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| School of Computing  Faculty of Engineering |

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Submitted in accordance with the requirements for the degree of  
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Session (e.g. 2014/2015)

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| *Deliverable 4* | *Software codes or URL* | *Supervisor, assessor (xx/xx/xx)* |
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# Summary

*<Concise statement of the problem you intended to solve and main achievements (no more than one A4 page)>*

# Acknowledgements

*< Karim Djememe This page should contain any acknowledgements to those who have assisted with your work. Where you have worked as part of a team, you should, where appropriate, reference to any contribution made by others to the project.*

*Note that it is not acceptable to solicit assistance on ‘proof reading’ which is defined as “the systematic checking and identification of errors in spelling, punctuation, grammar and sentence construction, formatting and layout in the text”; see* [*http://www.leeds.ac.uk/qat/documents/policy/Proof-reading-policy.pdf*](http://www.leeds.ac.uk/qat/documents/policy/Proof-reading-policy.pdf)*. >*

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# Introduction 1

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## 1.1 Project Overview

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### 1.1.1 Problem statement.

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## 1.2 Minimum Requirements

## 1.3 Objectives

## 1.4 User Collaborative Agile Design Methodology

For the development process of the project and Agile methodology was followed. As the project has to be completed in quite a short duration of time the ability to provide working software at each stage of development. Constant interaction with the client is allows for changes during implementation at any time so new directions can be taken with little effort. This is advantageous as following this methodology gives the ability deliver something that the client can use even if there are unforeseen problems or large changes that affect the schedule of the project.

The main goals of this methodology are :

* Get feed back from client by continuously delivering working software in each of the iterations.
* Allow changes at any time during development.
* Work directly with the client face-to-face if possible to deliver the best possible product to the customer.
* Justifying design/development choices and following best practices to speed up development process. (The Agile Alliance , 2015)

### 1.4.1 Agile Story Workshops

Various techniques are used in Agile, such as Agile story workshops. A story workshop is meeting with developers and the client(s) where stories are created to explain what is needed for each feature. For example “As a user, I want to be able to see information about a drug at a glance. This includes; a name, brand names, dose, type of drug, interactions, side effects and various routes of administration for paediatric and adult patients.” This describes the feature in what information needs to be displayed for a drug. This is done for all users so example of a different user would be “As an admin user, I want to be able to add or remove the drugs that are displayed on the mobile app.”. This describes the feature of adding an administration interface to be able to be able to add and remove drugs. This allows the developer(s) and client(s) to prioritise the features easily by rating the importance of each story. The developer(s) then plan which features to be done in each iteration make sure at the end of each iteration that the software could be shipped if necessary. (Quotient Integrated Solutions, 2014).

For this project this technique was followed but with the use of storyboards as well. From the user stories, storyboards were created to show a visual process of how the user interface. This allowed the client to see how the features would look and if this is how it was imagined in the user stories. This speeds up development times as the storyboards can help confirm the designs of the basic user interface eliminating the risk of the user interface needing large changes that could affect the schedule of the project. This can be done quickly and simply on paper in preparation or during a meeting. Following this approach conforms to principle 10 of The Agile Alliance’s Principles of agile software “Simplicity--the art of maximizing the amount of work not done--is essential” (The Agile Alliance , 2015). As the work that would be created in constantly changing the user interface to suit the client’s imagination would be eliminated because it was already confirmed.

## 1.5 Schedule

# 2 Background Research

## 2.1 Developing For Android Or IOS

The two most popular mobile operating systems are Android and IOS. There is debate on which is truly the most popular but mostly all sources agree these are the two market leaders. The two top companies for gathering data on the popularity of mobile operating systems are StatCounter and Net Market Share. Net Market Share gathers its statistics by measures total traffic and StatCounter measures daily unique users (Bott, 2014). Statistics for this year from; (Net Market Share, 2015), (StatsCounter, 2015), are shown in figure 2.1.1.

### Figure 2.1.1

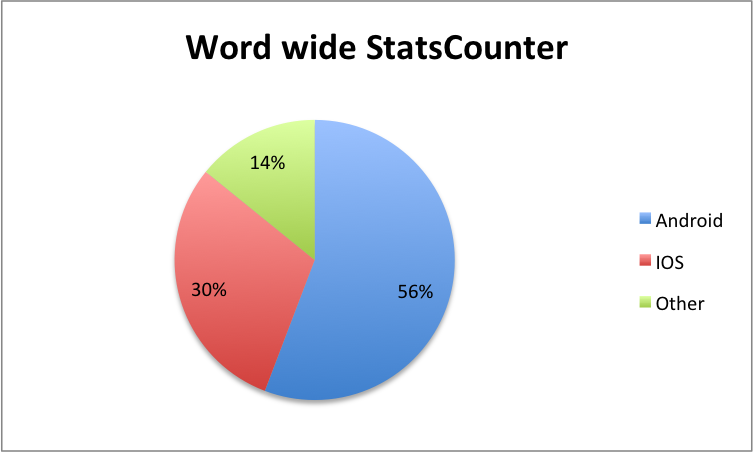
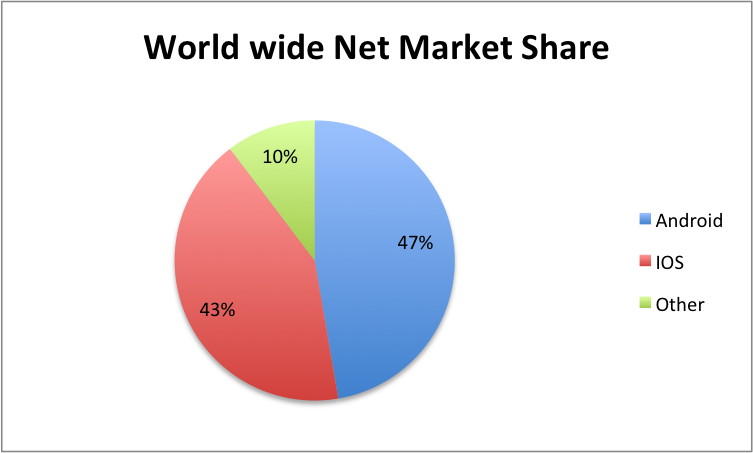
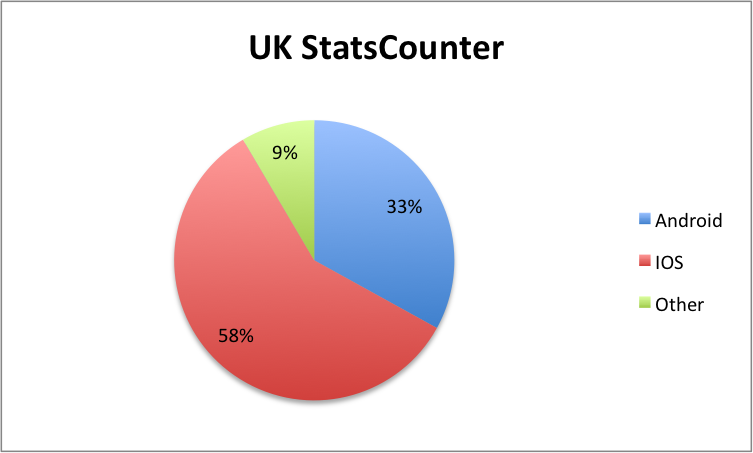


Figure 2.1.1 shows the percentages of market share for the mobile operating systems Android and IOS. As seen Android is the dominant operating system from both sources.

### Figure 2.1.2



Although the two sources agree that Android is the dominant operating system world wide as seen in figure 2.1.1, when filtered for the UK as shown in figure 2.1.2 IOS the dominant mobile OS in the UK (StatsCounter, 2015). Net Market Share does not offer region filtering for free so it is assumed that the statistics follow the same pattern.

### 2.1.1 Android

Android is claimed to be the most popular mobile operating system world wide and provides a very open market place to distribute apps (Android, 2015). Android has many devices in which its operating system runs on from various companies such as Samsung, HTC, Motorola, ASUS and many others. The devices created by these companies operate on many different screen sizes and versions of the operating systems. A download is available from Google Play’s support page that gives an A-Z list of all the devices that Android supports, the number of devices is approximately 8,725 (Google, 2015). As there are a great deal of devices testing can be a long process when developing for Android.

Google Play is Android’s main source of mobile application distribution although Android does not restrict developers to publish Android applications on other application stores. To publish an application a registration fee of $25 is required this is a one time fee per account and allows developers to publish their applications on the Google Play store. Google allows Android applications to be uploaded by developers on to the Play Store in short time usually the same day as it was published (Google, 2015). The applications are scanned automatically for malicious and poorly implemented software as they are uploaded to maintain quality applications on the application store (Mills, 2012). This is a major benefit to developers as the software can be released very quickly minimizing the gap between development and release lowering the cost of development especially for companies that hire many developers for a particular application.

### 2.1.2 IOS

The usage of IOS devices is prominent in the UK with over 50% of data traffic on IOS (StatsCounter, 2015). In comparison to Android there are far fewer device variants on IOS, various versions of iPad, iPhone, iPod Touch in which under 20 devices run IOS 8.0. As there is such a small number of devices testing is far quicker as well as the there is an emulator for each device build into the IDE that Apple provides.

The Apple App store is the only place where applications can be downloaded to mobile devices. The development for IOS is much more restricted than Android. To publish an application to the App store an annual fee of $99 is required to enrol on the developer program. This then gives the developer a certificate to authorise the apps they develop. Once the application is developed it has to go through the review process. This takes an average of 8 days according to the crowd sourced site (Shiny Development, 2015) as of 14th of April. If the application is not rejected it then will be released on to the application store, although if it is rejected the entire review process has to be repeated once the issue is resolved (Apple, 2015). In comparison to Android the release time can take much longer as if an app especially if some guidelines are missed during development. The reason for Apple doing this is to ensure the quality of the applications on its App store to keep the companies good reputation. This can be frustrating to developers and seriously impact development times but ensures only higher quality applications can be released.

### Conclusion to OS choice for development

The choice of operating system to develop for is IOS for the following reasons:

* The client wanted the development to be in IOS. It is the clients opinion that is IOS the most popular among the student doctors in Leeds University.
* IOS is assumed to be the most popular in the UK for mobile devices as discussed above.
* Testing an Android application may take longer than IOS due to the amount of variation between the many devices that use Android. Due to the limited time of the project, if Android was chosen the application may not be compatible with some devices as they cannot all be tested within the time frame. IOS however can has very few devices and the XCode IDE has emulator for all the most recent devices.
* Although getting the application on the App store may take longer than Android the review process will help identify any unforeseen bugs in the application and when it gets through it’s a sign that this application is of high quality.

## 2.2 Programming Language For Development

### Objective C

The chosen language for the mobile application is Objective C this is because it is the native language for Apple’s operating systems and is has a large supported community. This means it has substantial examples and libraries to help the development of this project.

Swift was an alternative but as it is still very new there could be issues with constant updates and changes causing features to become outdated or cause bugs (Eid, 2014). Also because it is so new there may not be as many examples to learn the code as compared with Objective C. Although this language is simpler syntactically compared to Objective C, Swift still uses Objective C libraries. This could make the code difficult to understand if written in two different languages.

C++/C could have also been used but the code would have needed some Objective C wrappers and converters for the application to run on IOS. This would of meant mixing languages making the code less readable and verbose.

## 2.3 REST

Representational state transfer, also known as “REST” is an architectural style of developing a distributed system which was first shown in a paper by Roy Fielding. As REST is style not a standard, there is no W3C recommendation for it and it is simple enough to be used for a variety of approaches. (Vogel, 2014) (Elkstein, n.d.)

### 2.3.1 Why Use REST?

Having a RESTful layer means that any application from any operating system can communicate with the server meaning that if needed other developers can look at the API and create their own app that displays the data the way they want it. REST is stateless meaning doesn’t rely on traditional methods of communicating with a server as it doesn’t create a session of persistent connections, it just uses HTTP perform operations on a web service. The benefit of this is speed and scalability as the application can just use a URI to get the exact data without having to maintain a session. Another advantage is loose coupling which means it can be platform independent as HTTP can communicate with mostly all devices that can connect to the internet. The client wants this system to be used after the project has been completed. Developing the server using REST will allow the data to be transferred to the app as it does not need to know anything about the server other than the URI for it to understand the data. Any application with an internet connection and XML handling can get and understand this data. If the app needs changing due to updates released by the operating system it can be completely redesigned without having to do anything to the server. This data will be in XML format so any platform can use the data to display the information.

### 2.3.2 REST Framework Jersey

To make the development of the RESTful server easier a framework called Jersey was used. There are many different frameworks that can be used to develop REST services but ///I HAVE HAD EXPERIENCE WITH JERSEY AND THE IDE ECLIPSE DURING MY DEGREE////. Due to the short time of the project the decision to use a more familiar framework will help shorten development and research time. Jersey is also recommended by IMB to create REST services with the use of Apache Tomcat for the container of the application (IMB, 2009).

Jersey also has some useful features built in such JAXB which converts nested Java classes to be converted into XML using simple notation. This a very useful library as the XML generation and input can be done automatically with a small amount of code. As this method has been tried and tested it reduces the risk of bugs in comparison to implementing the marshalling from scratch.

Jersey is designed to work with the Apache Web container Tomcat. The need for a web container is to handle the dynamic webpages ///////HHEHEREEEEEEEEEEEEEEERRRRRRRRRRRR

## 2.5 Integrated Development Environment

### 2.5.1 XCode

The chosen integrated development environment is XCode as it provides all the necessary tools and features needed to create mobile applications in IOS. XCode is what Apple recommends to develop IOS applications and Apple includes a great deal of documentation of how to develop applications for IOS in XCode. This IDE can understand languages of C/C++/Obective C and Swift and includes emulators for the most popular mobile devices to test the applications. XCode also includes build in Git Hub version control which can control the changes to the project (Apple Developer 2015).

### 2.5.2 Java

Eclipse

## 2.6 Database Design

Mysql,WAMP, JDBC

# 3 Design

## 3.1 Gathering Requirements

Client meetings, object structure, process of getting minimum requirements.

## 3.2 Low Fidelity Prototype

Paper to white board meetings

## 3.3 Clients Reflection on Prototype

Reviews on intial design changes

## 3.4 User Interface Design

Show storyboard

## 3.5 Mobile Application Structure

Basic IOS didFinishWithOptions() onLoad() etc.

## 3.6 REST Server Structure & Administration User Interface

Methods to implement server return html,xml, delete, add, EDIT?

## 3.7 Database Structure

## 

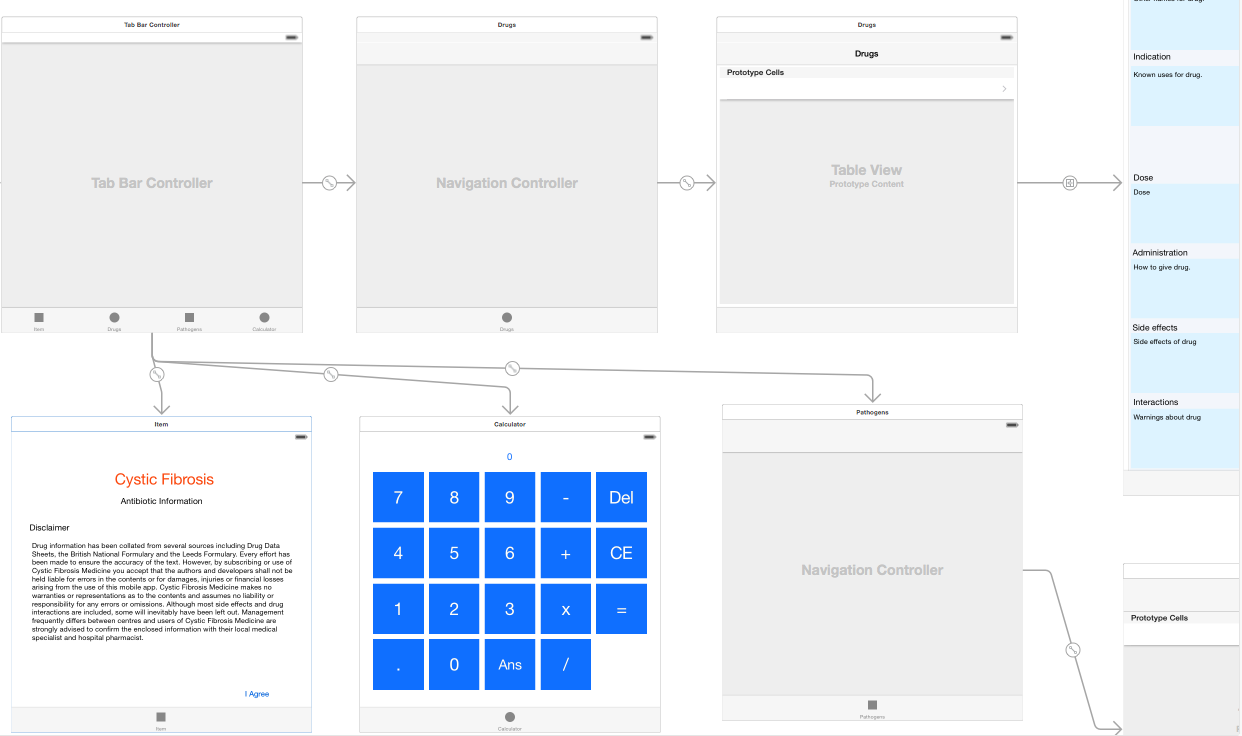
# 4 Implementation

The following segment of the report describes how the mobile application, server and database were implemented. The implementation section will give information on process of development to solve the project problem. The agile methodology is used for this project thus the implementation section is split into different iterations.

## 4.1 Iteration 1

Create working prototype from low fidelity prototypeCreate objectsLink user interface to objectsFill with temp dataClient Review

The aim of this iteration was implement a working prototype of the mobile application. The first stage involved creating the user interface in the Interface Builder in the XCode IDE. The reason for using the interface builder GUI tool rather than developing the user interface programmatically is that it creates a storyboard of how the containers interact with each other as seen in Figure 1. This a valuable tool to be able to show the client as the flow of the program can be understood without knowledge of the source code. This allows the client to request interface changes and see the effect of the change before actually having to change, compile and run the code for each change, saving time in development. Storyboards were created on paper from the user stories during the design phase so the process was quite simple and fast as XCode provides a simple interface to drag and drop components similar to those drawn in the user story created storyboards.



Figure

The main challenge of the user interface construction was getting it to resize dynamically for different screen sizes that are available for IOS. This is done by allowing all the objects to resize with the screen size but adding constraints to each of the objects inside the container to make the UI the. An example of a constraint is to make sure an object is always has a distance of 5 pixels to the right and of the container no matter how much they are stretched. This will allow for example a text area to resize to match the screen size to but always keep it centered. This is challenging because constraints can interact and override each other. When dealing with many constraints this can get very confusing into why a particular object is not behaving as it should when it is resized. XCode provides a feature “Resolve Auto Layout Issues” to help resolve this where it will fill in all the constraints that are needed to make the look like it does on the storyboard. Although this feature is very good at setting the positions the resizing is still an issue and needs other constraints such as keeping all the buttons on the calculator the same height and width ratio which have to be added manually.

The next step in the first iteration was to create the objects for the information on drugs and pathogens to be parsed to the UI. From the user stories decided upon in the initial meetings the objects could be created to suit the output displayed on the user interface.

## 4.2 Iteration 2

Make changes to interface per clients request

Convert from XML GDATA to object on mobile app.

Create simple REST server to send a small XML document with dummy data.

Object to XML JAXB

Construct object on server create server.

Client Review.

## 4.3 Iteration 3

Created database MySql,

Problems with clients database not standard format caused time lost.

Connect database to REST service JDBC database to the object

Return HTML of database

## 4.4 Iteration 4

Admin User Interface

Add/ delete from database

Advanced app features comparing drugs and finding pathogens.

# Evaluation

## .1 Results From User Testing

## .2 Future Work

Add more features to rest server, edit for example. Add different types of drug search feature.

Android.

## .3 Personal Reflection

Report is very hard.

Problems with clients database

Coding went well little problems. Research more frame works instead of reinventing the wheel.

Overestimated the amount of work that could get done in a the time three months sounds like a lot but it really isn’t.

## .4 Client Reflection

Was he satisfied ?

What does he wish happened?

Anything that went badly?

Professionally Managed?

Correspondance

Meeting Notes.

## .5 Dicussion on REST vs the Normal Way vs SOAP

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(If any.)

Appendix A  
External Materials

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# Appendix B Ethical Issues Addressed

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## B.1 Level 2 Heading

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1. [↑](#footnote-ref-1)