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Final Year Project Report

BEng. Computer Engineering ‘14

Department of Science and Engineering

Mobile Application Content Management System

Project Description: Android applications can make use of web views in which html can be displayed and can interact with the underlying Android layer through a Javascript interface. This project will target to set up a content management system for such apps such that the content of an app can be easily created by end-users. The content management system will make use of html, php and an SQL database to display, process and store the content. The content management system should contain a graphical user interface with which the user can create html pages containing all usual elements: graphics, text, links.

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Abstract

Content management systems are programs which allow users to publish edit and modify existing content on their websites, with the growing use of mobile devices the implementation of content management systems for mobile use is in ever increasing demand. The front end of the system (Content management application) allows the user to add, modify and remove content with limited technical expertise thereby reducing the need for hand coding and display this in an easy to use format. The mobile app content management system was developed in php, css and html with key drag and drop functionality being created through JavaScript. The final system offers robust features allowing the user to display, create, manage and store content on a mobile web page. This system offers users the ability to tailor their web pages for a mobile environment and easily manage mobile content which is in ever increasing demand.

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Chapter 1: Introduction

Nearly every single website today is based on top of some form of content management system. Content management systems hide the detailed code of a web site and allow the users to develop and maintain the site with a high level graphical user interface [1]. The primary focus of one of these systems is to create a user friendly interface to build and modify a website. There are many of these systems including well known ones such as WordPress and Drupal. The proposed project is based around the idea of creating a content management system in which mobile end users can easily create content for use in mobile systems. For this project the required skills and platforms to be made use of will be, amongst others aspects; PHP to display the web pages, CSS to format the HTML in a way that makes the web pages used visually pleasing, JavaScript to change the form of displayed content in order to implement drag and drop functionality, HTML the basic mark-up language to create web pages, and an SQL database to display, process and store the content. The system will contain a graphical web interface within which the user can create html pages which can then display the desired elements, i.e. text, graphics etc.

The purpose of a content management system is to allow a user to edit content and provide maintenance from a central interface. These types of CMS's have been around since the early 1990's and are a primary driving force behind many blogs, websites and other online web pages.

In the proposed mobile application content management system the goal is to allow the CMS to support images and text while allowing a drag and drop interface to move this content to its desired location on screen. This drag and drop will determine where the user can put their content

on the webpage. For example if the user has an image they wish to add to their website the content management system will provide areas that the block can be dragged and dropped into, this allows the content to be managed in chunks and for the user to visually design their web page while providing standard templates for the user to choose from, in the event the user wants to use stock images. Allowing the user to provide the option to use personalised images and upload and retrieve these from the database will be essential to allowing users freedom to create their own dynamic web pages.

At its most basic, the primary use of a content management system is to display information on a website in a user friendly and legible way. The content management systems can support various forms of data; text, video and images among them. A content management system is the difference between a web page that stores information stored in a database and a database driven website. This is done by creating a series of webpages with which access is restricted to certain users. These admin privileges allow a user to change details stored in the database in an easy manner.

In undertaking this project it was essential to design the content management system in a logical and structured manner to bring all different aspects of the system; such as the uploading of content to the database and the retrieval and layout of this content on the web page, into one concise user friendly layout giving the user a feel of a structured and complete web experience.

A content management system then is a system that controls the content of a website. Content can be categorized into two categories; Information which is the text, images and video displayed on the site, and the applications that actually display this information. The core difference is how the applications are managed versus how the information is handled. The difference between these is that while the information is

what is actually shown on screen, the applications are how this information is presented and the work that goes on in the background to drive the website and provide the user experience when they interact with the system. This can clearly be seen in the drag and drop functionality in the system. This is a prime example of an application which displays the content and presents it on screen, handling the information can be done by a user of the system whereby they can drag blocks of content obtained through the database to several pre-defined locations on the screen.

During the research period an in depth look into other content management systems such as WordPress was undertaken to come up with the project specifications. This gave a good background for what other content management systems were offering to their users and helped to zone in on what features the mobile application content management system would be offering as well as which features the system would not be implementing.

There are a plethora of advantages to using a content management system. Content will be still usable even as new platforms are created, this means that if a new technology is created and the user wishes to display their website on this device the same content can be applied to the new interface without having to rework the whole system. Content can be created once then stored in the database to be called and delivered anywhere and to any device whether this is in a different format the user still has access to the same core information. Content can be managed in chunks via a content management system. With the increased usage of mobile devices it is an important aspect to consider when designing web pages when 23 percent of total website traffic as of the fifth of November 2013 came from mobile devices. This shows a marked increase from 2012 with the increase being in the region of 63 percent [2]. Mobile systems are more becoming ever more pervasive and it is imperative that industry adapts to keep up with this marked change

in the way that users access information and data. The proposed content management system strives to do that with an interface designed with mobile end users in mind.

The goals which were set out in the autumn semester focused on creating most of the front end work done and to focus on the server and back end of the project in the spring semester. Creating most of the CSS and having this completed by the end of the autumn semester and have a clear layout for the user interface was imperative to giving a completed feel to the front end of the system. The CSS will provide the layout of the content management system, the presentation schematics written in html. The primary use of the CSS is to provide a distinction between document content and how that document is displayed on the webpage [3]. CSS provides substantially more control over content accessibility and readability within the content management system. A notable feature of CSS is to provide the same content to be presented differently on a given device; this is something which is important if the system were to be cross developed for use in a different end device or layout but not within the scope of this project.

The drag and drop feature was a major feature in the end design of the content management system. Implementing this in such a way that there are clear barriers and outline for where the content can be dragged and dropped to produce a clean and uncluttered webpage was the main challenge while giving the user a simple interface that would be pleasing on a mobile device. It was decided that several CSS layouts would be applied to allow for different types of potential content display windows (<divs>) whether this be a purely image based tile format or one in which text and images could be displayed or simply text.

The mobile application system used many software engineering practices such as version control which is discussed later in the report. This report contains several sections; Introduction containing an overview

of the subject area of content management systems and how it relates to the mobile application content management system, Background of the area and tools were used to create the project and an overview of existing systems in the content management industry, a Literature review exploring the various solutions and ideas in the area of content management , Specification and Design where the actual project design is reviewed and dissected, Discussion, a section where the merits and failing in the project are brought forward in addition to the challenges and learning outcomes, and finally a conclusion stating how the project went and any recommendations for future work.

Chapter 2: Analytical Background

The mobile application content management system will require the implementation of different elements to create the content management system as a whole. The content management system will require the use of CSS (cascading style sheets) HTML (Hyper-text mark-up language) PHP (Hypertext Preprocessor), JavaScript and SQL databases; which will be managed via PHPmyAdmin.

The PHP is a scripting language that was designed for use in developing web pages. It is widely used on webpages. The PHP is used to generate a webpage using a server. One of the advantages of PHP, particularly for the design of the CMS, is that the commands can be embedded directly into the HTML code, without having to provide a command calling an external file to process the data [4]. PHP will be the base on which the system is built and the means of accessing the underlying HTML through the localhost web server.

The HTML is the primary port of call for creating web pages which can be displayed through a browser window. The language is written using opening and closing tags which act similar to curly brackets such as those used in Java and C [5]. Within these tags designers can choose to add more tags, images and text. HTML is a fundamental component in webpage design and creating web pages, it allows the user to embed objects and provide interactive elements to a web page [6]. When developing a web page or a content management system HTML can be used in conjunction with CSS to change the layout of the elements described in the HTML, this is widely accepted as the best method of laying out HTML code and is encouraged by the World Wide Web Consortium the international standards for HTML and CSS [7].

CSS is used to present a page. Its primary function is to layout the web page's mark-up language in a legible and user friendly manner. While the HTML formats text and how it is displayed the CSS decides how theses blocks of content are displayed. It is concerned with things like layout and font. The benefits of CSS include improved access and displaying of content as well as consistency throughout the web pages. CSS offers a large amount of control over the presentation of the webpage and require multiple pages to adhere to the same layout giving the user a feeling of browsing a well put together website. One of the major benefits of CSS is its ability to display web pages differently on multiple platforms. This is especially beneficial for what I am hoping to achieve using a mobile interface which would be different to a desktop experience. It can also cater for differing screen sizes, which, given the wide variety of mobile screens on the market, is very beneficial. CSS also allows for major cross browser compatibility. The CSS can be stored in a separate .css document and linked to in style tags within the HTML or embedded within these tags in the HTML code [8].

Databases are a collection of content. SQL is a structured query language used to manage data held in a relational database management system [9]. SQL consists of a data definition language and a data manipulation language it allows you to access databases and modify contents. The database is managed via phpMyAdmin in the content management system. SQL offers the ability to execute queries against the database and in so doing retrieve or post information to this database. Creating new databases and tables is another aspect of SQL as well as handling the administration permissions of the SQL database and which users can access information [10].

Fundamentally speaking a content management system consists of two elements: the content management application (CMA) and the content delivery application (CDA). The CMA allows the content manager or author,

who may not know Hypertext Mark-up Language, to manage the content management aspects from a Web site without needing the expertise of someone who created the website itself and manages the creation, thus they can create pages, remove text boxes and otherwise manage content within the webpage [11]. They would be what I would consider to be the end user of my content management system. My project allows them to edit and create web pages without knowledge of HTML which can be extremely beneficial for business without a dedicated software development department. The CDA element uses and compiles that information to update the website; it is the publishing tool for the website [12].

Content management systems are available as installable applications and web-based user interfaces, this project will be concentrating on a web based design because it is preferable to use this type interface, as it simplifies the job of the website author. There can be multiple features offered in a CMS, having reviewed these a conclusion was reached about what features would and wouldn't be offered content management system. In the big content management systems some of the more widely used features are version control, web-based publishing, format management, security and indexing, search, and retrieval. These features were reviewed in making the decision for what features would be included in the mobile application content management system.

The revision control feature allows content to be updated or restored to another version. Revision control also allows the site administrator to view which user has accessed and edited the project. The Web-based publishing feature allows individuals to use a template or a set of templates approved by the organization, as well as wizards and other tools to create or modify Web content. The format management feature allows documents including legacy electronic documents and scanned paper documents to be formatted into HTML or Portable Document Format (PDF) for the Web site. An additional feature is indexing, search, and retrieval. A CMS system indexes all data within an organization. Individuals can then search for data using

keywords, which the CMS system retrieves. Security adhering to the OWASP Top 10 is of critical importance when considering a system which is accessible from the web. These system vulnerabilities can be exploited by malicious parties and can interfere with the system. The OWASP Top 10 offers a list of these security risks as well as the information to determine if the system at risk and if so how to counteract this vulnerability [13].

2.1 Existing Systems

2.1.1 Overview

This section explores the existing systems currently available in the content management industry as well as the features they offer. The purpose of this is to give a background into the other types of content management systems which are available and to look at their features to give the reader a sense of what is currently available and how this project expands on these ideas.

This section was also utilised originally in determining the route the project would take and an important step in deciding on features which would be include in the CMS.

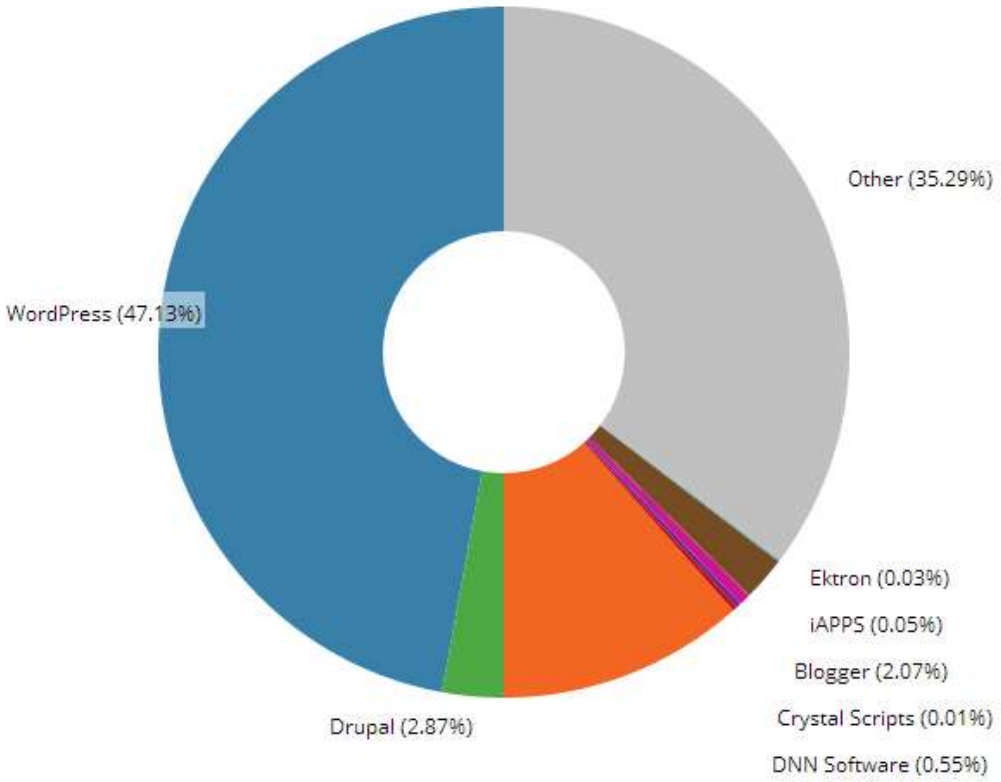

Figure 1

2.1.2 WordPress

WordPress is the most popular blogging system in use on the Web [14]. It is a content management system and makes it possible for those with websites to host their own blogging communities, as well as control and moderate all the blogs from a single dashboard. It is used to create blogs and powers 70 million websites. Aside from the blogging aspect it is also a very powerful content management system that allows its users to create their own websites from scratch. It is also open source; the community around WordPress create plugins, widgets and themes which allow for a fully customisable website [15].

Originally websites were created in HTML using their tags to format images text and other content. WordPress allows its users to use their "web based editor" to create web pages without the need to use HTML making it an ideal tool for users without a large amount of analytical background. WordPress is based on MySQL and PHP which are an industry standard [16]. The use of PHP and MySQL means that WordPress is capable of running on any modern web server. One of the huge benefits of WordPress is its user friendly interface. This means there is no need for a webmaster, which in turn means that the user does not need to contact anyone if they wish to make a small change to their content [17]. Some of the plugins offered by WordPress include polls and forums. WordPress sites are optimized for search engines which allow the site to be easily visible. This can be extremely beneficial to users as their site will be much easier found.

Figure 2

WordPress allows imports of content/data from other systems; exporting content away from WordPress is another feature. This gives the user full control over their site and their content.

Some of the interesting aspects of WordPress's service are its use of PHP and MySQL. Given the task of creating a content management system this is very beneficial as PHP and MySQL are industry standards and thus easily portable to other systems if needs be, this would be a beneficial addition to the proposed content management system.

WordPress's use of a web based editor as opposed to a downloadable program is a feature which was decided on to be the basis of the projects user interface as opposed to a program and this is less cumbersome for the user and in keeping with the lightweight design the project is hoping to achieve by having the user utilise all content management capabilities within their browser.

The purpose of the content management system is to provide non tech savvy users to create and edit their own web pages quickly, easily and without the need for a webmaster. Therefore as with WordPress, it is imperative to provide a friendly and easy to use interface within the mobile application content management system for the user. This is something

which will be included in the proposed project, a clean and uncluttered user interface will allow for an overall better dynamic to the web pages.

2.1.3 Drupal

Another popular content management system available on the market is Drupal. Drupal is an application used to organise and update websites. Drupal also allows users to build other applications with it. Like WordPress it is also open source and maintained by a large community of freelance developers [18]. Drupal is similar to WordPress in that it is also written in PHP and used as the basis of just over 2% of all websites worldwide (Figure 1). At its most basic, the features it boasts are user account registration and maintenance, menu management, page layout customization, organisation and finding, RSS feeds and system administration [19].

Drupal have implemented many improvements to their system, notably on the administrator and visitor end of Drupal. These include, but are not limited to, drag and drop functionality, colour contrast, default labels and fixing CSS display. A big part of the proposed content management system is drag and drop functionality. This will enable users to visually design sites and move blocks of text and other content. This gives instant feedback to the user in how the webpage will be laid out and an extremely intuitive user interface.

The drag and drop functionality is a proposed major feature of the content management system which will require the use of JavaScript in order to work correctly and function without issue, it is one of the major proposed components of the content management system. One of the issues with users regarding Drupal is the ease of use of the site [20]. They claim that there is a steep learning curve with regards to modules having overlapping functionality which can be difficult to master in order to effectively use their system. This is something that was considered when creating the initial project proposal in the hopes that this would not be an issue in the content management system.

Drupal is module based, this means that instead of having to write code for each and every page the modules have most of the needed functionality

immediately. This means there is a standard layout for things like “contact us” and “shopping cart” pages or other universal website aspects. This saves users time and money by not having to recreate standard page templates that already exist [18].

Another big feature in the proposed content management system is template pages for reusable content. Once the template is changed to update the colours, design, or navigational layout, all of the site's pages will be updated. This will provide a uniform feel to all of the sites pages, this has a lot of advantages over websites where changing the design meant redesign of the entire website itself. The separation of content and design allows easy change to the website without a huge overhaul or downtime on the site. Both Drupal and WordPress offer these templates and it is something which was implemented in the proposed CMS in the form of standard images within the database for the user to choose from.

Figure 3

2.1.4 Joomla!

The third content management researched was Joomla. Joomla is another CMS platform that has been downloaded 30,000,000 times [21]. It claims to be the only non-corporate backed community driven CMS. Joomla uses object oriented programming standards and a model view controller. Joomla has extensions available to expand the features offered in their CMS. Just fewer than three percent of all websites on the internet run Joomla based CMS's.

Joomla stores data using MySQL databases similar to Drupal and WordPress. The features it offers are RSS feeds, printable versions of web pages, news flashes and support for language internationalization. Joomla offers templates as well and are responsible for the layout, design and structure of their websites. The content is separate to the template so any changes made to the template will not affect the content. The template is where the layout is created and edited and Joomla offers users the ability to add even more customization to these templates [22].

Figure 4

Joomla, being open source also has many community created extensions to add more functionality to the CMS. These extensions fall under five categories in Joomla; Component, these are mini applications that have a site part and administrator part. This makes them large and quite complex.

Plugins, these are event handlers within the CMS. Templates, as discussed previously allow users to change the look of the site and keep these changes uniform across pages. Modules render pages quickly and they are linked to components to display content. Languages, these are quite simple while language and font information can also be used for PDF or PSD to Joomla conversions.

Chapter 3: System Architecture and Specification

3.1 System Architecture

The problem with existing content management systems today is that mobile is seen as an addition to the main mobile sites and is designed as such. This content management system aims to have an interface designed for mobile from the ground up to create, store and manage content in a manner designed for mobile systems primarily. The current systems see mobile as an addition to full web pages rather than its own entity which is an oversight considering the growth of mobile devices as a primary means of content consumption [14].

This project was chosen due to the importance of this kind of system given the market growth and directionality. It is imperative that content management systems adapt to the changing user requirements in order to continue experiencing the growth in websites adopting a content management approach to creating their web pages it has become accustomed to.

The aims of this project and report are to explore the content management systems currently available and serving a niche in the market for a mobile system and allowing users or developers of this system the ability to drag and drop content to specified locations on a mobile screen, upload and retrieve content from a database and choose layouts for this content whether it be textual or image based.

In this project there has been an assumed screen size for the mobile device but this could be changed to adapt to multiple systems and screen sizes. The project has been designed on the assumption that the content management systems created is to be used primarily for a music blog type interface however this is for viewing purposes, it is also a potential solution to any other types of similar mobile applications. The choice of a music blog type layout provides a more clear understanding of the system as a complete interface than using lorem ipsum placeholder text and stock images.

3.2 Software Engineering Concepts

In developing the content management system many different software engineering aspects were used such as design patterns, MVC and version control.

Design patterns are general reusable solutions to a commonly occurring problem in software design [23]. These design patterns are an imperative part of any software based problem.

MVC or model view controller design patterns are ideal for creating user interfaces. MVC was chosen as the design pattern as it is beneficial to code creation of the user interface where this project is primarily based. MVC was originally developed for desktop applications however have since become the de facto standard for web development [24]. This type of design helps to separate concerns in web development. It splits up responsibilities to gather, store and display data from a web page into separate objects similar to the exact specification of a content management system.

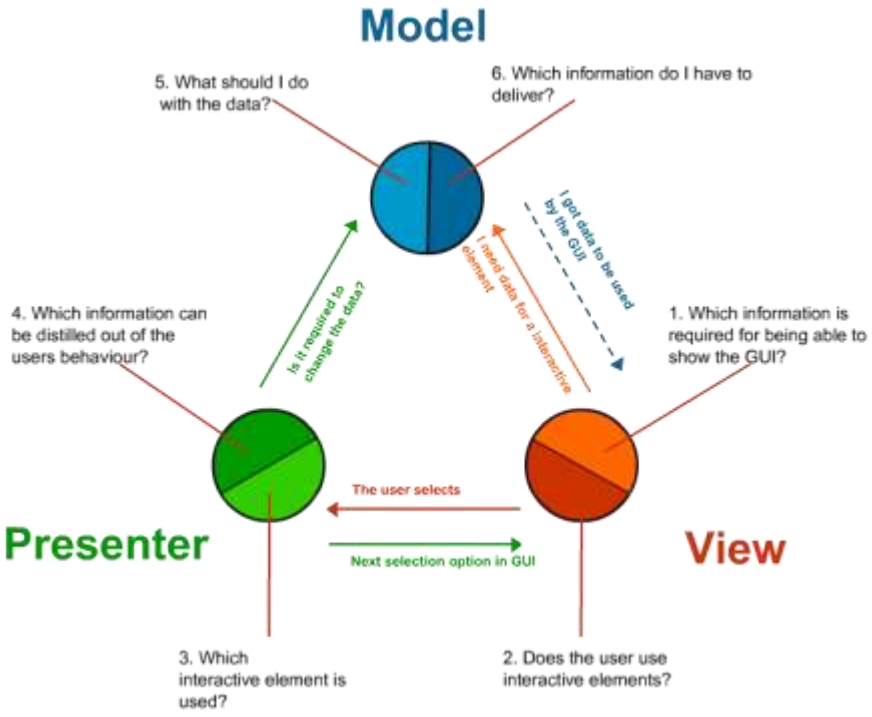

Figure 5

Version control is management of changes made to a program [25]. It is used to manage many different versions of computer files. It allows users to lock files and also track changes to these files and also allowing them to be edited by one person at a time. It is also widely used in the software engineering industry due to its nature as a team based software development tool. If a project is modified and an addition has caused the project to crash it is possible to access a previous working version of the project so that functionality is not lost as new functionality is created.

Chapter 4: Literature Review

In this literature review the aim is to review the various articles surrounding content management systems and related topics by looking into various content management system solutions and the surrounding literature to glean an insight into the topic. The review will look at different reports and systems and work through the different features they offer, their user interface and the journals take on content management systems and where they can go from there. In addition the various tools used in the area of content management particularly those of interest to the content management system were reviewed and explored how these tools are utilised in these systems. The objective of this review is to assist the understanding in creating a content management system and provide background knowledge of existing systems and their features while also exploring how they work and where the potential areas of advancement for these systems lie.

The following studies have been chosen based on their relevance to the content management system. It should also be noted that due to the nature of the development of content management systems there are not a huge amount of studies in this area due to the nature of patents in order for various ideas to be protected. During the literature review phase these patents were explored in order to see where the systems were going in the future and what it is possible to expect in terms of future development. This can be seen in section 4.2.

4.1 Explanation of Reviewed Work

4.1.1 Design and Development of Real-Time Communication Content Management System for E-Commerce

E-commerce is extremely efficient but requires substantial technical expertise to implement. This article looks at the existing infrastructures in place to cope with this. These content management systems lack real time communication. It is proposed to design a content management system for e-commerce based on real time communication and using instant messaging [26].

When researching this paper one of the important aspects of it were its core principle of adding content management functionality to an industry (e-commerce) where it was typically lacking. This drew parallels to the proposed content management system which involves supporting a niche market. While the mobile industry is not as much of a niche as e-commerce it still drew many favourable comparisons.

4.1.2 Application of Digital Content Management System Based on Data Warehouse and Data Mining Technology

This article looks at the importance of preservation of digital content. The paper looks at the digital content data model and also proposed a 7 layer reference model of digital content. It proposes use of data mining techniques to under data layer data extraction, comparison, analysis, and selectively format digital information for maintenance and preservation [27].

When researching the content management topic this study was chosen due to its look at content preservation. This paper was interesting in that it proposed a potential solution to the problem of content preservation as more and more content becomes available. It also makes the staggering claim that the data created in 2011 alone if printed into books and laid side by side would be ten times the distance from Earth to Pluto. This study did not ultimately shape the course of the FYP but did provide an interesting and very relevant insight into some of the issues in content management.

4.1.3 The Analysis and Design of the Content Management System based on J2EE

This paper explores the function design, structure framework design, content management becoming the standard for web applications, and also detailed design of a content management system. The uses of content management systems that this article looks at are those in e-government, enterprise information and comprehensive websites [28].

This study is similar to the FYP in that it is concerned with the storage and retrieval of content from a database to be displayed. This system also focuses on a specific area, similar to mobile applications in this project and the paper looks at creating a content management system. This was very beneficial in the approach.

4.1.4 Drupal Content Management System on Mobile Phone

This study is concerned with the use of an existing content management system, Drupal which is reviewed in the background analysis section of the report (section 2.1.2) and how it can be used on a web page which is running on a portable device. It is designed to allow users to create a web design to their mobile. It is created so as to make use of the normal functionality offered on Drupal within the confines of a mobile web page [1].

This study was beneficial to the FYP due to its focus on mobile the same as in the mobile application content management system. This study directed the area in which the project was to proceed and was a major factor in research especially since Drupal had been covered previously in section 2.1.3.

4.2 Overview of Patents

4.2.1 System and methods for managing content in pre-existing mobile applications

A patent for the distribution and retrieval of data (content management) and then utilising control logic to display this content in mobile applications which are currently available and on the market. The patent is for the analysation of data and the system to decide on a placement for this data based on the system specifications and the content type. This patent is geared towards advertising and is designed to fit into mobile applications while potentially changing the application to support the content while there would be a portal application to handle communications between device and server to retrieve the advertising content [29].

4.2.2 Offline viewing of internet content with a mobile device

This patent is concerned with the display of content offline from a host server to the mobile device by connecting the mobile device to the server and allowing it to access the hardware and software capabilities of the device. The content is then pulled from the host server onto the mobile device under the criteria specified when the server accessed the hardware and software capabilities of the mobile device [30].

4.3 Overview of Literature Studied

From what was researched in the journals and papers which were primarily hosted on IEEE mainly and in addition to others hosted on Google scholar and other databases, there is plenty of supporting documentation in the area of content management. This, in addition to the case studies and patent review, was very beneficial in getting an insight into what is being done in the area of content management today. This information was useful to an extent in researching these quite high level designs it gave a good understanding of the base systems under these modifications. The core systems gave some idea as to the route the project would take and what would be included and excluded from the content management system.

Generally the papers in the area of content management were of quite a high level and were more to do with modifications to existing systems than new ideas for content management systems from an original developmental aspect and due to this they were not overly helpful in determining ideas however as observed above the core systems on which these systems were to be built were of some benefit to the decision making process regarding the project.

4.4 Conclusions from Literature

During the literature review both good and bad elements were observed. Some of the information was not overly relevant to the FYP but did help with giving a deeper understanding of content management systems and their various uses and abilities should this project be taken further in the future. The most useful review of supporting literature and patents was found in looking at the content management systems described in section 2 above.

The actual industrial applications were the most useful as these had features and were not simply an addition to a system as was observed primarily in the literature review. These industrial solutions (WordPress, Drupal, Joomla) ultimately lead to the decision as to which features would be included in the content management system due to their real world uses and the practical aspects of these systems.

The individual studies and patents were beneficial in some ways but not so much in others. The most beneficial and noteworthy was the Drupal content management system on mobile as this directly referenced the work which was being done in the mobile application content management system.

From the studies, while enormously beneficial in determining what was being done in the content management field, they were primarily of a high level and focused on systems being developed on top of existing infrastructure with some exceptions. Due to this the primary factors in deciding the course of the FYP were those systems studied in the background study and exploration of different content management capabilities they offered.

The literature review is an important aspect of the report if only to see where the potential for growth in the industry is headed and how the proposed system can fit in to this expansion of knowledge within this area.

Chapter 5: Implementation

5.1 Overview

This section of the report is concerned with the development of the content management system. This section will be split into three subsections; Front End Development, Back End Server Side Development and Overall System Design.

The front end development will be concerned with the development of the HTML code and the PHP used to generate this HTML as well as the CSS and JavaScript required in order to create a good user experience with this content management system.

The back end server side development will explore what was required to communicate with the server from the PHP code and in what way the content is added and managed within the database using SQL to provide queries pertaining to the addition and retrieval of data from this database.

The overall system design will look at how the front and back end communicate to create an easy to use interface to provide the functionality discussed in section **5.4** to allow the functionality outlined in the back end to work with the front end to give the user a seamless and hopefully easy means of accessing and storing their data within this server without the need for an understanding of SQL commands or data storage and retrieval from a database by using a simple and intuitive user interface.

5.2 Front End Development

The front end of the content management system provides the user interface and how the user uses the tools provided to interact with the system. In the content management system the objective was to provide a simple and uniform feel to the web pages within the site making it easily navigable and intuitive to understand. The front end of the content management system is the user interface or what the user can do with the system. In this section of the report the nature of the front end will be discussed including but not limited to; user experience and the options they have as regards tools and capabilities of the content management system.

Figure 6

The welcome page (figure 6) is designed to be uncluttered and simple for a new user to decide what they would like to do whether that be uploading images or text to the database or choosing a layout with which to manage content the options are all presented in a readable way. There are further options contained within each page on the site and these will be discussed in detail.

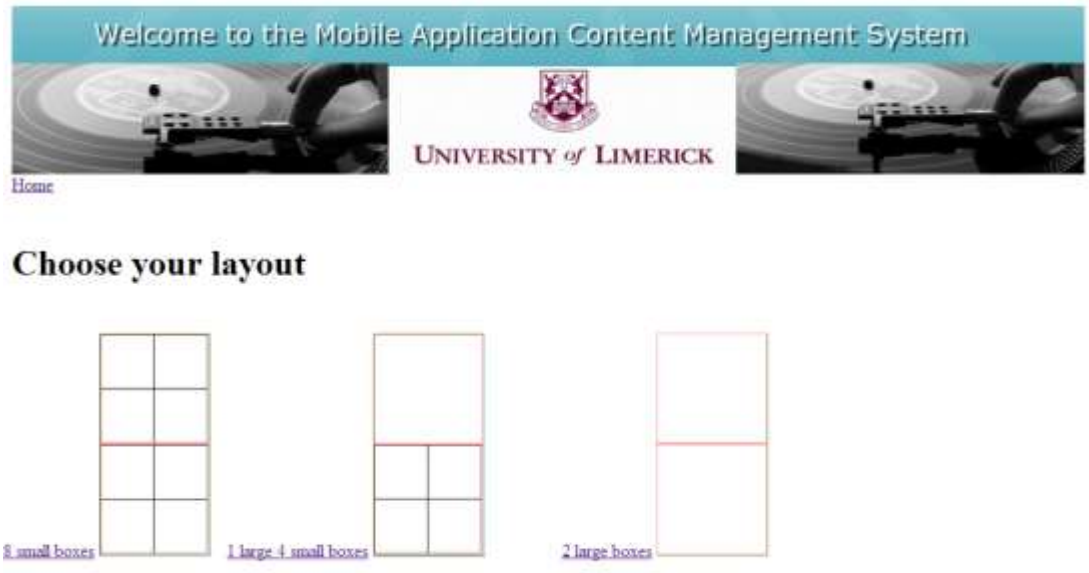

Figure 7

The header image is standard throughout the different pages on the website (figure 7-8) giving a familiar environment and allowing the user to get a sense that the project is a complete and standardised website and finding it easily navigable in order to return to the home page or deciding what option they want to utilise.

In order to design this user interface it was important to make it visual as well as textual because the ease of use was an important factor. In addition, the visual web design aspects reflect the ability offered in the content management system to perform the desired tasks to an acceptable standard, it also conveys to the user that the system is created by someone with the know how to create their own web page. This is of particular importance given the nature of the project being one of website design albeit the design of mobile applications. None the less it is essential that the page look professional. This was attempted in the inclusion of images as to what different layouts etc. are offered by the system before actually clicking into these links (figure 7). The web page is rather bare boned currently but while not looking massively impressive it does have a lot of content management capability.

The front end content management aspects can be seen within these layout features which allow the user to drag their content throughout the screen to

designated locations. These locations are marked in the content editor window so the user can see the borders and constraints of the system. This gives the user immediate visual feedback of how the content will be laid out on the screen of their mobile device.

There are also several other options on the home screen. The options for database usage allow users to query the database without the use of SQL queries using a simple user interface. This was designed so as to mitigate any high level knowledge required to query the database and allow non tech savvy users to use the system as this is who it was primarily designed for. It is split into two sections, one for blog or bio entries and the other for images which are stored as blob types in the database.

The text section was designed to allow the user to enter a value for the band name and then a short bio about this band as seen in figure 8 below.

Figure 8

When submitted the HTML page redirects to another PHP form to query the database. This php page contains a database connection file which allows the user to connect to the database giving them write access to the database. The page then takes the query entered from the php page previous and inputs this data into a table

in the database under the defined heading of title and article. There is also the option to expand this input field to include other criteria which can already be seen in the database such as the option for embedded video (figure 9) but which was ultimately outside the scope of this project.

id	author	date	title	subtitle	article	video
1	Cian	2014-03-05 21:53:38	Arctic Monkeys	Bio	Arctic Monkeys are an English indie rock band form...	<iframe width="560" height="315" src="//www.youtube.com/embed/7i2gb3dJ6ik" f allowfullscreen></iframe>
2	Cian	2014-03-05 21:53:38	The Strokes	Bio	The Strokes are an American rock band formed in Ne...	<iframe width="420" height="315" src="//www.youtube.com/embed/b8-tXG8KrWs frameborder="0" allowfullscreen></iframe>

Figure 9

This data is then retrievable and displayable within the confines of the content management system from the database using the user inputted band name. When the user enters the submit button the screen refreshes to display “Form Submitted!” or other error messages depending on the outcome.

There is also the option for images to be uploaded to the database. This is again done through the use of HTML forms which redirect to php pages containing SQL database queries. The form creates a pop up window to allow the user to navigate to a location on their system and upload their desired image.

Figure 10

In the case of image uploading there is also error detection in the case that the user attempts to upload something that isn't an image the form will display that what the user attempted to upload is not the correct file type similar to the text uploader success or failure displays on upload to the database (figure 11).

Figure 11

Retrieving image content from the database is a challenging problem, currently this is still being worked on to be perfected, it is easier to drag images which have been stored locally however when retrieving images stored as BLOB types from the database these images have to be converted to base64 in order to be displayed as an image rather than random text (figure 12 below). This has been achieved but requires some finalisation which will be completed by the project presentation.

```
echo "<img src=\"" . base64_encode( $row['image'] ) . "alt=\"image2\" id=\"image2\" height=\"250
width=\"250px\" draggable=\"true\" ondragstart=\"drag(event)\"/>";
```

Figure 12

The inclusion of this will allow a user to choose the images they would like to be displayed in the boxes at the bottom of the layout screen which can be seen further ahead in figure 13.

The actual content management system layouts were implemented and displayed using CSS. The use of CSS allowed the design to be more visually based by formatting the boxes in the desired layout than by use of standard HTML without CSS and this allowed the layouts page to be more graphically oriented and to create a friendlier user interface. The various layouts for content were created using CSS (figure 11) as well as numerous other things on the web page.

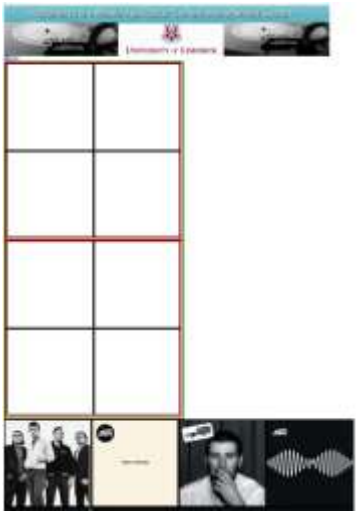

Figure 13

The boxes shown in figure 11 were colour coded based on their type in order to easily identify them when modifying the CSS. There are several different layouts for these boxes however in figure 11 the content boxes are arranged in such a way as to allow for easy readability on a mobile device. This layout in particular was designed primarily as an image based grid whereas others have greater support for text than this primarily image based model.

The content is draggable to any of these boxes. This is achieved by the use of JavaScript. This portion of the project was a big task as it required the designation of images to be treated as a draggable item and in allowing the boxes to be an area where content is able to be dragged to. This was achieved through a series of standard JavaScript commands. These include defining boundaries of where content

can be dragged and dropped and assigning which items can be dragged and dropped.

Figure 14

Using JavaScript it was possible to move various images throughout the screen giving the user immediate feedback of how their page would look. This can be seen in figure 15 below. The bar at the bottom containing the images is simply an area to drag the content stored in the database from to be displayed in any desired box on the sample mobile screen, whether this is user defined or stock images depending on what has been uploaded to the database by the user as discussed above.

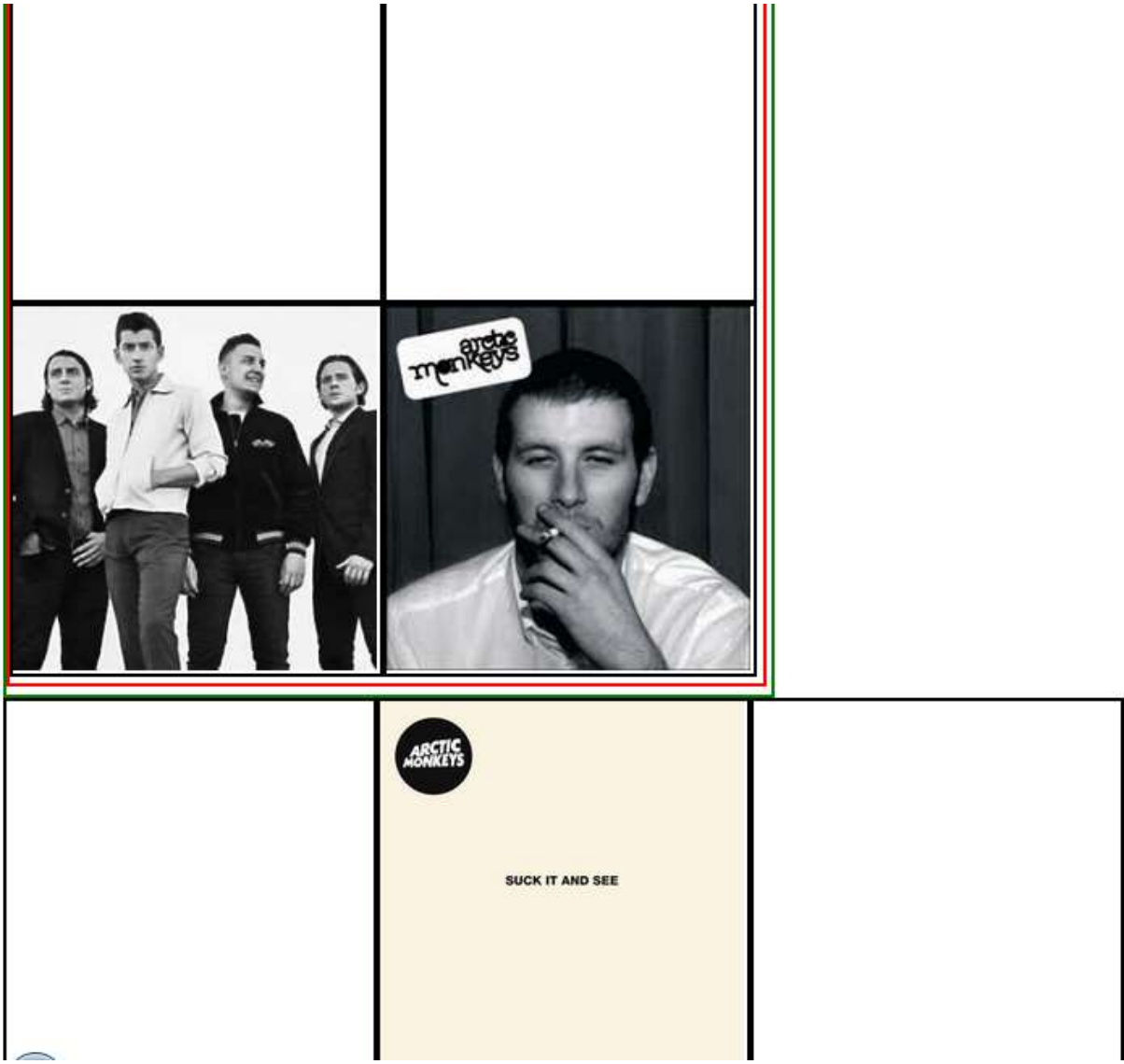

Figure 15

5.3 Back End Development

The back end of the content management system provides the server and database from which content is taken and stored through the use of PHP code and in what way the content is added and managed within the database using SQL to provide queries pertaining to the addition and retrieval of data from those database tables.

Within the content management system data retrieval is the key to making the system a success. The basis from which the CMS is built on is in retrieving content from the database and displaying the content. How the content is displayed was discussed in **5.3** Front End Development this section is concerned with how that content is stored and retrieved.

The primary means of communicating with the database was through SQL commands in the PHP. These commands formed the basis for user queries on top of which of the forms were implemented. The user would enter their information into the box as shown in figure 16. The SQL query would then be generated in order to decide what content to retrieve from the database. This was done by assigning SQL variable names to each of the fields inputted/chosen by the user. The SQL would then generate a query based on this whereby it would select all information from the database under the category (title) selected by the user.

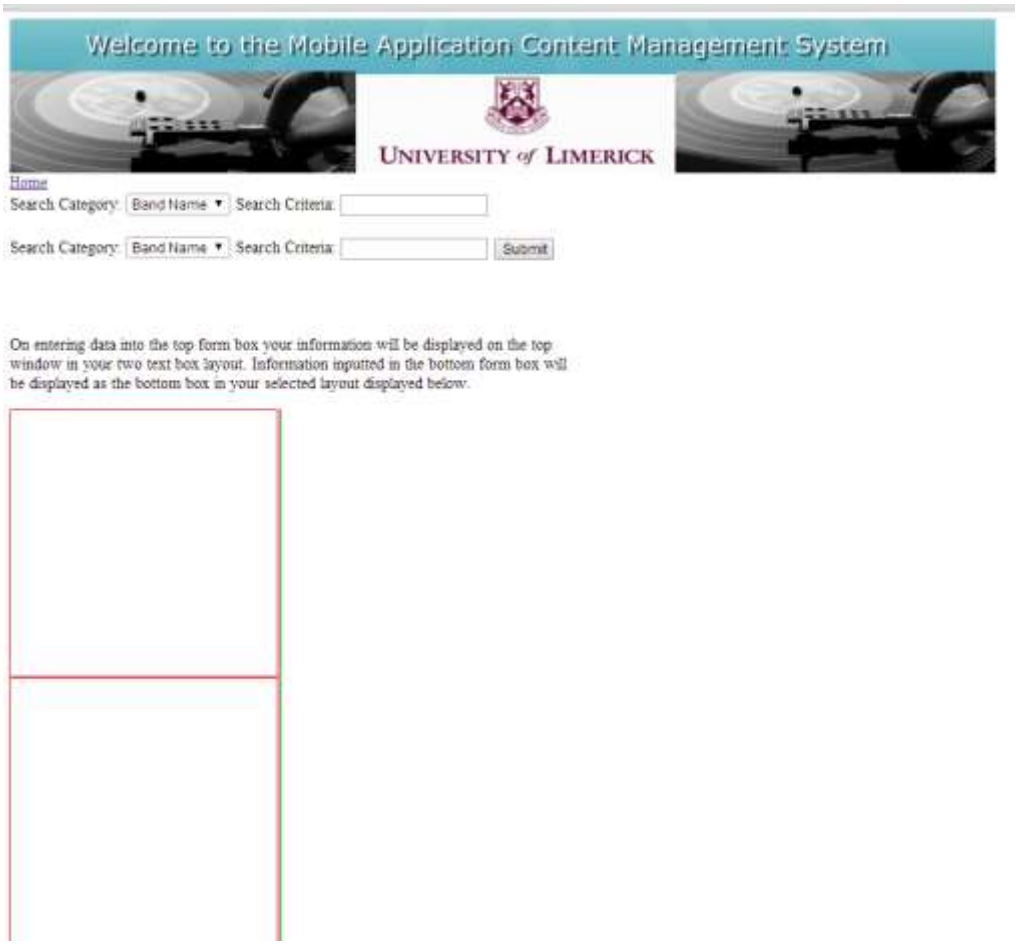

Figure 16

This information would then be displayed textually in one of the text based layouts which the user can choose from on the select layout page. There is also error detection where the user will be informed of a failure to retrieve information from the database by way of an error message outputted in the browser window (figure 17).

Figure 17

The text based content retrieved from the database is shown using the two large text box layout as an example (figure 17). This content entered by the user as in figure 18 describes how the content is to be laid out in the text based divs in the HTML.

The image bar at the bottom of the layout page was included here also even though it is primarily text based. This is in the event the user wishes to only select one blog entry and would still like the option to access image based data and include that in the empty div generated by the form inputting a NULL value which has been set to a valid option in the database for a situation arising similar to as described above.

Originally it was hoped that these divs could be made draggable similar to what was achieved with the images. However this resulted in problems and as such was left out of the final draft. This is discussed in more detail in **Recommendations for Future Work.**

The layout of this content is displayed in the same manner it is inputted i.e. the top user input form populates the top div and the bottom user input form populates the bottom div (figure 18-19).

Figure 18

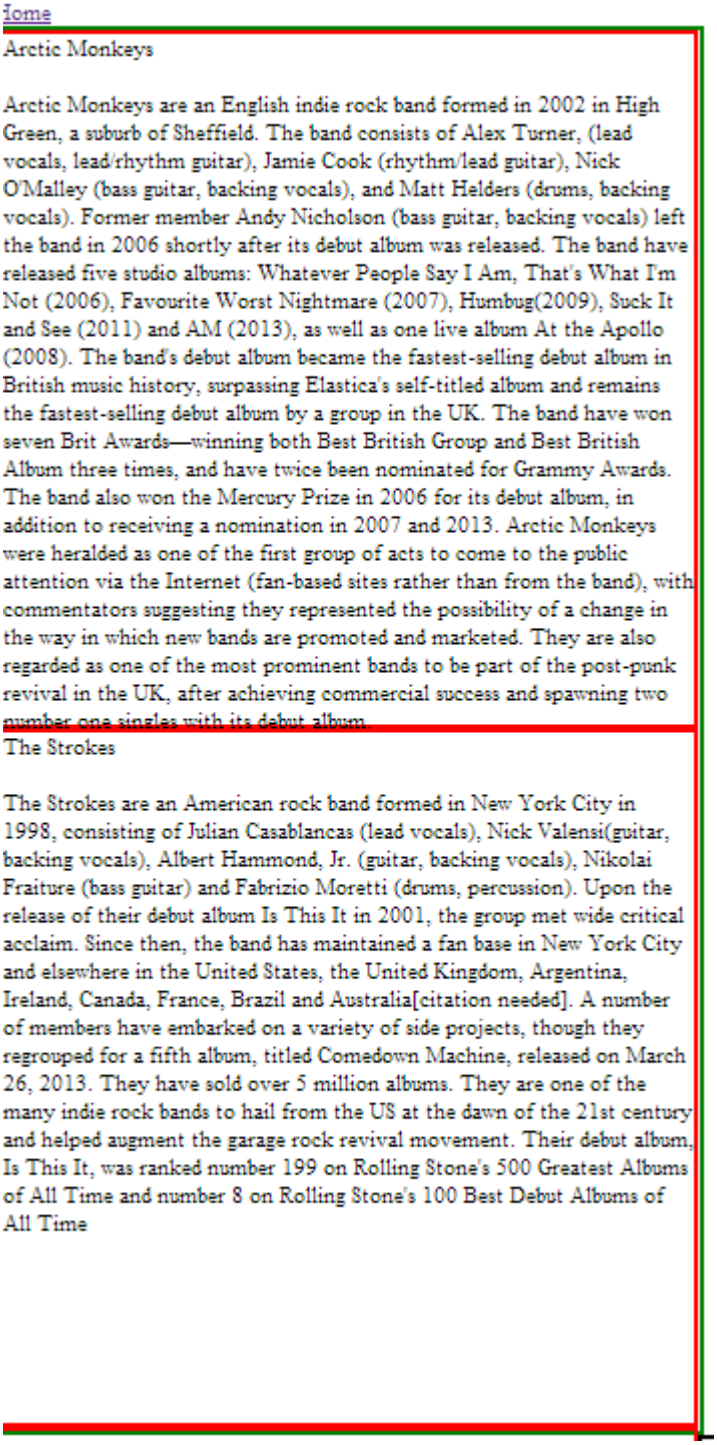

Figure 19

The back end also operates similarly in the retrieval and storage of images from the database. The images are stored in a separate table to the blog entries dedicated to images. This table hosts the images in blob format. Originally an alternate approach was considered to retrieval of images from the database. This

approach consisted of storing the images in a local folder for the user to choose from. This was scrapped due to the lack of portability of such a system should the user wish to modify their content on their web page from a different device.

	id	name	image
Edit Copy Delete	1	Arcitc Monkeys	[BLOB - 17 KiB]
Edit Copy Delete	2	whatever	[BLOB - 5.6 KiB]
Edit Copy Delete	3	suckit	[BLOB - 23.5 KiB]
Edit Copy Delete	4	favworst	[BLOB - 7.2 KiB]
Edit Copy Delete	5	humbug	[BLOB - 6.4 KiB]

Figure 20

These images can be retrieved in a similar manner to the textual content and displayed in draggable form so they can be easily manipulated, dragged and dropped in the specified locations on screen as outlined in Section **5.2 Front End Development**.

5.4 Overall System Design

The overall system functions as it was originally specified however there is some functionality missing as time constraints became an issue as the project neared completion, this is down in part to a failure to allow the time required for these sections as it became more obvious that the work involved in these aspects was greatly increased. These issues are discussed more in chapter 7 and recommendations for further work in the area are also provided.

Overall the website in which the system design is housed while quite bare boned in terms of visual aspects of a typical website it features most of the intended functionality. The content management works well in allowing users to retrieve and store content in the database. The page layouts option utilising JavaScript to drag and drop content is to a standard that was specified in the original outlines however the lack of functionality in saving this layout to a database to be retrieved by the underlying android layer is disappointing and again is discussed in more detail in chapter 7.

Chapter 6: Discussion

6.1 Overview

The aim of this chapter is to look at what was presented in the previous chapters under two sections; Learning and Challenges provided. The learning section discusses what was learned while completing this project. ***The software engineering concepts section mentions the concepts which were utilised in the creation of this project and the planning and implementation of the CMS.*** The challenges section discusses the challenges during the completion of the project and what was done regarding them whether they were overcome or otherwise.

6.2 Learning

The purpose of a final year project is to challenge a student in the area of their course in a manner that they learn a plethora of different skills pertaining to their industry and also to provide them with the key skills needed in order to create and implement a large project undertaking from start to finish.

In the introduction it was specified that many websites are created using content management systems and that their purpose was to build and modify a webpage. This section specified the areas in which learning would be required in order to complete the project. The content management system provided an opportunity to become familiarised in areas such as PHP and HTML web development, JavaScript and SQL queries, among others.

This project imparted an understanding of what is required in creating both a web page and a content management system while using logical thinking to solve problems and come up with solutions to issues which may arise in the course of the project. Some of the major learning opportunities came in the form of learning PHP, SQL, HTML, CSS and JavaScript. These are areas which were not part of the curriculum for Computer Engineering. However the strong analytical background gained from the degree coupled with knowledge of other programming languages allowed these other languages/scripting languages etc. to be overcome.

In order to learn these various programming languages codeacademy.com was an invaluable source of information. The tutorials hosted on this site gave the groundwork needed to understand and write these languages. There are some inherent differences from other programming languages such as the use of tags but after enough time and tutorials these differences were overcome and the programming languages started to be more easily understood.

In addition to learning these programming languages it was also a challenge to learn how these languages interact together. This is an important area as the real key to these languages is their ability to use one another to create a seamless web experience. Web development was a big learning aspect of this project having not been discovered prior to the final year of computer engineering.

6.3 Challenges

This was quite a challenging project. There were several obstacles overcome in many different aspects. There were also changes required and not all areas of the project were completed as much as would have been hoped.

One of the major challenges was the creation of draggable and droppable content throughout the screen and designating areas on the screen for this content to be dragged into. A lot of time was spent researching various methods to solve this and apply it to the content management system. This challenge was overcome and solved in the form of image based files and work is still ongoing regarding the text based content.

Another challenge was met in querying the database. Adding and retrieving files from a database in and of itself is not of huge difficulty however this became more difficult when changing user inputted variables became apparent. This meant the SQL would have to be adapted to allow user inputted data to specify which data would be retrieved and then display where on the web page this data would be outputted to. This was another issue; the data would have to be outputted through echo commands in the PHP which were in turn embedded within while statements to only output this data if the conditions specified were met as opposed to simply outputting it through html.

The actual saving of the HTML page generated by the dragging and dropping of user content became a large issue and one which was not possible to overcome in the manner originally intended.

Overall this project was a challenging and rewarding one while testing engineering skills and also providing an opportunity to learn a great deal about not only web development but about the content management industry which is only set to continue to rise in popularity die to the ever more widespread use of the internet and the number of websites being created to facilitate this need.

Chapter 7: Conclusion

7.1 Summary

The huge increase in mobile device use for web browsing coupled with the spread of internet has made the mobile content management system market a booming industry. The potential for mobile application development is an extremely important topic given the rise of mobile devices as well as these devices becoming the primary means of accessing content.

The most important aspect of the content management system is the ability to store this data on a server and then retrieve and manipulate this content. In that sense the project was a success however the storage of this layout is an ongoing issue and something which will have to be continued and indeed is still being worked on. This is the biggest weakness that can be seen in the system but does leave room for potential expansion and wider and more viable options than the one currently being pursued to better display and present the content hosted in the database.

7.2 Suggestions for Further Work

Despite some of the goals for this final year project being reached there were also those which did not manage to be completed such as the layout defined by the user being saved to be generated on the mobile device. This is still actively being pursued by saving the image and text locations to a database which are mapped to a location depending on first, the text layout and second, the occupied divs containing content. There are more elegant solutions to this which due to time constraints are outside of the scope of this project but which if this report were to be taken further would be a viable option for displaying this content on the mobile device.

Another suggestion to be made is the ability for content to span multiple boxes. This could make use of differing content sizes and allow text to span multiple boxes while at the same time allowing images to be split based on the smaller boxes that this text may span. It makes the available space more dynamic and would give the user more options.

My final recommendation is also something which is being worked on currently and that is allowing the divs containing text to be draggable to other locations. The current constraints on this lie in the target div and content divs size. They are of the same size because they are the same box type. The solution to dragging the images was in allowing the image to fit into one of these boxes. With text the div containing it must be selected and as this is the same size as the target div which is defined in the CSS therefore the content containing div is too big to be hosted within the target div.

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