Geolocation instead of Google Maps to find artists	-
Customer and Artist Direct Messaging System	No	-	Lack of time management into implementing this feature
Consultation and Appointment Bookings	Yes	I have only allowed customers to book consultations with artists	-
Login System and Profile Designing	Yes	Users can customise their profile during the registration process.	-
Rating System for Artists	No	-	I implemented a star rating system however didn't have the time to fully develop it therefore I removed It entirely
Monthly fees for artists	No	-	Requires more research in the field of marketing the product and general business plans.

Here are the new features I added which can be seen in the final version:

New Feature	Description	Implemented
UserMatch and CustomerMatch	Allows users to find other users in the area. Gives Artists the ability to find customers in the area.	Yes
Profile Picture and Bio	Allows users to add a profile picture and Bio to their dashboard	Yes
Portfolio Images	Gives the user the opportunity to show off their tattoos by uploading their own Images	Yes
Update Profile	Users are able to also alter their profiles from within their account	Yes
View Artists Page	Allows users to find artists using TattMatch then have the ability to view their own TattWho? Page	Yes

The overall CSS design and layouts has stayed the same during the development of the application. It's important to understand that the approach taken was to give the consumer the best user experience possible. I had the strategy from the beginning to adopt a 'minimal design' method that gives the user full functionality of the application whilst aiding in the ease of use. Using bootstrap contributed to this as it provided multiple templates designed into helping users navigate throughout the application effectively.

You can see the contrast between my original proposal and the definitive version of my prototype that a lot has changed during each stage of my project. It's common to fall into this scenario as overtime, factors that I didn't knew existed would hinder the overall progression of the project. It's impossible to plan for the unknown therefore I tried my best to produce the features I promised with the obstacles and time I had.

Chapter 7.2 Critical Analysis and Evolution

Throughout the journey of building my application, there have certainly been morale fluctuations that have contributed to the outcome of this project. Now it is at a finished

state, it important for myself to reflect back, analyse each stage and critique the approach I took. It's important to ask myself provoking questions such as, was the approach successful and if not, how would I improve it for next time? This is a form of self-reflective learning that allows me to absorb my mistakes, rectify them and essentially apply the solutions into a future project.

I feel that my most substantial issue consisted on allocating time to develop particular features. As clearly demonstrated, I have a passion for this project, not only for academic purposes but I also had the enthusiasm to make it a success. Having this attitude meant that I wanted to produce each function to a high standard which resulted in myself spending far too long on some areas. The approach I should have taken, as suggested by my supervisor, was to ensure I had the most viable product available. This meant I needed to confirm that every feature of my application was working. Even if the functionality was to a minimum, this would have still been acceptable as an MVP.

This was evident when developing the function TattMatch. As this feature was the main core of the applications functionality, I took the approach of developing it until it was to a personal acceptable standard. By doing this meant I was spending weeks at a time coding the various aspects required in order to make it work. Adding to the longevity of building this function was accumulating the knowledge of Geolocation as this technology needed to be understood to employ it to the application.

It seemed that I approached developing this feature with a narrow mind. I allowed myself to get carried away and focused all my time TattMatch as I felt that by ensuring the functionality of the main feature could guarantee an acceptable end product. This was a complete contradiction to my mentality towards my project as surely if I wanted to make my application a success, I should have put an equal amount of effort into each feature.

Encompassing this type of attitude would also assure the prevention of achieving the projects overall goals and objectives. Another mistake I made was that I let my passion cloud my mind in terms of the whole purpose of making this application. It seemed that everything I worked towards ceased to exist as a result of my carelessness towards the project.

The purpose of the artefact was to provide tattoo enthusiasts a way into connecting with potential artists in their area. This was the main aim I should have been striving for throughout the entire journey however it was clear that the effort to achieve this overall objective was not present. It was vital to keep the aims and objectives of the project at the forefront of my mind as they lay the foundations into why I undertook it.

Reflecting back has shown me that the approach I should have taken was to analyse the project goals at the end of its lifecycle and investigate whether they have been met. I could have ensured this approach using various techniques such as checking on a daily or weekly basis the project proposal document to see what the goals were. This could be then used to analyse the current stage and monitor the progression towards the next objective.

Almost in every occasion, project proposals will not reflect the final outcomes as over the course of the development, many concepts change. This was certainly the case with my artefact. Upon evaluating my proposal at this current stage, it's difficult to see an aspect that has persisted throughout. The only obvious difficulty that has remained was the intellectual challenges involved.

As discussed before, I was faced with the task of undertaking a large amount of learning over a short period therefore managing my time was essential for this project. I felt that personally, I was ready to accept this type of challenge as essentially, I would be gaining knowledge on something I am passionate about. I almost had a sense of leniency towards the learning period as I felt understanding mobile application development was straight forward. Reflecting on my overall personal progression, I had overestimated my capabilities of learning meaning that implementing these exciting features no longer became an expectation, they were more exceptions.

Chapter 7.3 Accomplishments and Lessons Learnt

Starting a project of any magnitude is a huge responsibility and can be seen as an accomplishment in itself. For students who have no previous experience in undertaking a project such as myself, it's a great triumph being able to see it through to the end. It's not about simply completing a project, it's about utilizing the tools and techniques provided into creating the planned outcome. Working on a project also allowed me to learn the different procedures in addition to the methodologies used to

produce an end product. All these skills learnt can be applied to any projects I may undertake in the future.

One of the main accomplishments of the venture was having the determination in learning the knowledge into creating a working application. I essentially started from having no existing skills or experience in mobile app development therefore being able to create an app in comparison to my initial ability level is something to be proud of. I feel I have progressed on a personal and academic level as completing this project not only has given me the encouragement to take on larger projects but also has changed my outlook into tacking challenges in life.

Making my project a success required that I possessed a good sense of time management. Throughout the process, it was proven that this wasn't the case as I would repeatedly fall behind schedule. This was normally due to my negligence over the amount of time it took into reaching the next goal of the project. In particular, learning the skills needed in order to build my application took longer than expected therefore I didn't compensate on the time lost. This as a result pushed all upcoming millstones back meaning my overall project progression would be delayed. Managing my time is one of the most fundamental and useful skills I will be taking away from this project as honing this skill will allow me to become a more productive project manager.

Another accomplishment on mine was having the ability to identify a problem and providing the solution in which to fix it. I've created a mobile application with the goal of bringing customers and artists together in which I feel has been accomplished. Producing something of significance knowing that it will not only achieve my project goals but also have the ability into bringing people together is a feeling to peruse.

Overall, I feel I have accomplished a considerable amount during my time on this project. I feel I have advanced both intellectually and as an individual. It was important to me personally that I completed this project as it's hard to think of a time where I've held the determination of completing something of this magnitude. I am grateful to be given this opportunity and I look forward into continuing making myself and those around me proud.

Chapter 8 – Conclusion and Further Work

When bringing my project to a close, it's important to reflect on the overall journey endured to produce my artefact. It's also a good opportunity to discuss whether my aims and objectives have been met. Embarking on this project was an obvious choice as it was the perfect platform to demonstrate the skills that I had learnt. The combination for my appetite in mobile applications with my love for tattoos fused together nicely allowing me to produce a product I was passionate about.

It was evident that this application is needed on today's market. This was proved as according to my findings during the market research stage, both artists and customers feel that there needs to be more of a singular platform in which to connect with one another. This was the overall main purpose of this project and I feel I have achieved this.

I have produced a professional mobile application that has been planned, developed and implemented using the techniques and methodologies provided in my project proposal. The final product has dramatically changed in comparison to the first version I had produced. This shows my ability into understanding modern technologies and to then implement them into improving my application.

There are many features I would have liked to include but didn't possess the time to dedicate for the implementation. These features would have boosted the overall functionality of the application whereas some were for cosmetic value. With enough time and manpower, adding these features would excel the application providing it with more capabilities to attract customers into exploring it.

An additional improvement that would have enhanced TattMatch even further was to employ the use of being able to search via a postcode. Geolocation supports the use of postcodes meaning this would increase locational accuracy as this also retrieves the latitude and longitude. This also gives the user the opportunity to input a location in which they currently might not be situated. For example, if they decide to search for artists from a house in another country, this could be done by imputing their postcode without having the need of physically being there.

A large function that would have taken a substantial amount of time to implement would have been the introduction of charging customers for using my application. If I decided to release my application to the public and it became popular, I would explore

ways into generating money for using it. This money produced would go towards employing staff to help me expand the application and invest in the latest technology to improve the overall functionality.

For the artists, I would start to slowly implement ways of getting them seen more over others in the area. For example, allowing them to upload two images on TattMatch to give customers a better understanding into the work they produce. There is also the opportunity to charge artists a monthly fee into being a member of the application. The membership could have package types which give artists access to more tools. I.E. Bronze, Silver, Gold etc.

For the customers, I always had the strategy of keeping the application free at first. Once the customer base started to expand, there is the option of adding microtransactions that could provide the customers with more abilities. For example, being able to send direct messages to other user or even artists.

There are a few other small features that I would have liked to improve such as screening images before they are submitted. Profile pictures and portfolio pictures are uploaded freely without any sort of security checks. If a user wanted to upload something inappropriate, there isn't anything monitoring this kind of behaviour. Another function that would improve TattMatch would be to match customers and artists based on similar likes. For example, if a customer likes Colour and Japanese type tattoos, then when playing TattMatch, it would only show artists capable of tattooing in these types. This would reduce the potential work load for artists meaning less time would be wasted on customers with incompatible tattooing desires.

There are many possible routes to take my application down. With the correct amount of enthusiasm and determination, I feel I could make my application a success. I am excited to see what the next step is for TattWho?

References

The Telegraph, 2018. *We're not going to reach 'peak tattoo' until 2025*. Available at: http://www.telegraph.co.uk/men/fashion-and-style/11545649/Were-not-going-to-reach-peak-tattoo-until-2025.html. [Accessed 11 January 2018].

Project Smart, 2018. *FIVE GOALS OF EVERY PROJECT*. Available at: https://www.projectsmart.co.uk/five-goals-of-every-project.php. [Accessed 11 January 2018].

Harvard Business Review, 2016. *The Four Phases of Project Management*. Available at: https://hbr.org/2016/11/the-four-phases-of-project-management. [Accessed 11 January 2018].

Project Accelerator, 2017. *Popular Opinion Says Project Managers Lack Basic Skills*. Available at: http://www.projectaccelerator.co.uk/popular-opinion-says-project-managers-lack-basic-skills/. [Accessed 15 January 2018].

The Debate. 2018. *Do we depend on technology too much?* Available at: http://www.debate.org/opinions/do-we-depend-on-technology-too-much. [Accessed 18 January 2018].

Puttaswamy and Zhao, K.P, B.Z, 2017. Introduction. *Preserving Privacy in Location-based Mobile Social Applications*. 1, 1. Available at: https://dl.acm.org/citation.cfm?id=1734585 [Accessed 18 January 2018].

Madden, M, M, 2017. Main Findings. *Teens and Mobile Apps Privacy* 1, 1. Available at: http://www.pewinternet.org/files/old-media/Files/Reports/2013/PIP_Teens%20and%20Mobile%20Apps%20Privacy.pdf [Accessed 18 January 2018].

Elkhodr, M, E, 2012. MOBILE PRIVACY & THE IOT. *A Review of Mobile Location Privacy in the Internet of Things*, 1, 4. Available at: http://ieeexplore.ieee.org/abstract/document/6408566/ [Accessed 18 January 2018].

Smart Insights, Dave Chaffey, 2018. *Mobile Marketing Statistics compilation*. Available at: https://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/. [Accessed 17 January 2018].

Survey Monkey, James Early. 2018. *Tattooing Services Mobile Application - Artist*. Available at: https://www.surveymonkey.com/results/SM-RDQSW8TN8/. [Accessed 17 January 2018].

Survey Monkey, James Early. 2018. (1) *Tattooing Services Mobile Application - Client*. Available at: https://www.surveymonkey.com/results/SM-LVHF3DTN8/. [Accessed 17 January 2018].

University of Bedfordshire, (2018), *Introduction to Json Web APIs and Ajax* [ONLINE]. Available at: https://breo.beds.ac.uk/ [Accessed 9 May 2018].

jensimmons, (2018), *Using the Geolocation API* [ONLINE]. Available at: http://apress.jensimmons.com/v5/pro-html5-programming/ch5.html [Accessed 10 May 2018].

Ryan Duell, (2018), *Determining the Distance Between Two Geographic Points* [ONLINE]. Available at: http://www.ryanduell.com/2012/12/determining-the-distance-between-two-geographic-points/ [Accessed 10 May 2018].

GitHub. 2018. *AJAX Artist Booking*. [ONLINE] Available at: https://gist.github.com/early237/b6845527a79c274a04cd3e577d98a305. [Accessed 14 May 2018].

University of Bedfordshire, (2018) (1), *PHP & MySQL* [ONLINE]. Available at: https://breo.beds.ac.uk/ [Accessed 14 May 2018].

Unifying The

Tattooing

Industry

Where would you look for one?

If I asked you where would you look for a tattoo artist, you'd most likely reply with either Instagram, Pintrest, Facebook or Google!
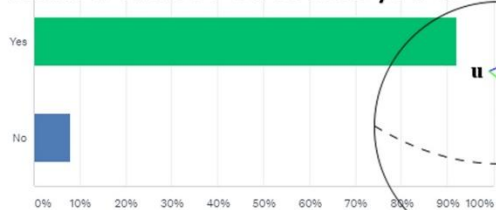
There is no singular platform to visit for all your tattooing needs which can cause frustration as all you want is some ink, right?!

Introducing my hybrid mobile application called TattWho? which provides the user with special features to make getting a tattoo even easier!

Such as:
- Find artists based on your location
- Visit Artists Profiles
- Book consultations
- Find other tattoo enthusiasts

How does it work?

The mobile app employs a locational based function called Geolocation that finds the user via their Latitude and Longitude.

This information is then applied inside an algorithm to find artists within a chosen radius of the current user.

The algorithm applied is known as the Haversines formula and is used widely for locational based features.

Want a Tattoo? Of course you do!

During the market research stage, I asked 30 participants to take a questionnaire to see if they would use my application.

One of the questions asked was if they would like tattoo in the near future and just over 90% said they would!

What are you waiting for?
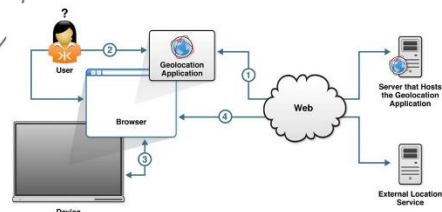
$$d = 2r \arcsin\left(\sqrt{\sin^2\left(\frac{\phi_2 - \phi_1}{2}\right) + \cos(\phi_1)\cos(\phi_2)\sin^2\left(\frac{\lambda_2 - \lambda_1}{2}\right)}\right)$$
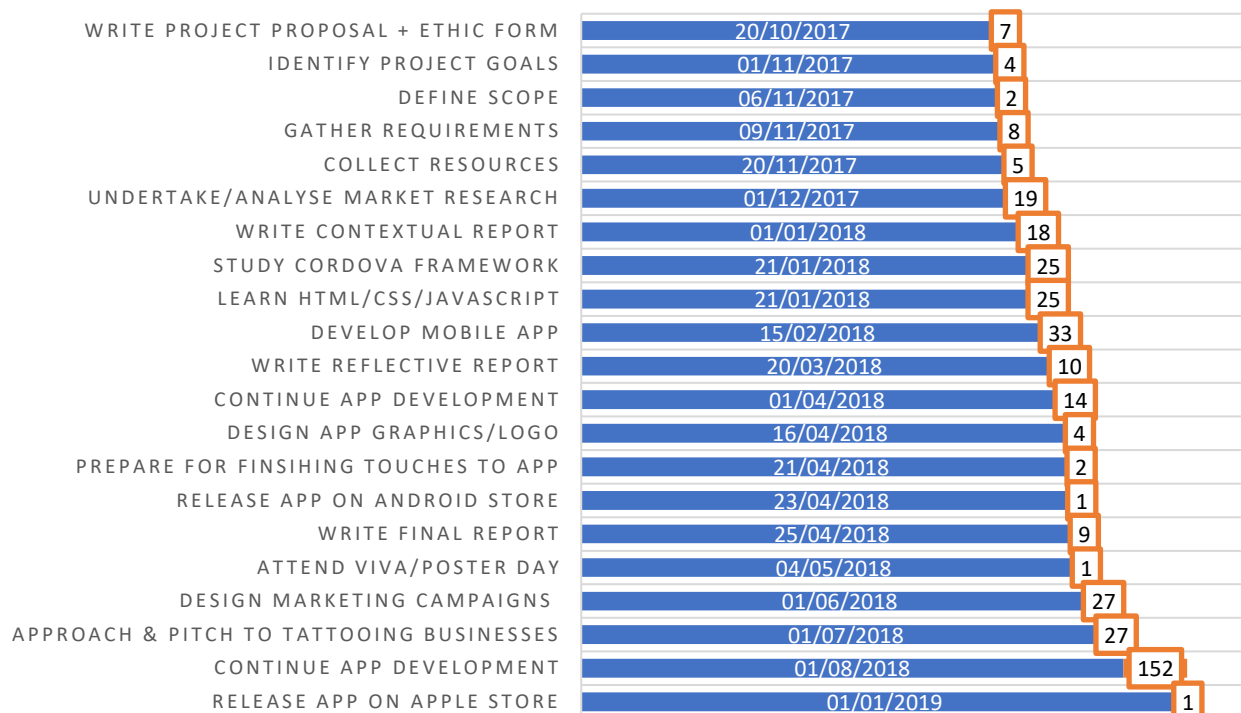
University of Bedfordshire

Student Name: James Early || Student Number: 1506910 || Course: BSc (Hons) Computer Science || Supervisor: Dr Mohammed Bahja
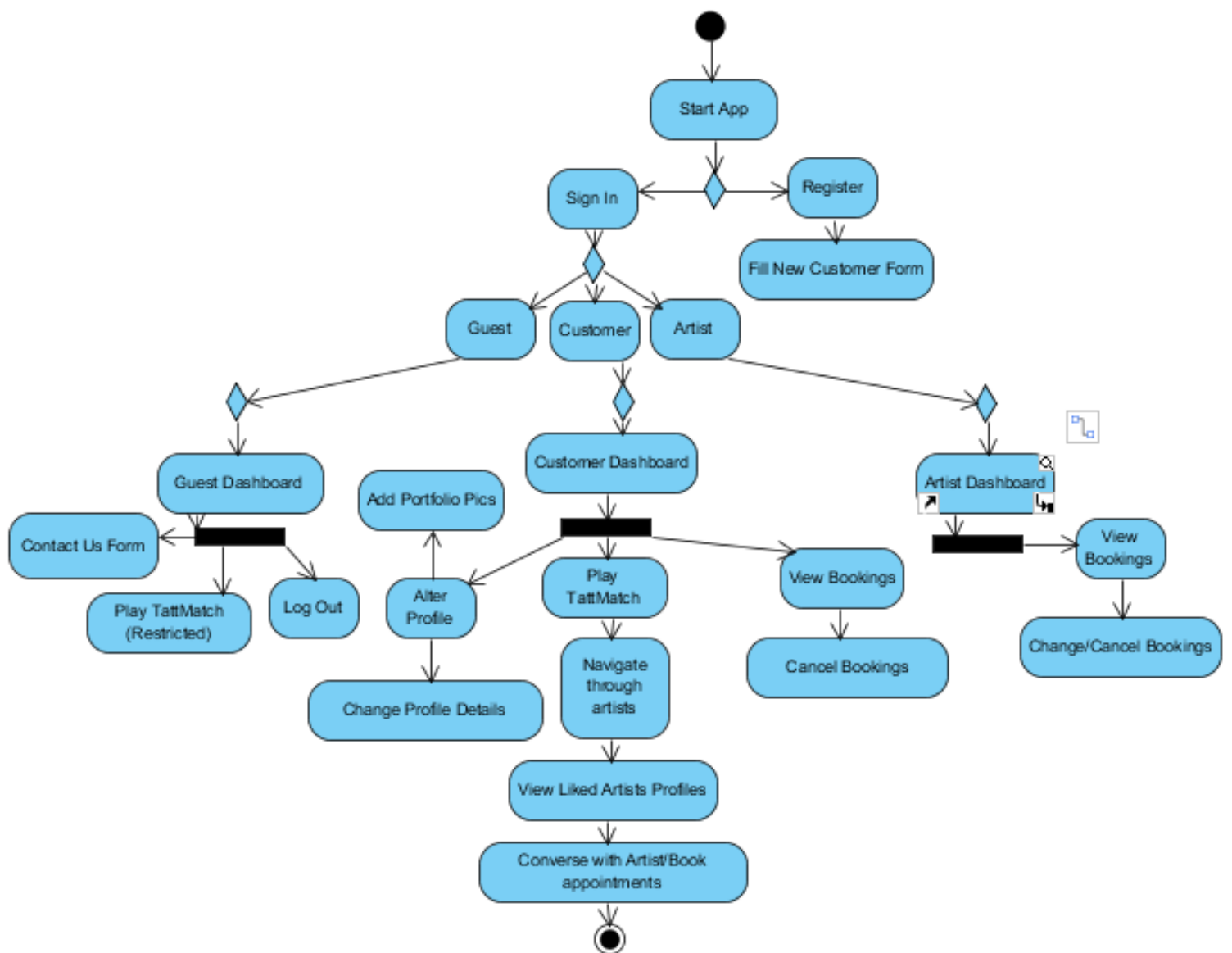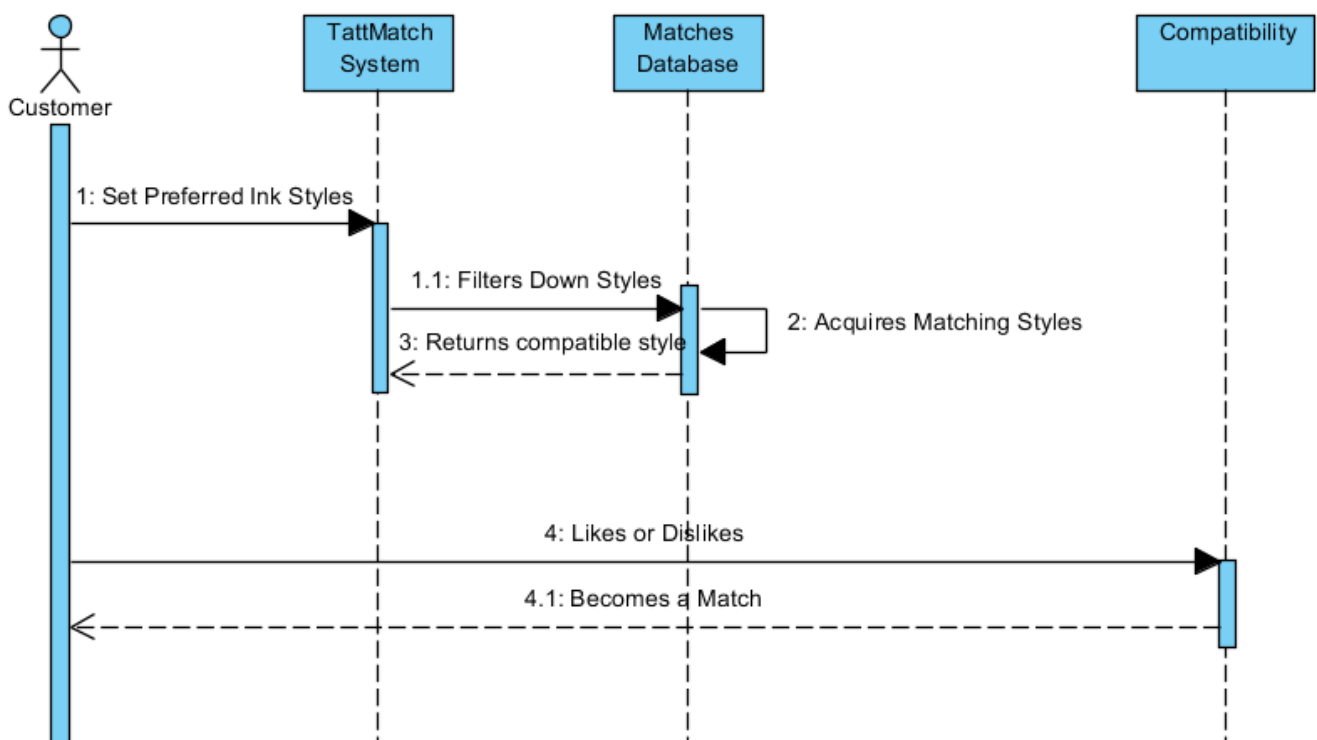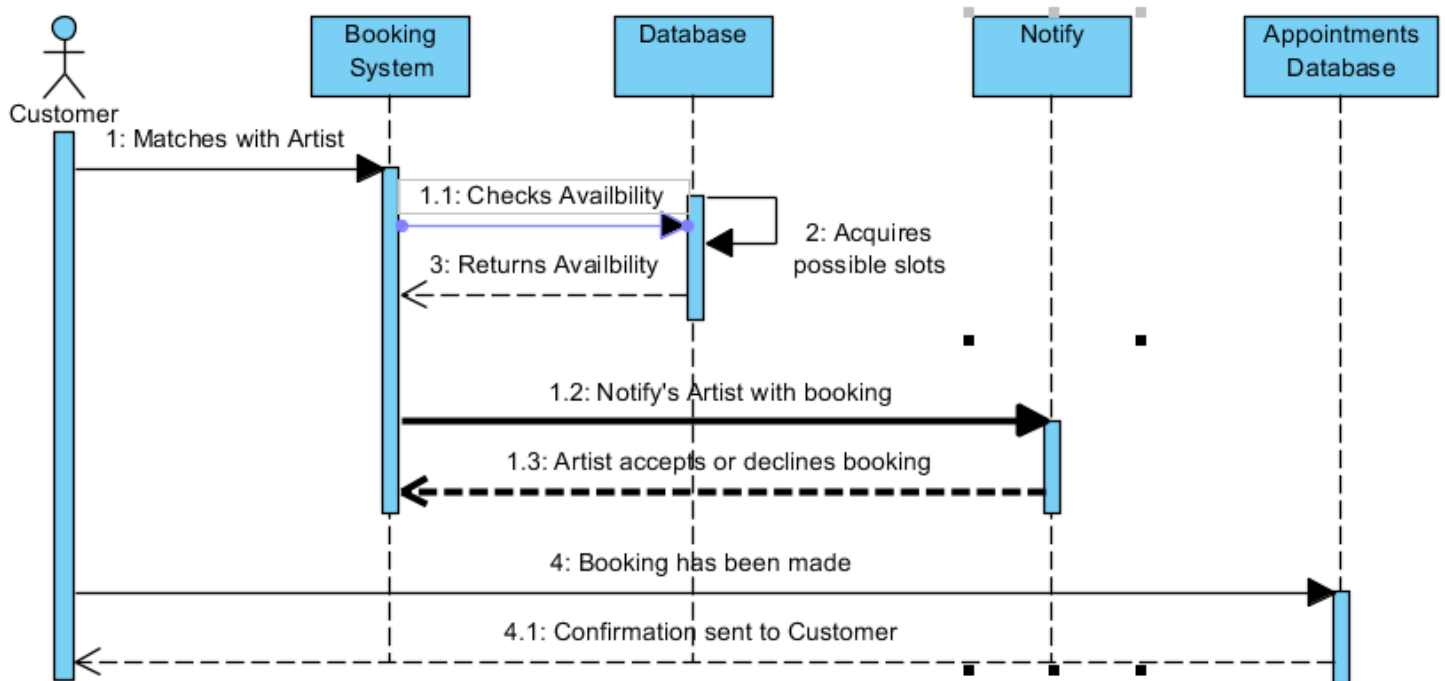
TATTWHO? GANTT CHART

Task Name	Start	End	Duration (days)
Write Project Proposal + Ethic Form	20/10/2017	27/10/2017	7
Identify Project Goals	01/11/2017	05/11/2017	4
Define Scope	06/11/2017	08/11/2017	2
Gather Requirements	09/11/2017	17/11/2017	8
Collect Resources	20/11/2017	25/11/2017	5
Undertake/Analyse Market Research	01/12/2017	20/12/2017	19
Write Contextual Report	01/01/2018	19/01/2018	18
Study Cordova Framework	21/01/2018	15/02/2018	25
Learn HTML/CSS/JavaScript	21/01/2018	15/02/2018	25
Develop Mobile App	15/02/2018	20/03/2018	33
Write Reflective Report	20/03/2018	30/03/2018	10
Continue App Development	01/04/2018	15/04/2018	14
Design App Graphics/Logo	16/04/2018	20/04/2018	4
Prepare for Finsihing Touches to App	21/04/2018	23/04/2018	2
Release App on Android Store	23/04/2018	24/04/2018	1
Write Final Report	25/04/2018	04/05/2018	9
Attend Viva/Poster Day	04/05/2018	05/05/2018	1
Design Marketing Campaigns	01/06/2018	28/06/2018	27
Approach & Pitch to Tattooing Businesse	01/07/2018	28/07/2018	27
Continue App Development	01/08/2018	31/12/2018	152
Release App on Apple Store	01/01/2019	02/01/2019	1

Appendix C – Activity Diagram

Appendix D – Sequence Diagrams

MONTHLY PROGRESS REPORT FORM

James Early	Dr Mohammed Bahja
November	Report No - 1

Summary of progress (including any problems)	• Project Proposal written and graded • Contextual report started • How to approach artefact development **Problems** • Poor time management with contextual report
Plan for next month	• Carry out primary and secondary research • Further develop web development skills • Continue contextual report
Supervisor's comments	- Good Progress - Work harder on contextual report

When signed this form must be scanned and submitted via the relevant link on BREO.

Student's Signature .... Date 21/03/2018

MONTHLY PROGRESS REPORT FORM

James Early	Dr Mohammed Bahja
December	Report No - 2

Summary of progress (including any problems)	• Market Research completed and reviewed • Contextual Report continued • Learnt new web development skills e.g. PHP, Bootstrap **Problems** • Adjust some market research questions to suit clients • Lack of effort on contextual report
Plan for next month	• Complete Contextual Report • Continue learning new mobile development skills • Begin app development
Supervisor's comments	- Good Progress - Work harder on contextual report

When signed this form must be scanned and submitted via the relevant link on BREO.

Student's Signature .... Date 21/03/2018

MONTHLY PROGRESS REPORT FORM

James Early	Dr Mohammed Bahja
January	Report No - 3

Summary of progress (including any problems)	• Contextual Report close to finished • New web development skills learnt e.g. JavaScript, JQuery • New skills applied into building foundation of app
Plan for next month	• Complete Contextual Report • Continue learning new mobile development skills • Continue app development
Supervisor's comments	- Good Progress - Work harder

When signed this form must be scanned and submitted via the relevant link on BREO.

Student's Signature ....Date 21/03/2018

MONTHLY PROGRESS REPORT FORM

James Early	Dr Mohammed Bahja
March	Report No - 4

Summary of progress (including any problems)	• Contextual Report submitted and grade discussed • Progressing with app development • SQL database designed and implemented **Problems** • Understanding and applying new mobile technology concepts
Plan for next month	• Create UML diagrams to breakdown different parts of the system e.g. Activity, Use Case and Sequence • Change structure of app – Must understand and use AJAX, JSON to implement PHP and SQL • Apply Agile software development methodology
Supervisor's comments	- Good Progress - Work harder

When signed this form must be scanned and submitted via the relevant link on BREO.

Student's Signature .... Date 21/03/2018

MONTHLY PROGRESS REPORT FORM

James Early	Dr Mohammed Bahja
April	Report No - 5

Summary of progress (including any problems)	- Created UML diagrams - Implemented the transition of Cordova compatibility e.g. divided PHP from JS - Complete the development of artefact **Problems** - Time management
Plan for next month	- Fully finish artefact - Complete Thesis - Attend Viva and Poster Day
Supervisor's comments	

When signed this form must be scanned and submitted via the relevant link on BREO.

Student's Signature .... Date .09./.05./.2018