

Project Dissertation

by Aaron Matthew Yates

FILE	18851_AARON_MATTHEW_YATES_PROJECT DISSERTATION_78196_1 743651095.DOCX (1.39M)		
TIME SUBMITTED	20-APR-2016 11:10AM	WORD COUNT	11431
SUBMISSION ID	56109252	CHARACTER COUNT	67573



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Investigating the use of web technologies to implement mobile applications

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Project submitted as part of the requirements for the award of BSc (Hons) Web
Development

April 2016

Declaration

I, Aaron Yates declare that I am the sole author of this Project; that all references cited have been consulted; that I have conducted all work of which this is a record, and that the finished work lies within the prescribed word limits.

This work has not previously been accepted as part of any other degree submission.

Signed:

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Form of Consent

I Aaron Yates hereby consent that my Project, submitted in candidature for the B.Sc.(Hons) Web Development degree, if successful, may be made available for inter-library loan or photocopying (subject to the law of copyright), and that the title and abstract may be made available to outside organisations.

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Abstract

Aims & Objectives

The main aim of this project is to develop a functional mobile application to help kids with their timetables. This will be achieved by following the objectives that will be set which are to firstly investigate the background of creating mobile applications, the second objective will be to build a prototype application and test it and thirdly it will be to get feedback from users to see what recommendations they have to improve.

Methods Used

With the approach that has been chosen it is the inductive approach the reason for this is because firstly you will start off by collecting data and once there has been a sustainable amount that has been collected you can move onto the next step and start to analysis and once the analysis has been done you move to the final step which will be to start experimenting. On the development side though the prototype method being used which was both good and bad. The good side of prototyping is being able to make the application bit by bit and test it along the way with also getting feedback from other users which can help with improvements. The bad side of prototyping is it can be time consuming as you could build the app wrong and have to start from scratch again.

Major Findings

The major finding that was found was using PhoneGap to create the mobile application that was wanted. Another major finding was how kids can actually learn better from a mobile application than reading a book as it has more interaction and can be more engaging.

Conclusion & Recommendations

On the conclusion side of the project this will talk about how certain things have been achieved and what has failed but how it can be worked around to be fixed. While the recommendations will talk about improvements can be made on the app that has been created or what new ideas can be added on to the application.

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Introduction

Within this report it will include the main aim of the overall project while having the objects to be completed. With talking about that there will be a step through of what the other sections of what this report is about.

The main aim of this project is to:

- To develop a functional application to help kids with the maths timetables

The objectives for the project are:

- To investigate the background of creating mobile applications
- To build an application and test it
- To get feedback from users to see what improvements can be done

The next chapter of this report is the literature reviews for where there will be an explanation of the history of mobile apps, software that can be used to create any apps and how kids can learn from using different mobile applications

In this report there will also be an outline of the research and development methodology which will include what strategies have been used to overcome to help create the application.

After the research and methodology section has been completed the following chapter is the design and implementation for which this chapter will talk about the requirements that was needed to be done to help, while including what work has been done to make the application while analysing what has been used to help.

Another chapter of this report is the evaluation chapter for which it will talk about what work has been done whilst comparing it with the objectives that were set.

The conclusion and recommendation chapter will summarize what has been done and what avenues can be done for future research.

The last chapter of the project is the reflection for which it will show what has been learnt from the project and whether or not has it changed the developer as a person.

Literature Review

History of Mobile Applications

Firstly a mobile application is an app that is downloaded to either your smartphone or tablet; these apps could either be a game or a social networking app such as Facebook, Twitter, and WhatsApp etc. Google play which was once known as the Android market is one the international app stores that was just developed for android phones. In August 2014 there were approximately 1.3 million apps that were available to download in the Google play store. [1]

In 1988- 1998 the candy bar phones had a relatively small display that was a resemblance of a candy bar and also had a very limited amount of data service to use. The apps that were developed in that era were only targeted to various phones and had limited functionality. From 1998-2002, there were new phones out that supported the wireless application protocol (WAP) these phones were also able to support the WML which stands for wireless mark-up language. Even though those phones had the use of HTML it was still difficult to deploy the applications. [2]

Table 1. Mobile device application eras.		
Era	Timeframe	Characteristics
Candy bar phones	1988-1998	Very limited data service to phones
Phones supporting WAP	1998-2002	WML, MMS/SMS, small screens, etc.
Smart phones	2002-present	Java-ME, Windows Mobile, Palm OS, RIM, etc.
Touch screen era	2009-present	iPhone, Android, etc.

Figure 1 Mobile Application Eras

Mobile Apps vs. Mobile Web

The difference between these two is the apps are downloaded and installed onto your mobile device directly and the mobile web is the website with is developed for a mobile device but only access through the mobile browsers, mobile web are at a more reasonable price compared to an application as it can be released into any form without an approval from the app store or the marketplace. Institutions prefer to use a mobile web rather than an application but students are vice versa as they have the most activities in daily affairs for example a social network app such as Facebook and Twitter. Another comparison between these two is that the mobile applications have a better result in performance for the effectiveness of speed and easier to use without advertisement popping up like a website. [3]

Number of Mobile Applications Downloaded

In 2009 mobile applications that were downloaded were approximately 2.52 billion apps that users downloaded onto their mobile devices and that they are expected to reach 268.29 billion in 2017 but in 2010 the earnings that mobile developers had incoming was amounted to 6.8 billion dollars.

With having some many applications downloaded and having more developed in the future the app stores will be expected to meet the demands that are necessary such as the quality and what users would like to have. From July 2014 the number of apps that was in the app stores was recorded for comparison, customers that was using the app store in that month would have to number of downloads recorded and the results from that was Google Play had roughly 1.3 million apps which

led to having the world's leading app store, and Apple app store came in second place with an amount of 1.2 million apps downloaded. The biggest app that was downloaded was Facebook with having the 69% of the mobile audience. Twitter came in second place but only reached 21.3% of the mobile audience.

With the available apps and having people downloading them could have an effect of the download rates. The normal average rate with per 100 users was calculated in different countries throughout the world, in the second quarter of 2014. Download rates was discovered that worldwide there was 1.23 apps downloading per the 100 users. India and UK were lower than the worldwide and in the U.S they only had a slight higher rate which was 1.25 apps per 100 users. With doing this statistics showed that the highest rate was in Asia with had an app rate of 4.64 app that was downloaded.[4]

Mobile Platforms

Windows

Windows operating systems are normally known for their PCs and Laptops but on November 2011 they introduced their first Windows phone which is known as the Nokia Lumia, Windows are still being developed by Microsoft. In the early 2004 the codename "Photon" was a massive windows mobile update but was cancelled. [5]

In 2008, Microsoft then started to reorganize the windows mobile group and also then started to work on a new operating system. [6] The senior product manager Larry Lieberman told eWeek "If we'd had more time and resources, we may have been able to do something in terms of backward compatibility".[7]

With updates coming out for Windows, users can now download and run Windows 10, with having this system on PCs, laptops etc., there is a new apps that is currently being developed that goes by the name of Universal Apps. One main feature of this application is that users can now make apps without coding, how the users can access this feature is the Windows app studio will be on a web base system and no other software will be required all users will need is the internet connection. [8]

Android

The Android operating system which are currently still being developed by Google and based on the Linux kernel, the apps that are in the Android system are built by Java which has complete access to the android APIs, when using Java they can normally combine with the use of C/C++. [9] Android have had a growing selection of third-party applications what are acquired by the users by downloading and then installing the application APK (Android Application Package) file or downloaded from the Google Play store which will also allow users to install, update and remove the applications from the user's device [10]

IOS

IOS is the operating system for the Apple's iPhone, iPad and the iPod touch and any other the Apple devices that are out. The operating system was originally called the iPhone OS but in 2010 it was renamed to the iOS which was reflected to the evolvement for the additional Apple devices. The iOS is currently in the v7.x release which was firstly unveiled in September 2013, with the release of the iPhone 5S and 5C. [11] The latest version of the iOS is iOS 9 that runs on the portable Apple devices. One of the new features in this version is known as Monarch which has a new enhancement by "Proactive" a contextual and also predictive personal assistant which is also linked to another iPhone

feature that everyone knows as Siri which will grant users to deliver personalized information that is based on their preferences, habits and now their locations [12]

Why are Mobile Apps Important

Since the first mobile to now they have evolved from a little toy to an essential tool. Mobile devices have now become the main point into business. The technology is advancing in so many ways throughout each day people are attached to their phones or any other devices. The interfaces and high speed data access have made the mobile computing have a better experience for users. Smartphones and Operating Systems have seen the emergency of the utility and the productivity for gaming and editing data. The app marketplaces have now made it easier for people to get all information that is required just by using their fingertips and to keep them connected to their work.

Organizations apps have brought a remarkable growth inside the business operations and customer services. Companies can reach out towards their customers by build their own business app or even included themselves in a popular app so they can tap into an existing user-base.

Companies such as Banks and Financial Institutions have found out that mobile apps have a great effect to increase their visibility and sales for their businesses. Websites as well that have got their business applications enables users to buy/sell or even just look increases their business popularity as using those apps to connect to the virtual and physical worlds seamlessly. It gives the users power to choose what make life easier.

Gaming community have also had their shares like business application with the big buy outs such as Zynga who created a Poker application that allows users to log in with Facebook and grants those users to play the game with their friends, which ushers in a dynamic and more creative community of social gaming developers.

With having more businesses that are using the enterprise mobility, it will complete any solutions to access the core business, and the demand for application to have an increase in growth. Meaning there will be more opportunities for Mobile App Developers and Cross Platform Experts to challenge themselves with different skills, such as their creativity and innovativeness to grant them a spot in the marketplace. [13]

User Experience with Mobile Applications

Mobile application development is still evolving at a high pace, but in marketing where the quality and performance will come before the brand of the mobile, with creating a fluid user experience this will help with the success of any mobile application development. Knowing the user experience is increasing with the crucial feature when it comes to the digital landscape. It tells the developer how the user feels and thinks about the product from their own perspective. An improved fluid user is normally split up into several benefits for the companies that will provide it. These benefits follow as: [14]

1. **Loyal User Base:**
when using applications everyone will run into bugs, errors, annoying interactions and behaviour problems. With this users will know that the developer has designed a poor application which will result in a reduce in the customer loyalty, but on the other hand if there is a good user experience this will create a kind of loyalty which will make customers come back for more, and have an increase amount of engagement. When doing this it will

help users have a reason to return with being engaged and useful will help with one way to enhance the fluid user. This will leave a good impression and gives user the sense of value for downloading those applications.

2. Reduce Support Costs:

having a well-designed app can save time and money, consumers normally struggle with some issues that can easily be solved which are found on a good app. Mobile applications will give customers a way that can help find solutions. Well-designed apps that are used in business can offer direct calls with the sales people, access to help desks and even provide an on-going support to their customers. People can save money with those apps as they do not need to hire as many help desk staff and with this users will not waste as much time asking for help. The app will provide the information with customer needs on the companies and products and in return it will result in having a higher level of engagement.

3. Increased Customer Satisfaction:

satisfaction is the main key to having a success. This is normally measured by the number of satisfied users. The better experience developers provide the more satisfied they will be. If there is a bad experience developers create then this will lead to the user being frustrated and will leave the developer a bad review and will not give out any recommendation to other people. If user do not like the app this means the chances that the user expectation are not being met or this is not any value of the application being offered so if the app that has been developed that frustrates the user there will be a high probability that the application will be deleted. The reason for why the users will delete the app if there is a poor user experience the app could be deleted because it uses a high battery usage or there could be too many ads that will pop up, if there is not a good first impression that it is going to end up in a negative response.

4. Increased Sales:

having a well-designed app will have an increase transaction and conversation. Those apps will keep attracting more clients who will keep buying the apps and giving out a positive feedback, keeping in mind if there is a happy customer then it will lead to them spreading the word out about how good the app is and making sure they download it. Users will not spread the word if it fails to meet the expectations. With this the user will also review the application online which is an important role in convincing others, but what the developer has to keep in mind is that the reviews online is a trusted source of information and building the trust is a key component to ensure users will download the application.

How Mobile Apps Can Help Children

Implications of Learning from Apps

Mobile applications can bring new learning dimensions to children's everyday activities across different settings. The flexibility means that the educational purpose of applications in not just in the context but how they can act as and used in various contexts to address in children's development. Evidence does show that children can learn from a designed application which also signals a new challenge to produce a quality context and provide guidance to the developer. [15]

Are Young Children Interested in Using Mobile Apps

The Sesame Workshop and Cooney Center interviewed around 114 kids between the ages of 4 – 7 for them to understand how the young child knowledge works with the perception of use with smart phone, with the focus of using the iPhone and the iPod touch applications, the parents of the participating children had to complete a survey about the different types of devices they own.

Can Young Children Learn From Apps

Rockman et al (REA) who are an evaluation firm assessed on the effectiveness on the different research based, and the educational apps that were developed by PBS KIDS and WGBH: Martha Speaks: Dog Party and Super Why. The researchers gave an approximate amount of ninety kids between the ages of three to seven an iPod touch, for which they then will have to play the two different apps for two weeks. The parents of the children would then have to complete an observation log, whilst the children were given a pre-test and a post-test for which it will assess the ability in their reading skills and the content areas which were covered in the apps.

Key Findings

- How much access do children have for smart mobile device - the children do have access to the different smart mobile devices out, but their access is limited such as apps that cost money or if they are too young for the app.
- What do children do with the devices – most of the kids will just play games on the phones but with the parents answers from the survey they also said that some of the kids use the phones or a variety of activities.
- How adept are children at using smart devices – from the research that was conclude most kids are able to use the devices straight away while some of the kids took a few minutes to justify how it works then they was able to work the device straight away.
- To what extent do children learn from apps – previous mention of the Martha Speaks app this was used in helping kids with their vocabulary skills especially for the older children and the Super Why app helped the younger children with their literacy skills.
- How can apps successfully sustain the younger children's interest – to keep an app interesting for kids it's always good to remember to keep going with having new content, keep waiting time low, having activities which are fun and even having goals to complete for achievements.[16]

Usability Testing of Mobile Applications

The usability testing in one of the most used common tools to evaluate the usability of mobile applications in the development process. Users are normally given a task in different test environment and then encouraged to think aloud while they are trying to accomplish the task that has been set. This will then give the usability practitioners the information that are needed on how the user interfaces will match with the natural human way of thinking.

The different ways of testing usability one of them is traditionally conducted in usability test laboratories such as the user's living room or in an office for which they can connect to a monitoring area with having a one-way mirror. The laboratory environment is also conducted in a peaceful space, where the user will be able to focus on the given task.[17]

User Interface

The user interface design which is also known as the UI design will describe the design of websites, apps and any other graphical elements of software applications. [18]

Ten Principles of Mobile Interface Design

In this section it is going to mention the ten principles that you should include when looking at the interface design of a mobile application.

1. Mobile Mind-set:

With the differences that you get from mobile and desktops, it is imperative to get use of mobile mind-set knowledge before starting.

- Be focused – more is not always better which means you will want to edit your features and that developers will have to leave stuff out.
- Be unique – make sure that you know what will make your app different then amplify it. If there is going to be nothing special about your application that no one will download it.
- Be charming – mobile devices are personal. They are our companions, with having apps that are friendly and reliable are delightful to use and users will become attached to the experience they are getting.
- Be considerate – developers often focus on what will be fun to developer, they will have their own mental model of the app of items that are based on their personal business goals, they can be a good start but you will have to look into what the users will like if you want to create an engaging experience.

2. Mobile contexts:

With having the image of the busy professional racing through different places with having one thing in one hand and a smartphone in the other is what people picture when thinking about mobile computing context. That is one context but it is not the only one, when thinking about mobile contexts there are three major ones which are bored, busy and lost.

- Bored – loads of people use their phones when they are bored such as sitting at home, travelling on bus/trains etc. with this context, immersive and delightful experiences it will be geared towards longer usage sessions, when thinking about it there will be interruptions that will bother you so your app can pick up where you left off such as Facebook, Twitter etc.
- Busy – the ability to accomplish micro tasks quickly and reliably with having one hand in different environments is critical. With this the user will have to tunnel vision with using this context.
- Lost – users who are in transit, in surroundings that they do not know or in familiar surroundings but are focused in something unknown. This context, sketchy connectivity and battery life are major concerns so developers should offer some level of offline support with being sparing with use of battery hogs.

3. Global Guidelines:

Different apps will call for different approaches, designs and techniques with this the inherent nature of having a pocket-sized touchscreen devices will suggest several guidelines.

- Responsiveness – this is critical, if the users does something then the app will have to acknowledge the interaction within seconds, but with responsiveness it is not the same

and speed as bigger apps for smartphones can take time to respond but the app will have to let the user know that it is trying to work on it.

- Content – the touch interface is enabled users to interact directly with the content. This will remove abstractions such as the mouse or track pad and is more in line with the user's brain.
- Controls – when you will have to add the controls you should aim to put them at the bottom of the screen which in other words beneath the content. For example a computer the controls are beneath the display, because if they were in front of the display then users will not be able to see what is going on with the content.

4. Navigation Models :

There is more than one novel navigation model for apps but if developers are going to pick one of the common model then they will have to make sure that is the right choice for the app.

- None – a single screen for utility apps.
- Tab bar – three to six distinct content areas
- Drill down – a list and detail content hierarchy

5. User input :

- There are roughly around a dozen keyboard variations on most smartphone, developers should consider each of the input fields and be sure to display the correct keyboard that will be considered as more useful for the data entry.
- Auto-correct can be frustrating and that people should consider each of the input fields and decide which auto entry options should enable.

6. Gestures:

One iconic aspects of the modern touch interface is that they should be able to support gesture based user interaction.

- Invisible – the gestures are invisible, so the discovery of them are an issue, developer will have to think when to reveal the existence of these gestures to the user.
- Two hands – most gestures that have multi touch with require two hand operation, this can happen when zooming in and out, these can be a problem if a person is travelling and they have something in one hand and there is no place to put them down.

7. Orientation

- Portrait is the more popular choice for orientation so developers should optimise for this case first.
- If the app contains a lot of typing, then the developer should contain landscape orientation so users can access the larger keyboard.

8. Communications

- Provide feedback – with providing instant feedback for the interactions will help the developer, if the user for example has requested an action that take some time to load then the developer should program a progress bar that will let the user know that you have received the request and working on the problem.

- Confirmations – when the developer has asked users to confirm the action, it is acceptable to display the confirmation dialog. Confirmations are also less of a distraction than the alerts because they only happen with the response of the user actions and therefore in the context and perhaps expected.

9. Launching

When the user has used your app then decides to go back on it, it should instantly pick up from where it previously left off, this will give the illusion of the speed and then will help with the contribution to an overall feel of the responsive side of the application, if it is possible then the launch screen should display when the app is first loading and should be a content-less image of the app. Any interactions will cause frustrations by inviting failed interactions.

10. First Impressions

- Icon – the icon will have to compete for the attention with the other apps. With this being the case then the developers should think of them more as a business card than a bit of art piece.
- First launch – when the app is going through with the launch it is a make or break situation. If a new user gets themselves confused or start to struggle with the app while trying to work it then they will close the app. [19]

Types of Mobile Applications

Native Apps

Native applications are apps that are coded in a certain scripting language such as Objective-C for iOS and Java for the Android operating systems. These types of applications should normally provide a faster performance and also having a high degree of reliability. [20] Native applications are also normally installed straight onto the user's device and they will acquire these from the different app stores [21].

Native Apps can also work offline on devices and can take full advantage of the device functions such as the GPS and the camera and are normally developed specifically for just the one platform. [22]

Web Apps

Web applications have been around before the web gained its mainstream popularity, Larry Wells developed Perl which was one of the popular server-side scripting languages in 1987. This was seven years before the internet started to gain popularity outside of the academic and the technology circles. [23] Web applications would normally use the basic HTML coding language to build their apps. When the developer starts to code an app they would use an open software source such as PhoneGap or Cordova which are also known as using a web application framework. These frameworks will facilitate the rapid application development which will allow the development team to focus on parts of the application [24].

Hybrid Apps

Hybrid mobile applications are a combination of both native and web applications, most users would define this type of application as another version of a web app as it is usually built with HTML5 and JavaScript than it being wrapped inside a native container which will grant access to the native platform features. When building a hybrid application you would develop it using an open software source as it helps creating hybrid/web applications easier than a native app. [25]

Different Types of Software

PhoneGap

PhoneGap is one of the biggest open source frameworks that use the simple web technology such as the HTML, CSS and JavaScript to build the mobile applications on Android and iOS. PhoneGap was built by Nitobi and then successfully bought by Adobe. PhoneGap is the only open source framework which supports seven platforms, which will provide many interfaces to support the native API throughout the calling of JavaScript. The current version of PhoneGap is 1.5. [26]

TABLE II. THE SITUATION OF PHONEGAP SUPPORT IN EVERY PLATFORMS

	iOS	Android	Mobile Phone	Symbian
Accelerometer	yes	yes	yes	yes
Camera	yes	yes	yes	yes
Compass	no	yes	yes	no
File	yes	yes	yes	no
Geolocation	yes	yes	yes	yes
Media	yes	yes	yes	no
Network	yes	yes	yes	yes
Storage	yes	yes	yes	yes

Figure 2 PhoneGap Support in Different Platforms

Advantages of PhoneGap

The different advantages of using PhoneGap are:

- The main feature of developing the different mobile applications while using PhoneGap is the portability, which means that if an application is developed for iPhone, it can be easily ported to the other mobile platforms such as the androids just by transferring the code.
- The development skills that you just need to know of building applications is the basic knowledge of HTML5, JavaScript and CSS.
- Existing web developers can also be a part of PhoneGap which then the target can increase the user base.
- With also using PhoneGap this can also help users distribute and also integrate payments throughout the different app stores.
- The finally advantage of using PhoneGap is that the developers can use the plain JavaScript or different libraries like jQuery to handle the different interactions that are going to be used in the applications. [27]

Disadvantages of PhoneGap

The disadvantages of using PhoneGap are:

- With the PhoneGap software being free there is no guarantee of success, with the emergence of PhoneGap is clear presentation that Apache Cordova is woefully incomplete. Also the strengths of the software being an open source, and the leveraging of talents of different arrays of contributors are both a blessing and a curse. If the user is going to look for custom PhoneGap plugin there is a big chance of finding one but the problem with that is that it could be out of date or the plugin could not be supported on the platforms that you are using.

- With the performance of Cordova/PhoneGap apps being criticized, it could be an issue when your mobile applications include different types of the graphic elements. To make sure that your app will be able to run smoothly you will need to implement caching or even try out the use of 3rd party solutions to accelerate the use of graphics. The native UI will always be able to outperform hybrid solutions, but the improvements in the device hardware and Web View implementations have been able to narrow the gap.
- Documentation of the PhoneGap software is not descriptive and also at times they can also lack the important information that will be required. With that though it is harder to be able to find the clearer information and the different directions for user interface and also other practices to be able to make the applications better.
- There are small issues that the developer will have to discover for example. You will have to think about what interactions such as buttons that you will be using. Android devices have their own back button, but for iOS you will have to develop that back button into your own application. That also means that your app does not use native widgets so it will not look as a native app.
- The final disadvantage of PhoneGap is the device fragmentation within the web browsers is a real thing. The different devices that might render the same applications that have been built differently. This might also mean that the developers will have to extend on extensive testing and fine tuning to make sure the user interface is right when it comes to working on more complex applications. [27]

Apache/Cordova

This software is also an open source mobile development framework. It allows the user to use a standard web technology to be able to create cross platform development, which avoids each of the different mobile platforms native coding languages. The applications that are built while using this software are then executed within using wrappers that are targeted to the platforms, and that they also rely on the standard compliant API binding which will grant access to each of the device's sensors, data and also the network status.

Apache Cordova graduated in the October 2012, which was a top level in the Apache Software Foundation (ASF), through the ASF though the future inside the Cordova development will ensure the open stewardship of the projects that are going to be built. Also the software will remain free and open source throughout the Apache license. [28]

Advantages of Apache/Cordova

The advantages in using this software are:

- You will not have to learn a new web language if you already know how to build web applications
- It is very quick to prototype
- Even though you do not use it, jQuery mobile makes it even faster to code
- There are a lot of library options in case you make an error in your code
- Easy to understand and quick to learn
- If users wanted to they can bypass the app store by hosting files on their servers, they can then utilize app cache to make things go quicker. Changing the app is just the same as changing the web page and its cache manifest file
- Managing the images for the multiple devices is easier with the CSS and media queries that it is for the iOS xcode project and an android project with its own files.

- The Apache/Cordova software is also a lot easier to create their vector graphics to the design specifications[29]

Disadvantages of Apache/Cordova

The disadvantages of Apache/Cordova are:

- There are a lot of mobile devices out there that have their own varying hardware, the different screen sizes and also the network speed
- Some of the features that you could be using aren't for all the devices out there. Since those devices aren't as good as the new ones out there now, using a JavaScript shim will be out of question if you care about the performance of the applications.
- With having new documentation for the software is also decent not many people will have the reliable information on the newer versions of the software
- There are some issues with the some of the version of the software with the Facebook connect plugin. To find how out to make sure this will work properly some users had to download the older version of the software
- With the older version of the software there were some problems with the API functions that would then cause the JavaScript errors.
- There are also some problems with linking to other applications like the Google map applications.[29]

Research Methodology

Research Philosophy

Positivism

With using the positivism philosophy it will generate a hypotheses which then can be tested and allow explanations that will be used and measured against the likes of knowledge. The positivism will take the epistemological stance throughout the subject under the research that is studied through the objective methods rather than the subjective methods such as the sensation and intuition. Positivism is also known to explain the behaviour of the subject by identifying the fundamental laws through observation. When studying the independence of the observer and the subject (app) this should be maintained and have questions like what and how the app should work. This should also be determined by free objective criteria like the human belief and interests. [30]

Research Approach

Inductive Approach

With using this approach the user will start off by getting different work such as previous apps, webpages and then when there has been a sustainable amount of work gather, you will have to start to analyse it and look for patterns in there. Once you have finish with analysing the work then the user can start to experiment and start to build an app with using the ideas of previous work. The inductive approach does go by a different name which is the bottom-up approach meaning that the researcher will use different observations to build the abstractions. [31] The advantages of using the inductive approach are firstly you can see the work that developers have done in the past and use their ideas and put it all into one, another advantage of inductive approach is the learners will start

to have a favourite pattern and use that to recognize the abilities and give them the upper hand on problem solving. The disadvantages of the inductive approach is that it can be time consuming this can be an easy way to work around as the learner can look at work which could be similar to others and just use them for analysing the work. Another disadvantage is it can be frustrating this can be a problem as learners could get annoyed when they are trying to build their own app and feel like they should give up. The way this can be resolved though is when they are developing they should split the work up so that for a certain amount of time they work on one section of the app and give themselves a break and once they feel ready to carry on then they can start on the other section of the app.

Advantages

The advantages of using inductive are:

- You can see other peoples work to get the ideas.
- You can build the app using other ideas but put it then in your own way by combining work together.

Disadvantages

The disadvantages of using inductive are:

- One major disadvantage of inductive is time consuming, this is because you have to gather a sustainable amount of data before you can go ahead and analysis it which then that part is also time consuming before you can then experiment and start to build your own work.
- Another disadvantage is when you are gather data most of it can be the same type of work and then you are just going to be analysing the same thing.

Research Strategies

Experiment

With using this strategy, the user will be able to test the app to see how it feels and if it works properly, when using the experiment strategy the developer can test it along the way to see how the progress is going and if there are any bugs then he can solve it there and then. The developer can also get some tester to try the app and then ask them a couple of questions and then get the feedback to see how the app is going and what changes can be made.

Advantages

The advantages of using experiment are:

- You will be able to get a better outcome at the end with the feedback from other people
- You can see how the progress is being made step by step.

Disadvantages

The disadvantages of using experiment are:

- With doing experiment and making different prototypes can make the final overall time consuming as you will be wanting to try new things.
- You could keep getting errors if there is no testing beforehand.

Development Methodology

Within creating the mobile application the developer will be focusing on using the prototype approach, the reason of choosing this way of method is that the developer will be able to make the application bit by bit and testing it to make sure that the code is working before making the final steps of developing the real application to publish. When using this type of method it will give the client an actual feeling on the application since all of the interactions that will be involved in the application will be enabled for a better understanding when the users use this application. Prototyping is one of the major features when creating a complicated or large systems for which do not have manual process of an existing system to help with requirements. The main goal of using prototypes is to provide a functional system as they will not be completed systems and that most features will not be built in the application just yet.[32]

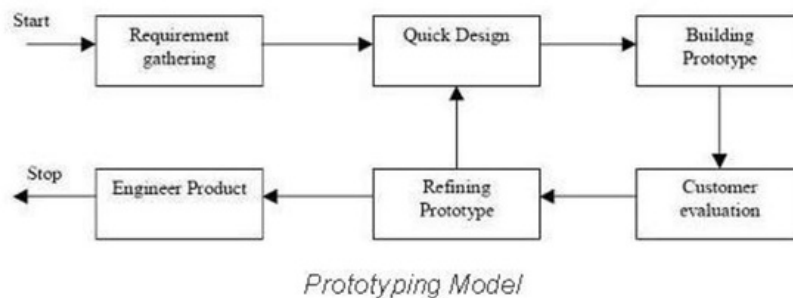


Figure 3 Brief Description of how Prototype Works

Advantages of Prototypes

In this section it going to show the advantages of using prototype model when developing the application:

- When the prototype application is shown to the user, he/she will get a clear understanding of the application of what it is going to be and how clients will be able to work it.
- This type of approach while developing the software is it normally used for the likes of non-IT-literate people. The reason for this is that they will not be able to specify the requirements and not properly understand what they will expect from the software.
- When the client is not confident with the developer's use of creating software, they will ask for a prototype so that the client will be able to judge the developers capabilities.
- Prototyping will occasionally help with funding for the project when showing the demonstration the concept of the software if the developer is not able to fund for themselves.
- It will reduce the risk of the application from failing, as will creating the prototype it will identify any risks can be solved early before the final software is created.
- The time that will be taken to create the software will be reduced, since with the prototype the developer has a better understanding of approach.[33]

Disadvantages of Prototypes

In this section it is going to show the different disadvantages that will occur in using prototypes:

- Prototypes will normally cost the developer, which should be done using the minimal resources. It could be done using the RAD (Rapid Application Development) tool.
- Once the proper requirements are in use from the client with showing them the prototype model it could be of no use. That is why the prototype model is also referred to as the "Throw-Away" model.
- When creating prototypes it is a slow process which could take up the developer's time to create different software for another client in the meantime.
- There is normally too much involvement from the client which would end up disrupting the developer from creating the software as the client could make a certain change from what the developer has already created.
- With having too many changes it could then disrupt the rhythm of the development team.[33]

Design Patterns

The design patterns are a piece of solution to the common design problems documented in standard formats. Design patterns support design by providing a shorthand way and common language to refer to more common design problems, but using the design patterns will grant experience developers the record and share their insights.[34]

Different Types of Design Patterns

Main Navigation

There are many ways to design a main navigation for your app however more common ones are the horizontal menu and vertical menu, the choice is up to the developer and how they think the look and feel of the app should run. There is also an inverted L menu which is another popular navigation as it uses both horizontal and vertical menus, this will let the user click on one of the tabs to go down and find where they need to go and it will split up and go to the right for which the user can then find the sub menu item they need. [35]

User Interaction (swipe, tap)

After the pull up gesture came out so that the user can refresh the page, swiping is another gesture that has recently become common, some apps that have already been developed have got this interface developed into them which will allow the user to swipe across to get more detail of the information or even perform other actions such as editing a post or deleting them. Every application will have their own different purposes and value to their users, which then the developers will have to take their time in planning their ideas and putting them together. [36]

Software

In this section it is going to show what software is going to be used and why will it benefit the developer. The software that is going to be used for creating the mobile application is PhoneGap as it is open software platform so that the user can also use it for the different mobile platforms and test it while developing it so the developer can see if there are any bugs in the code and that will easily be fixed. It is appropriate for the development as PhoneGap uses the basic use of HTML, CSS and JavaScript so the developer will not have to waste time learning a new coding language. Another good use for PhoneGap is that any of the application that are built with this software will use the different mobile platforms web view to the render content which means that any content that is used in building the application it will appear identical of the platforms like it would show on the web page. PhoneGap have also got a bridging mechanism will allows the use of JavaScript to run in the web view to invoke the native code that is contained within the mobile application. Another good use of PhoneGap is that it comes with the complete plugins that will support the device capabilities like the use of the camera, file system and the accelerometer. [37]

Material and Tools

This section is going to explain the different language package for this application, the chosen package that has been chosen is HTML, CSS and JavaScript as they are easier to use and they are also the basic coding language that most developers use nowadays.

HTML

Hyper Text Markup Language which is also known as HTML consists of series of short code which is typed into a text file by the developer. When developing a website/application they will always be saved under a HTML file for which the user can browse then on the different browsers that are available. Anyone can make up their own websites but using the correct tags to their vision. One of the major benefits of HTML is that developers can work either online or offline and can store it all on their personal computers and transfer it across to another computer that has internet access and view their work. [38]

CSS

CSS which developers will know as Cascading Style Sheets, these are plain file for which can be modify the contents on their applications, the developer will use these for keeping the description in the right places to what they have put in the code. It can also be used for colour and the borders so the developers will know that they have got multiple choices of the colour scheme and can pick the appropriate scheme for whoever the target audience is. One major benefit of CSS is that developing can use one CSS file for the whole application and can find any bit of code they might want to modify but finding the correct tag that has been declared in the HTML file. [39]

JavaScript

JavaScript is one of the programming languages that can make any website or applications interactive. It will run on the user's computer and will not have any downloads that will put of the user from running the website. One interactive program that is made by JavaScript is quizzes, there are many templates that are available on the internet so new developer will not have to stress over writing a new page they can use that template which will plug in to you software and be instantly available to the developers. Developers can be the JS file in the same file with the HTML code but normally new users will make a new page just the JavaScript code and use the .JS extension to help them identify the correct time to use that file. [40]

Design & Implementation

About the Project

In this project the developer will be making a mathematical app for kids to learn their timetables, it will help them with the one timetable all the way to twelve.

Outcome of the Project

With the outcome of the application, the developer will be hoping the app will be successful and making kids more active in learning their timetables better and having a better understanding.

Key Features

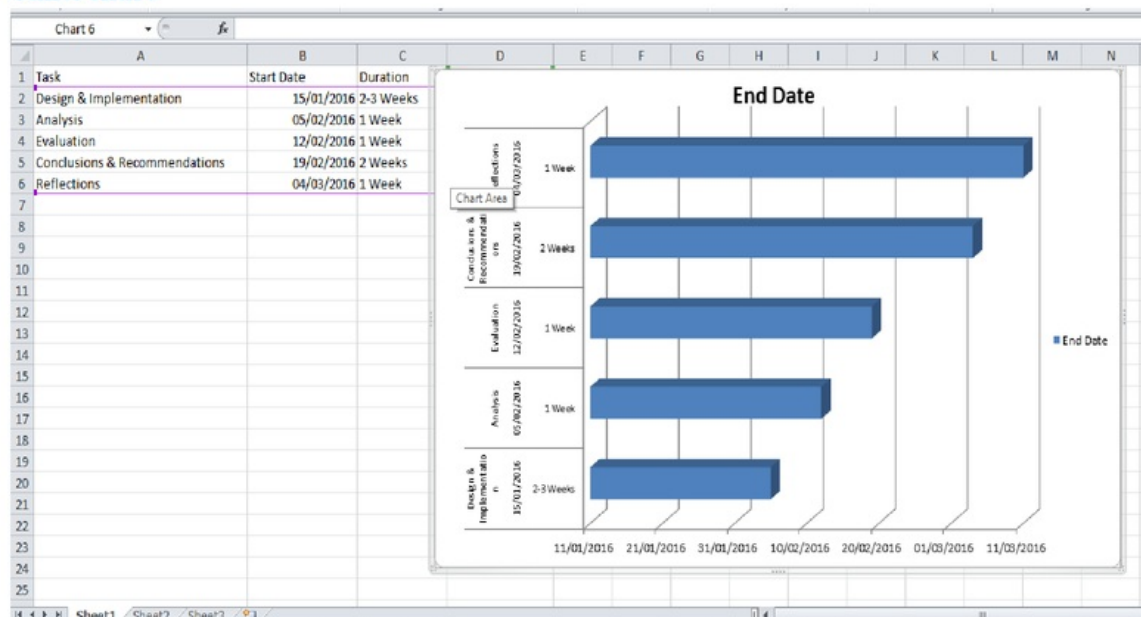
Buttons

One of the key features of this app is the buttons to go on the different pages with the different timetables. Instead of having all the images of one page and making the page go on forever, the users will have to use the interaction of the buttons to find the timetable they want.

Images

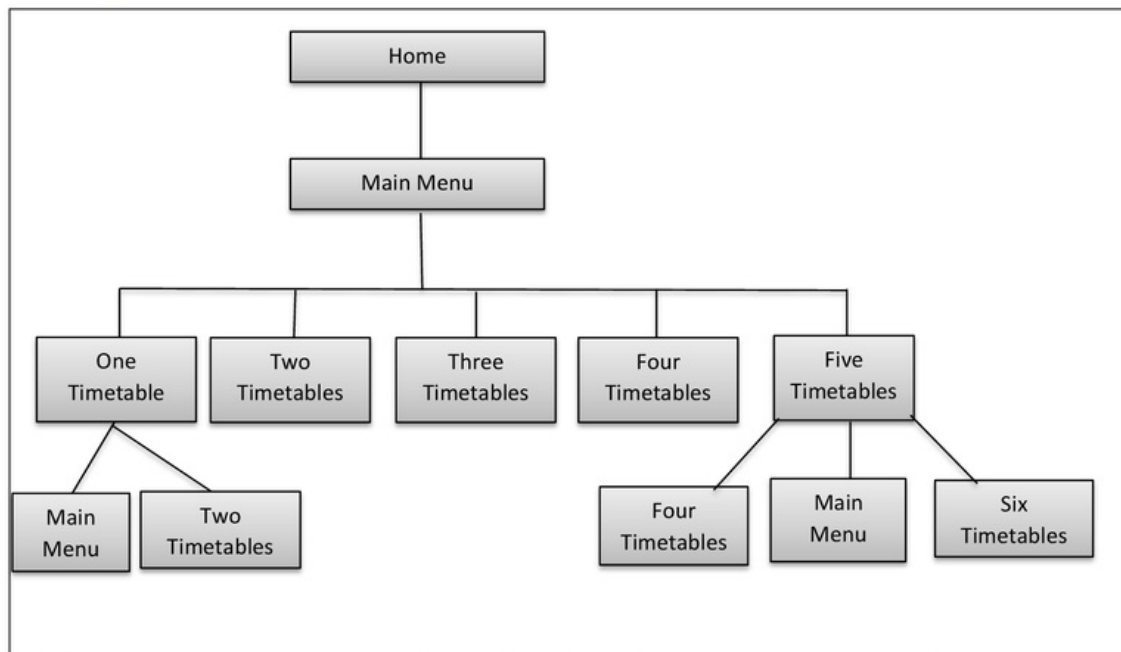
The images will be different on the pages for example the seven timetable image will be on the page with the header Seven Timetable. These images will be bright so it will attract the users and make them more engage into using the app, while having the images bright they will also be clear so that the user will be able to read them.

Gantt chart



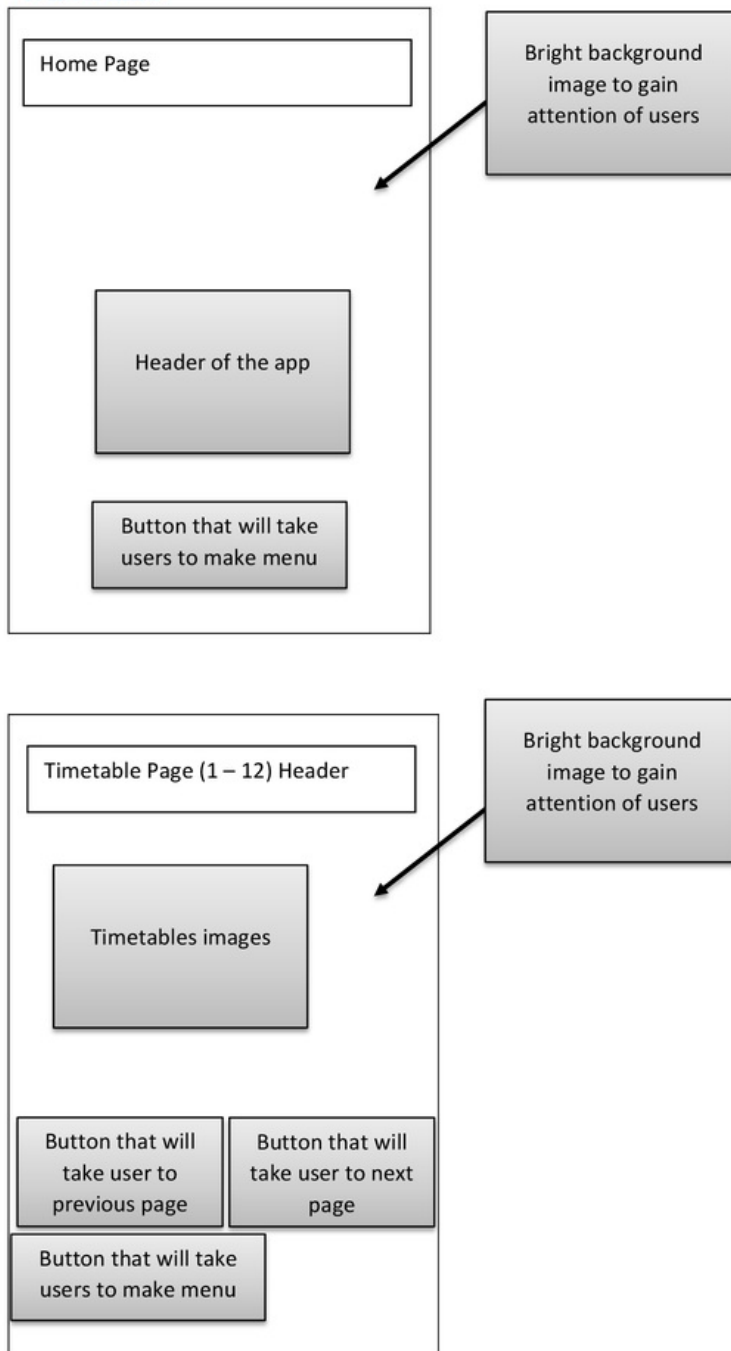
This image above is the Gantt chart that has been created to show how long it will take to finish the rest of the project off.

Sitemap



The sitemap above shows how the app will work, firstly it will display the home screen for which there will be a button to get onto the main menu where the user will select which timetable they will like to view. Once they have selected a timetable for example the click on the four timetables it will take them to that page and display the four timetable images, underneath the images there will be three buttons that will perform different actions.

Wireframe



With the two different wireframe design above it will show the homepage of the app and the different times table, when the user have clicked on either the one timetable or the twelve timetable is will only display two buttons instead or three.

Use Case Documentation

Goal	Buttons working
Description	To make sure that the buttons on the pages are working correctly
Execution	This will execute when the user is ready to move onto the other pages
Scalability	Only one user will be able to use the app on one mobile device.

Implementation

Buttons

The buttons also act as a link to take the users to the right pages that they are designated for. For example if the user has click on the button with the text saying Two Timetable it should then take the user to that page. Once the user has clicked on a button between the Two Timetable and Eleven Timetable they should then be able to see three buttons that will have different actions for them (previous page, next page and main menu). If the user has clicked on either the One Timetable or the Twelve Timetable then they should only see buttons but on the One Timetable there should be two buttons that will have different action one to take them to the Two Timetable and Main Menu whilst the Twelve Timetable should have the buttons that will let the user go back to the Eleven Timetable and the Main Menu.

```
<a href="eighttimetable.html" class="button">Eight Times Table</a>
<a href="tentimetable.html" class="button">Ten Time Table</a>
<a href="mainmenu.html" class="button">Back To Menu</a>
```

Images

There will be different images for the different pages like the Four Timetable page should have the image that should display the four times tables, one problem that encounter in this was that the images was not fitting to the size, which was fixed by doing a little bit of work with the cascading style sheet by setting the width and height to an appropriate fit.

```
<h1>Nine Time Table</h1>

```

Prototypes

With the prototypes of building the app the developer firstly started by making a basic home page with very little interaction to see how it will look and if everything will work correctly. Once they did that part then they would start again with a new project but have more interaction on it with different pages to see if users could then use the buttons that was on the pages to make sure that they would perform the right action. Once that bit was working correctly then another prototype

was created with having images on it so that the user can see what they would be looking at and after then the developer would start with the style sheet so that the images was placed in the right position and that they would fit properly to the screen size and that all the images was not blurry and that users can see what they are properly.

Six Time Table				
6	x	1	=	6
6	x	2	=	12
6	x	3	=	18
6	x	4	=	24
6	x	5	=	30
6	x	6	=	36
6	x	7	=	42
6	x	8	=	48
6	x	9	=	54
6	x	10	=	60
6	x	11	=	66
6	x	12	=	72

[Five Times Table](#)
[Seven Time Table](#)
[Back To Menu](#)

The image above shows an example of one of the prototype that has been created for one of the page, one change that is going to be made here is the white background behind the numbers this will be change to a brighter colour to attract young viewers eyes.

Evaluation

The evaluation section will entitle the conclusions that was drawn from the project, if any of the data has been collected it will back up the research that has been done and it will also shows if the aims and objectives have been met.

The conclusion that has been drawn up that it is difficult to build a mobile application from scratch without having any ideas beforehand. When having the idea though it can then be simple to create the app when the developer has got previous work to look through and analysis it, like the developer has been with using the inductive approach.

The data that was collected will be able to back up the research in the literature review as it shows that kids can learn better from using mobile applications that reading from a book as there is a lot more interaction to make them engage.

One objective which was successful was investigating the background how to create a mobile application. This was successful because the development methodology backs up this objective as it shows the reader what software was used to create the app whilst the design patterns showed the readers what things you can do on the app.

Another objective which was to create an app and build it this objective was another successful as the app was creating and that users can test it without having problems.

The aim was a success which was to develop an app to help kid if they struggle with their timetables, this has been proven with the app that was created and that the users can see which timetable they would like to look at and view it so they can learn from it.

Overall the answers were expected as the app that was created can be used for anyone but mostly it was aimed for children that are in primary school and learning the timetables. Another answer that was not as expected was the design of the app. This was a struggle at first because there were problems like how would the app make kids engage with it.

If the project had to be done again, the differences would be to make plans before starting the coding like go around different schools and asking how would like the app to be done. Another change that would be made is the backup research, if there was more research like other apps this would make plans simpler as you will already have more of an idea what can be done.

Conclusion & Recommendations

The conclusion section will summarize what work has been done already and how it has been achieved.

The literature review section will tell the reader about the history of mobile applications like when they first started out and what you can do with them now. It will also show the number of mobile apps that have been downloaded from previous year with what platforms they can be downloaded on and what mobile applications there are like the native and web applications and what are the differences of them. Another part of the literature review is how apps can help children this will explain how they can learn from apps and what apps are interesting for kids. It will also have the ten principles of mobile interfaces and what they do. This section will also cover the different software there are to help create the applications like PhoneGap and Apache this will cover what they do and the advantages and disadvantages.

The research methodology section will cover the philosophy, approach and strategies, first the philosophy which is was positivism, the reason for choosing this philosophy was because it will generate the hypotheses which will be able to test and allows explanations to be used. This was also chosen because when studying the observer and the subject it will be maintained and have questions like how will the app work this will be achieved by having users test the app and getting feedback from the users. With the research approach the technique that was used was the inductive approach this was chosen because firstly before starting any development the developer would firstly get find some research so he could analysis it before start coding for the application, this was achieve as the research that was found would give examples like the different types of design patterns and how can you make the app more engaging. The only problem with using the inductive approach was it was time consuming but was easily solvable as there are a lot of apps that are similar so you see the technique they were using. The strategy that was chosen was experiment this was chosen because while the app is being building you can test it along the way to see if there are any errors with the app and can they be fixed straight away. This was achieved because the app has been built without any errors and users can successful use it without problems.

The development methodology section will cover the prototype approach, the different design patterns, software that was used and the material and tools that were also used to help with creating the application. First with the prototype method that was useful as you could create different designs of the app and once of prototype was created then users would be able to test it and then the developer could get feedback and see what improvements can be made to get the final application. Prototypes are also used when developers are creating a large system so that if they get to a certain point and then test it and it has errors, they can go back a previous section and start from there again. The design patterns are used for a piece of solution to design problems, design patterns also support the design by providing them with a shorthand way and using common language to refer to a more common design problem but with using these they will grant experience developers to record and share their insights, one of the design patterns that was achieved in using was the main navigation, the main navigation have many ways to show themselves in an application as they have the likes of the horizontal and vertical menus. The software that was used that helped create the app was PhoneGap the reason for choosing this is because PhoneGap is one of the open software platform which allows the developers to test the app before finishing on any mobile platform (Android, iPhone). Another reason for choosing this software was appropriate as you can use the basic coding language (HTML, CSS and JavaScript). One other reason for choosing this

software is because any parts of the application that is built with this software and using the different mobile platforms web views to their render contents which means the content that is going to show will appear identical. The material and tools that was used to create this application was HTML, CSS and JavaScript these was used as they are the basic language to building a mobile application and one of the most popular languages for building anything to do with web. The html was used to shows what content show on the app like the images, headers and buttons while the CSS is used to style the application and make the app look more eyes catching to its users.

The recommendation section will cover what could be done to make the app better.

One recommendation that could be done to improve the application would be to make the images into a slideshow which the user can the swipe to change images after they are finished with the timetables they are on instead of using the buttons to go back and click on the timetables they want.

Another recommendation is after the user is finished with studying the timetables, there could be a page with a quiz on it for which images will display and there will be a number missing in the timetable either the answer or what number they have to use to multiply it by. For then the user will have to work out the answer and type it in and it will either display as correct or wrong.

Reflection

After going through the year while working on the project that has been a few things that have been learnt, one of the biggest things that have been learnt and found more interesting than others things is how PhoneGap can be used to utilize a web page into a mobile application.

While learning that it has also proven that creating mobile applications, are easier than people think they are once you have got the idea you want and start to plan it out by sketching design first.

With having the knowledge of HTML, CSS and JavaScript, it was better for creating the app as there has already been previous experience using those languages.

Another thing that has been learnt is if you have started to create the prototype for the application without having ideas it will not work properly as done before as there was not clues to how the design to look or what should the content be placed to.

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