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# Job Portal Using CakePHP Framework

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## Abstract

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<p>The goal of this master's thesis was to design a user-friendly web application that is easy to use for jobseekers and employers. The goal of this research and project was to create a new web based job portal where users and companies do not necessarily register or login before they can use the services.</p> <p>The application was developed using web techniques including easy to use web interface for providing flexibility to the end users. The frontend system was built by using HTML, CSS, JavaScript and Bootstrap, and for backend programming PHP and MySQL were used. For giving flexibility and smoothness in the development phase, CakePHP framework was adopted providing the set of libraries and classes to make life easy.</p> <p>The development of the portal involved the agile methodology that reduces deliver risks, increases competitiveness and gives flexibility to get a quality product.</p> <p>Testing was carried out in different phases of the application development to achieve the required goals. The user management, the responsiveness of the webpages and the behavior on different devices was tested and the results were positive in respect to the set goal.</p>	
Keywords	PHP, CakePHP, MVC, JavaScript, HTML, Bootstrap, MySQL

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## Terms and Abbreviations

HTML	Hypertext Markup language
CSS	Cascading style sheet
PHP	Hypertext preprocessor
SQL	Structured Query language
UI	User Interface
CGI	Common Gateway Interface
URL	Universal Resource Locator
MAMP	Macintosh, Apache, MySQL and PHP
MVC	Model-View-Controller
MPPT	Modified Pre-order Tree Traversal
WBIS	Web-based Information Systems
CRUD	Create, read, update and delete

## 1 Introduction

A job portal, also known as a career portal is a modern name for an online job board offering a broad range of jobs and providing employers in their quest to locate ideal candidates. Job portals offer a broad range of jobs in a vast number of fields. Government agencies, private businesses, universities and non-profit organizations have their own open job vacancies posts which can be accessed on the organization's website, but it does not fulfill both the employer's and job seeker's requirements completely. Most companies waste their valuable time and resources trying to find the right candidates.

This master's thesis describes the process of building a new online web based job portal that targets the job seekers by providing a service for searching a new job opportunity for finding a right and satisfactory job as per their qualification, and also provides facility to the companies for posting their job advertisements to search for a suitable candidate. This job portal acts as a recruitment system for companies, agencies and freelancers for fulfilling their manpower needs. It also provides a bridge between job seekers and companies.

The proposed system helps the job seekers to find a new job of their choice in the location they want. Job seekers and employers do not need to login before using the services.

### 1.1 Background Information

Job searching and job posting is a practice to find out a suitable candidate for the right position. After the endless development of Internet and IT facilities most of the companies have an online recruitment system. There are much more jobs available in the market when compared to the past few years, there are all kind of jobs under several categories in various skills levels and several private, government industries.

Unemployment is one of the serious social issues faced by both developing and developed countries. For example, in Europe the rate of unemployment has been increasing rapidly since 1970's. One of the reasons for this problem is unfair distribution or lack of

information on job opportunities so people do not know of the new job vacancies. An efficient search of the Internet might help jobseekers in their job hunting [39].

## 1.2 Technology Problem

Most of the job search portals available online in the market have been developed in the way that users need to register or login before accessing any kind of service, for example to apply for a position or post a new job advertisement, users need to provide their credentials. Many people do not wish to share their personal information so they are reluctant to apply where the system needs to get their personal information.

## 1.3 Research and Outcome

The objective of the thesis was to develop a web application that provides a common platform for job seekers and companies. The job seekers can search for a job according to their qualification and they can also apply directly without the need of login. The job portal is a combination of different components such as graphics, scripts, text files and images. The interface is very easy to use for all users providing more flexibility to the users to use the services as they want.

This job portal has three main entities:

- Job seeker module
- Employer module
- Administrator module

Candidates can register themselves, modify their details, search and apply for the jobs. Candidates can upload a new resume, update their profiles and view the status of the jobs they have applied to.

Employers can register themselves, upload logos and edit their profiles. Employers can buy services such as: Hot Employers where they can advertise on the main page, and posting hot vacancies and listing in the featured employers list. Employers can also add a note or some information about their company, which acts as an advertisement on the candidate page.

## 1.4 Project Methodology

The aim of the project was to design and develop web-based software that fulfills the requirement of job seekers and companies. After the initial requirements were obtained, the software was designed and developed using the agile software development method and object-oriented PHP language. The CakePHP framework was used to develop this project.

There were several mature technologies available for the project, some of the technologies were evaluated and compared to find the best solution. The whole project process was executed in a software agile style, meaning that the system requirement is flexible to modify according to the better understanding of the system. The software implementation can be modified and improved when the requirement is assessed and approved to be modified.

There were practical implementations and verification activities planned for each phase, the function unit test was performed when doing features implementation and the system integration verification takes place when the whole system features are ready.

Finally, in the paper the outcome of the project is reviewed and the pros and cons are covered together with a conclusion of the project.

## 1.5 Scope and Structure

The project was scoped to the high-level system architecture design and the system software implementation. The whole system architecture was fully designed, the system software was partially implemented, and some open topics were left for the future development.

The thesis consists of six sections. Chapter 1 provides the detailed introduction to the study, its background, challenges, scope and the processes. Chapter 2 describes the theoretical and technical framework including the technologies used in this project. This section also includes the detail introduction of the web framework and its components.



Chapter 3 describes the system architecture, software development methods and architecture used in this application. Chapter 4 then covers up the software structure, its functionalities and implementation part of project. Finally, Chapter 5 shows the testing techniques and scenarios followed while developing this project. Lastly Chapter 6 describes the conclusion of the study and presents suggestions for future work.

## 2 Theoretical and Technical Framework

This chapter provides the description of the theoretical and technical details related to the design and implementation of the Job Portal. It also provides the technical details related to the web platform.

### 2.1 Background of Web

The World Wide Web (Web) is a system of Internet servers that support special formatted documents. The documents are formatted in a markup language HTML (Hyper Text Markup Language) that supports links to other documents. User can move from one document to another by simple clicking a link [1].

It was originally introduced in 1990, and in start it was only static. The user could not easily interact with contents and to modify some text in a published material on web, the author had to modify locally and upload it to the server. For the solution, Common Gateway Interface (CGI) standard was introduced for interfacing external applications with web servers [2]. CGI is an interface that tells the webserver how to pass data back and forth to and from an application. It provides a consistent way for data to be passed from the user's request to the application program and back to the user [3].

CGI creates a new process for each request to the server resulting in heavy load on server side when dealing with a great number of requests, thereby the demand for something more efficient grew. In 1995–1996 the demand of web application increased dramatically [4] and at the business was moving to e-commerce. ColdFusion, PHP and ASP (Active Server Pages) were created during the same period. Today ASP is replaced with ASP.NET, but ColdFusion and PHP are still developed and used. The term “web application” was first introduced in 1999 in the Servlet Specification version 2.2 for Java language. Figure 1 shows the time line of web history and the releases of web framework.

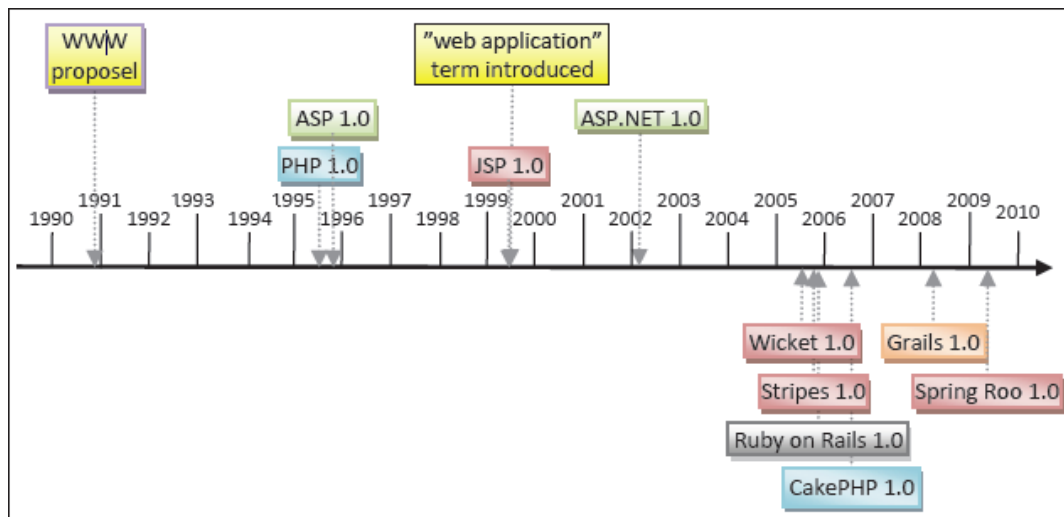


Figure 1: Time line of web history and releases of web framework

In addition to showing the time line of web history, Figure 1 also illustrates the development and process of web applications and web frameworks.

## 2.2 Web Application

Web application is an application that can be accessed by the users through a web browser. The browser creates HTTP requests for specific URLs that map to resources on a web server. The server renders and returns HTML pages to the client, to be displayed in the browser. Server-side logic makes a web application more powerful and productive. It contains several distinct layers. The three-layered architecture is the most common type of software design pattern used when designing any web applications [5].

In the early stages of designing a web application, the goal of the software architect was to minimize the complexity by dividing the tasks into different areas of concern while designing a secure, high performance application. Figure 2 describes web application architecture with components organized by different areas of interest. It shows the client server architecture where client send the request to server that is then handled through different web server layers. It also explains the data source, which is used to store the data and web services that were used to make a client server system more useful.

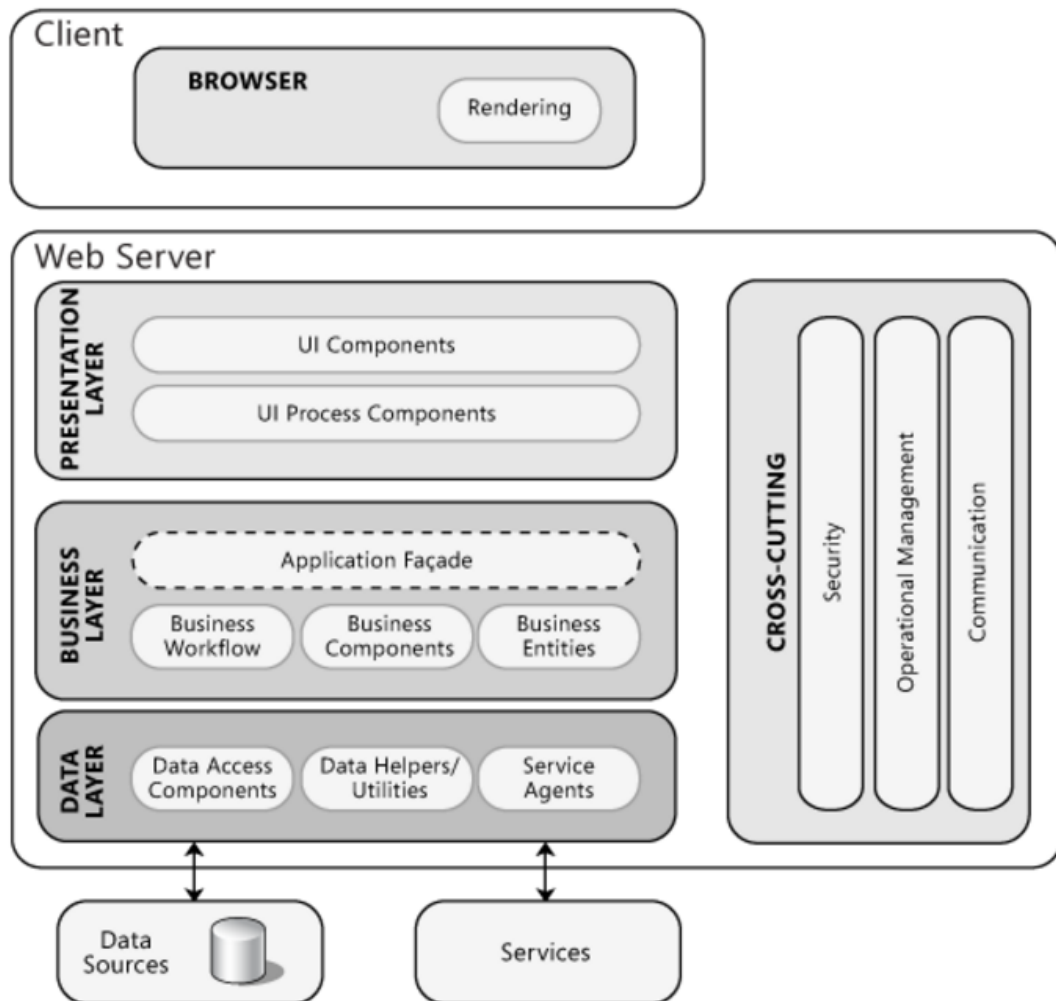


Figure 2: Web application structure

Applications are broken into logical tiers where every tier is responsible for a specific task to be handled. The figure above shows that user triggers the initial request through a web browser over the Internet to the web application server. The web application server accesses the database server to perform the requested task updating and retrieving the information lying within the database. The web application then send the responses back to the user through browser.

### 2.2.1 Three-Layer Architecture

The three-layer architecture is a client-server architecture in which the functional process logic, data access, data storage and user interface are developed and maintained as independent modules on separate platforms. It is a well-established software architecture that provides scalability, performance and availability with the help of using

cache [6]. Figure 3 shows the basic structure of three-layered architecture with all the components in each layer.

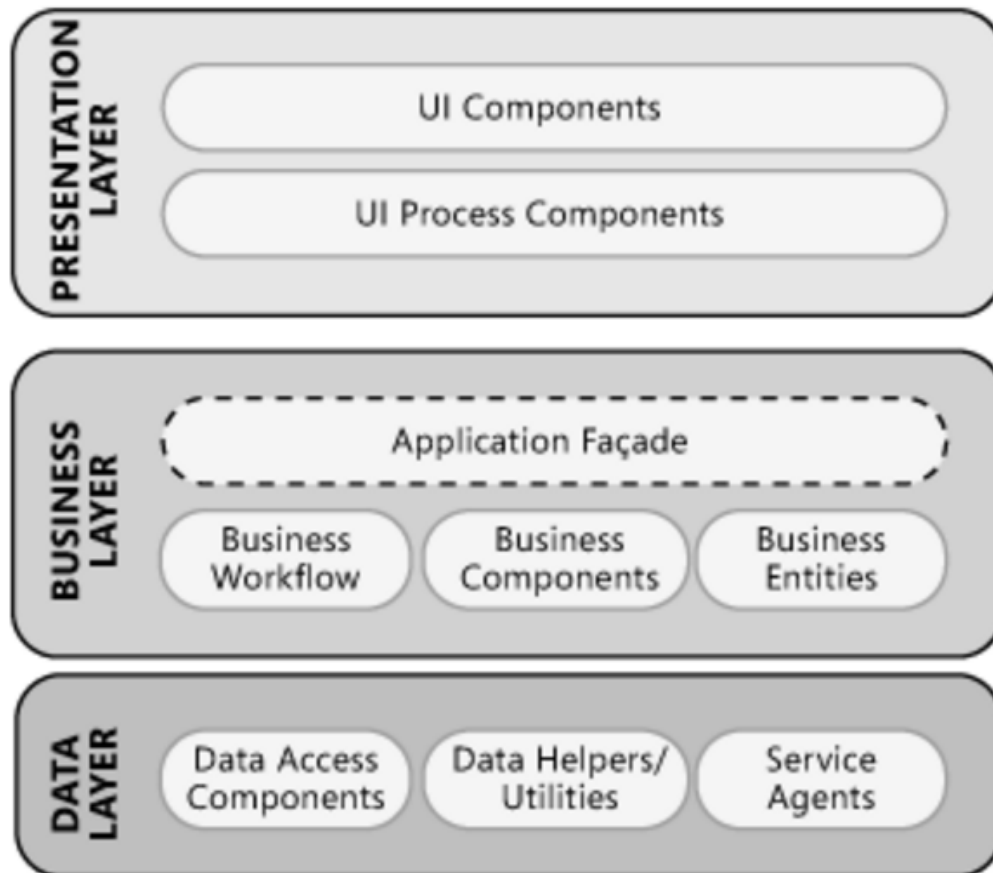


Figure 3: Three-Layer Architecture

The three-layer design shown in Figure 3 consists of the following layers:

1. **Presentation Layer:** Also known as User Interface (UI) layer. This layer contains the user-oriented functionality responsible for managing user interaction with the system.
2. **Business Layer:** Consists of business logic, business workflow and business entities components. This layer implements the core functionality of the system, and encapsulates the relevant business logic.
3. **Data Layer:** Includes data access and service agent components. This layer provides access to data hosted within the boundaries of the system, and data exposed by other network system access through services. This layer interacts with database, process database queries and use stored procedures to access the data from database [6].

Modern applications require increased scalability and availability. To support ever-increasing demands for scalability and availability, three-layer architecture is best fit in this type of situation. It is a micro-services friendly n-tier architecture where tiers are grouped into layers. The layered groups of tiers are very important as they delineate both software functionality and engineering department.

## 2.3 Technical Specification

This section explains the main features, technologies, tools and the process involved in building the online job portal web application.

### 2.3.1 HTML

HTML (the Hypertext Markup Language) is the most basic and common technology for building web applications. HTML as a structured language, has rules for where element can and cannot go. These rules are present to enforce an overall logical structure upon the document. HTML is a markup language with set of markup tags, which describe different document content [7]. HTML tags are keywords which are in angle brackets, for example “head” tag is use to create web page header section. Figure 4 shows the basic structure of a HTML page.

```
<html>
  <head>
    <title>Page title</title>
  </head>
  <body>
    <h1>This is a heading</h1>
    <p>This is a paragraph.</p>
    <p>This is another paragraph.</p>
  </body>
</html>
```

Figure 4: Basic HTML code example

As see in Figure 4 above, the core structural elements are `<html>`, `<head>` and `<body>`. Information about document goes in `<head>` and document content goes in

<body>. These tags tell the server that the page is an HTML page with all the HTML tags.

### 2.3.2 CSS

CSS (Cascading Style Sheet) is a style sheet language use for styling HTML elements on a web page. It defines the presentation of HTML elements, how they appear on web page, including designs, layouts, fonts and tailor pages on different environment [7]. Figure 5 explains the syntax of a CSS file with the properties of HTML tags.

```
body {
  margin: 0;
  padding: 0;
  height: 100%;
}
#wrap {
  margin: 0 auto;
  border: 2px solid #000000;
  width: 1200px;
  min-height: 100%;
  height: 100%;
  position: relative;
}
#header a img {
  border: 0;
}
#headerlink {
  width: 1000px;
  height: 100px;
  min-height: 100%;
  background-repeat: no-repeat;
}
```

Figure 5: Basic CSS code example

There are different ways to insert a style sheet in a page:

- External style sheet
- Internal style sheet
- Inline style

Depending on the need of using the CSS styles, the developer can make a choice how to include a style sheet in the web application [8]. CSS is independent of HTML and can also be used for styling in different markup languages, for example XHTML and XML.

### 2.3.3 PHP

PHP (PHP, Hypertext Pre-processor) is a scripting language originated in 1995 by a software development contractor named Rasmus Lerdorf. It has developed as one of the best larger scripting languages around the globe [9].

PHP is a server-side scripting language that was introduced for developing dynamic web applications. PHP code is embedded into HTML source file with PHP tags and interpreted by web server [10]. Its syntax is a mixture of C, Java and Perl languages. PHP became very famous among developers because of its easy connectivity to MySQL databases that leads to creating dynamic web sites. PHP can be used from command line interface or in standalone graphical applications. It can be deployed on any server and any operating system easily. Figure 6 shows the syntax of PHP code in an HTML file. PHP starting and ending tags makes it available anywhere in the page to use it as scripting language.

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
  <head>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <title>Welcome</title>
    <link href="style.css" rel="stylesheet" type="text/css" />
  </head>
  <body>
    <?php
      $firstname = "John";
      $lastname = "Smith";
      echo ("Hi! Welcome to my website $firstname $lastname.");
    ?>
  </body>
</html>
```

Figure 6: PHP code in HTML file

In order to use PHP in a web application, the web server must have a PHP installed. PHP file ends always with 'php' extension, so it is easy for web server to automatically pass it to PHP processor. PHP can be included in side of HTML code, but the most recommended and useful approach is to store PHP code in a separate file so that it can be modified and reused easily in future. PHP is an object-oriented programming (OOP) language, which makes building complex, modular and reusable web applications [11]. OOP is all about creating modular code, so object oriented PHP code will be



contained in dedicated files that will then insert into normal PHP pages using PHP includes [12].

### 2.3.4 JavaScript

JavaScript is a cross-platform, object-oriented scripting language, used to develop web pages more user friendly. It is a small and lightweight language. Inside a web browser, JavaScript can be connected to objects to provide programmatic control over them [13].

JavaScript contains a standard library of objects, such as Array, Date and Math, and a core set of language elements such as operators, control structures, and statements. Core JavaScript can be extended for a variety of purposes such as Client-side JavaScript and Server-side JavaScript. It is very useful from the security point of view, because it does not allow entering any web application without authentication. Figure 7 shows the JavaScript code in an HTML file.

```
<head>
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <title>Welcome</title>
  <link href="style.css" rel="stylesheet" type="text/css" />
</head>
<body>
  <script type="text/javascript">
    document.write("Hi! Today is " + Date());
  </script>
</body>
```

Figure 7: JavaScript code in HTML file

JavaScript has a lot of third-party libraries that have been developed to make JavaScript code writing much easier and flexible, the most used one is jQuery [14].

### 2.3.5 AJAX

Ajax (Asynchronous JavaScript and XML) is a method for developing faster, efficient and more interactive web applications with the help of XML, HTML, CSS and JavaScript [15]. Ajax helps to build interactive applications for the web that process user re-

quests immediately. Ajax updates the web page contents immediately when a user performs an action [16]. The main component of Ajax is JavaScript object XMLHttpRequest made for asynchronous communication.

### 2.3.6 MAMP

MAMP (Macintosh, Apache, MySQL and PHP) installs a local server environment on a working station. MAMP uses Macintosh as the operating system, Apache as the Web server, MySQL as the database server, and PHP as a module for the web server. It is open source and includes all the tools to start with developing dynamic web applications [17]. It includes Apache, PHP and MySQL. MAMP is a combination of free software and it is open source without any charge. Figure 8 shows the main page of MAMP on mac environment.

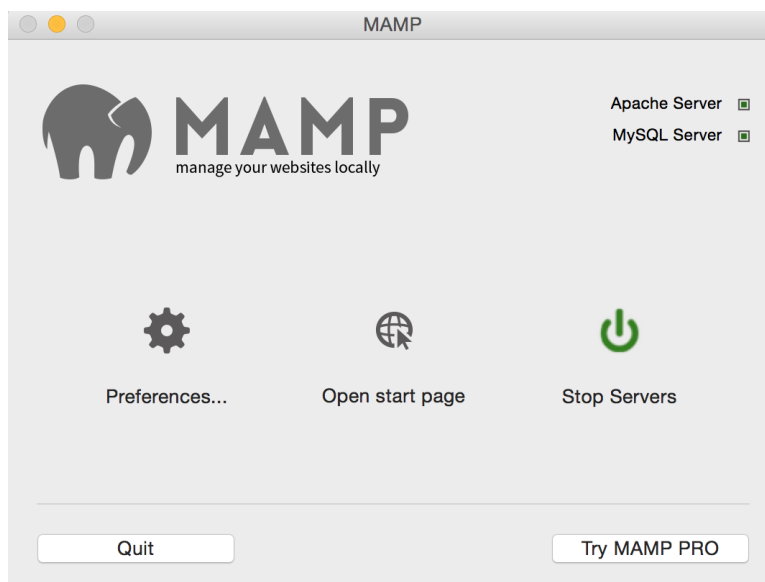


Figure 8: MAMP

MAMP window have preferences tab that have the features of changing the version of PHP, Apache ports and also web server that can be used.

### 2.3.7 Apache

Apache is an open source HTTP web server, which is the primary part of MAMP. Because of its speed, reliability and security, it is the world's most used web server software [17]. Apache is a powerful and flexible web server. It is developed and main-

tained by Apache Software Foundation. Apache server is used in a PHP implementation. It has the features of running virtually on all computer platforms. Apache users can have a lot of support from its website. The usage of Apache is more when it comes to usage when compared to other web servers [18]. Figure 9 illustrates the usage of web server around the world and also the statistics for usage of web servers.

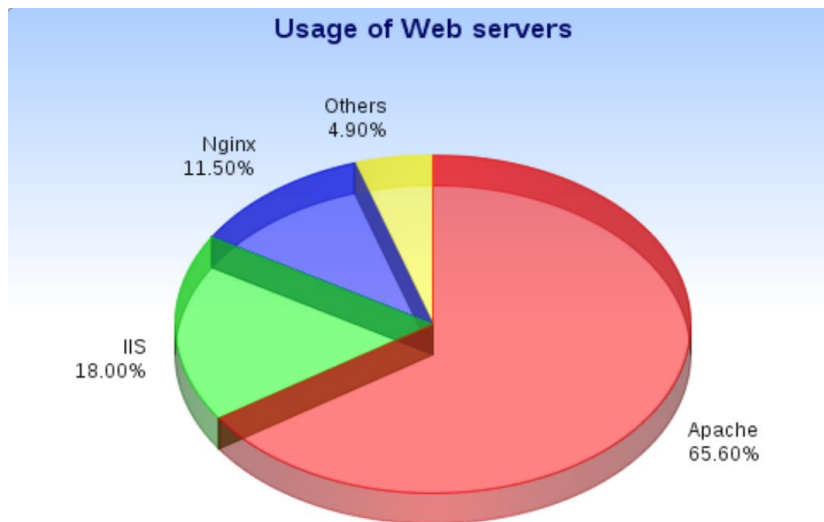


Figure 9: Usage statistics of Web Servers

Figure 9 above shows the comparison between the Apache server and other servers. Many big companies around the world are currently using Apache server. Its usage percentage is more than the half of the total. The main feature of Apache is that it is easy and flexible.

### 2.3.8 MySQL

A database is a collection of useful information that can be easily accessed, modified, managed and updated. It is used to provide efficient retrieval. The data, which is stored in a database, can be in any format [19].

MySQL is an open source Relational Database Management System (RDBMS) that uses Structured Query Language (SQL) [20]. The main features of using MySQL are that it is very user friendly, easy to use, quickly processing and flexible. Because it is a relational database, it stores data in different tables making it possible to use same

data flexibly in different ways [21]. MySQL server controls the access to project data and makes sure that multiple users can work parallel with the same data with fast and easy access. It also restricts to the authorized users who can have access to the data.

Many large and medium scale companies are using MySQL to save money and time keeping their high volume, critical business systems. MySQL is easy to use and of a high reliability. It is very light weight and can run on over 20 different operating systems [22]. MySQL database contains tables, where each table contains rows, with each row containing columns where data is stored. Figure 10 shows the basic structure of a MySQL table with rows and columns.

<b>id</b>	<b>username</b>	<b>joined</b>	<b>password</b>
3	john_33	2012-02-15	11c931a873eb
4	northlite	2012-05-09	88c89be093d4
5	maroon	2012-06-05	ea1fd4d63f2b5

Figure 10: MySQL table with rows and columns

MySQL consist of multiple tables that are indexed to speed up queries and to make relationship between tables. There are different types of relations between tables for example, one-to-one, one-to-many and many-to-many relationship.

## 2.4 Web Framework

In the world of software development, framework is a set of prewritten code and libraries that provides common functionality to develop an application. It is a collection of resources and tools for developing and manages web applications, web services and websites [23]. A framework includes template capabilities for presenting information within a browser, programming environment for scripting the flow of information and application programming interface (API) for accessing underlying data resources. A web framework also provides the foundations and system-level service for software developers to build content management system (CMS) for managing digital information on the web.

A framework is a hierarchical directory that encapsulates shared resources, such as dynamic shared library, image files, classes, header files and reference documentation.

Framework allows developers an easy and efficient way to develop unique features for the application rather than re-inventing the wheel by coding common and most used features found across many web applications [24]. The usage and advantages of a web framework is discussed in detail in the following sections.

#### 2.4.1 Usage of Web Framework

Web developers have specific ways and different techniques of building web applications, and it can be learned through experience with different projects. While developing any application, developers want to re-use some code that they have used earlier in same application or in a different project. For that purpose, they need to store that code in some files or libraries which is not easy to maintain. PHP frameworks are designed to solve this kind of situation. The main idea of a framework is to provide developers regularly used functionalities and core to build the application smoothly. The frameworks are a well-tested collection of code, libraries and conventions. They are flexible to support a wide range of simple and complex application designs. Frameworks are constantly checked and updated for security issues, which are the key part of any application [25].

Different frameworks might aim for different goals, but in general all of them have the aim for supporting developers in creating an application with as little effort as possible. A framework serves common functionalities and also helps learning a design pattern. New developers with little experience with coding can benefit from a framework by gaining understanding and programming skills.

#### 2.4.2 Advantages of Web Framework

There are number of advantages when using a web framework and to utilise its functionalities in the productive way. Below is a list of few important advantages that are most common in many web frameworks.

- **Efficiency:** The most vital and important part of any framework is its efficiency. To eliminate the need to write repetitive code that can be found being used in many different applications.
- **Security:** A framework is developed and tested by a team of developers and testers who are responsible for any security issues in the framework. They con-

stantly upgrade the versions of framework with passage of time to keep it up to date and more secure.

- **Empowers Developers:** Framework allows for quicker development of applications. It provides an environment where developer can easily start the simple or complex application very smoothly.
- **Support:** Web frameworks have a strong community who are ready to help any kind of issue regarding the framework.
- **Documentation:** This is the key part of any framework. Usually frameworks are well documented to help developers regarding the usage of framework [24].

With all these above mention advantages, web frameworks become more and more popular and developers become more comfortable with adopting this technology.

## 2.5 CakePHP Framework

PHP is the most popular programming language in the world. It is used to develop all kind of complex web applications. For the purpose of developing a job portal application, the CakePHP framework was chosen, because of its efficiency, security, cost and support, it is the best option to choose.

CakePHP is a free open-source framework for PHP. It is a powerful and robust PHP framework built around the Model-View-Controller (MVC), which is an architectural pattern used in software engineering. This framework provides the environment for developers to create web applications in the most efficient way. It has an experienced and active development team that ensures the security of the framework and keeps the core well tested and improves it constantly. CakePHP has number of features to make web application more reliable, for example:

- Compatible with PHP versions 4 and 5
- MVC Pattern
- ORM
- Ajax support
- Ability to create tests
- Build-in validations
- Caching
- Access Control Lists and Authentication.

With all above mention features, CakePHP becomes first choice to develop the job portal. Below the features and structure of CakePHP framework are discussed in detail.

### 2.5.1 CakePHP Folder Structure

After CakePHP has been downloaded and extracted, the folder structure of the CakePHP framework including all the folders that were created on the time of installation, is created in the root directory of the apache server. Figure 11 shows the folder structure after installation of CakePHP framework.

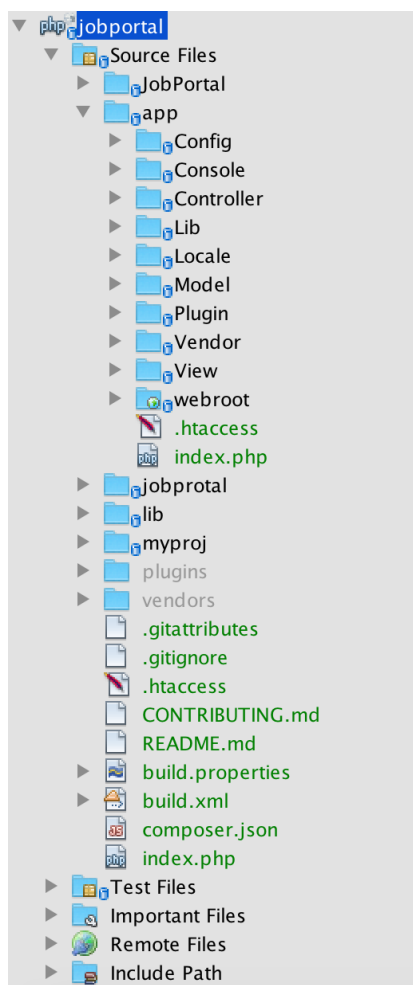


Figure 11. CakePHP folder structure

Below are the details of folders and files that are the core part of the CakePHP framework, which holds all the primary libraries and other supporting files that are used in the time of development.

- **app:** app folder contains files and folders for the application. The app folder is the development folder that includes application-specific folders and files. It contains all the application files and folders.
- **Config:** it holds configuration files that CakePHP uses. Database connection details bootstrapping, core configuration files should store here.
- **Console:** contains the console commands and console tasks for the application. This also contains the templates directory to customize the output of bake.
- **Controller:** contains the application's controllers and their components. Files stored here are used to manage the logic part of the application.
- **Lib:** contains built-in libraries that include in the CakePHP package.
- **Locale:** is the folder where string files are store for internationalization.
- **Model:** contains the application's models, behaviors and data sources.
- **Plugin:** this file contains plugin packages.
- **Test:** contains all the test cases and test fixtures for the application.
- **Tmp:** CakePHP stores temporary data in this folder. The actual data it stores depends on how CakePHP is configured. This folder is used to store model descriptions, logs, and session information.
- **Vendor:** third-party classes and libraries are kept here in this folder. It is convenient to access by using `App::import ()` function.
- **View:** this folder is used to store presentational files like elements, error pages, helpers, layouts, and view files.



- **Webroot:** this directory serves as the document root for the application. It is a useful place to store and handle CSS style sheets, images, and JavaScript files [26].

The folder structure helps to locate the files in the corresponding folders that will be used to create any application.

### 2.5.2 CakePHP Naming Convention

In the CakePHP framework, it is very important to follow the naming conventions. The table names are plural and lowercased, the model names are singular and CamelCased: the model filenames are singular and underscored: `model_name.php`, the controller names are plural and CamelCased with keyword Controller appended like: `ControllerNamesController`, the controller file names are plural and underscore with controller appended like: `controller_names_controller.php` [27].

### 2.5.3 CakePHP Helper

Helpers in CakePHP framework are components e.g. classes associated with the presentation layers of an application. Helpers contain a presentational logic that is available to share between views, elements and layouts. Commonly used helpers on CakePHP are:

- FormHelper
- HtmlHelper
- JsHelper
- CacheHelper
- NumberHelper
- Paginator
- RSS
- SessionHelper
- TextHelper
- TimeHelper.

Helpers were enabled in CakePHP by making a controller aware of them. Each controller has a helper property that lists the helpers made available in the view [28].

## 2.6 Communication Protocol

Communication protocol is a system to communicate securely and effectively to the database server. To communicate with database server, there is a need of protocol that will set the rules that carry out the connection between application and database on a network.

When the application makes a HTTP request, the request handler component accesses this information and checks the request type to change the site behavior according to the request. It is very handy to detect if the requests are AJAX and if they are done using a mobile browser.

The HttpSocket class comes with CakePHP and its main purpose is making requests. It is useful to communicate with external web services or remote APIs.

## 2.7 Security

Security is the most important feature of any application. CakePHP comes with infrastructure that already has many typical areas of web app security. Below are a few components that are used to build this application [29].

### Security Component

Security component is used for adding and handling extra security to the web application and also to get automatic form spoofing protection. It supports the features including:

- Restricting HTTP method that application accepts
- Form security
- CSRF protection
- Checks between communication of controllers.

## Authentication Component

Authentication is a pattern to identify the user with their credential to check if the user is real. It usually checks if the user exists in the system while checking the username and password. It hashes and salts passwords.

## 2.8 Data Management

Another key aspect of a web programming is data management. The sections below describe few of those in detail.

### Sessions

The CakePHP Session component provides the facility to communicate between page requests in the application. It allows the application to classify the uniqueness of users and facilitates with the functionalities of reading, writing and modifying data for that specific user [30].

### Modified Pre-order Tree Traversal

CakePHP tree behavior provides the way to create a hierarchical data. It can handle an absolute number of subcategories and very helpful for multilevel menus. It is based on the MPPT (Modified Pre-order Tree Traversal) logic.

### Translate

Translate behavior is very helpful in facilitating the application to copy the database tables in multiple languages. A separate i18n table is used to store the translation for every field of a corresponding table.

## 2.9 Benefits of CakePHP

CakePHP has a number of benefits that makes it unique from other frameworks. The main advantages are:

- Compatible with a number of languages facilitating.
- Used to develop large-scale web applications including e-commerce and blogs.
- Specifically designed for large-scale web application
- Manages context and themes
- Has customized fields and templates
- Easy to install and deploy on any kind of operating system
- Easy to test and debug
- Helps reduce web application development cost & time.
- Scaffolding code generation
- Easy to learn. [31]

There are many factors to consider when choosing the right tools for starting up with the help of knowing and analyzing the needs and goals. This depends on the work requirements, end product and current skills. Frameworks are created for common web applications but not all should apply. Some projects such as extremely specialist websites, small and static websites are out of range.

### 3 System Architecture

This section describes the research methodology and system architecture design for the application. The purpose of this research was to develop a web based online job portal. A job portal is a gateway to online information and services that provide users with search functionality, registering options, posting advertisements, and a way for communication between job seekers and employers. This portal provides a facility to share information of job seekers to those companies who are registered on this job portal.

#### 3.1 Research Methodology

From the early 70's, different methodologies have been adopted to develop information systems more effective. The methodology or a research strategy selected for this study is based on action research. Maddison et al, (1983) stated the different methodologies used for developing information system. The study defines levels, sub-levels and the technologies used in each level, with planning management, evaluation and control at the different levels and sub-levels. Before the web-based technology was available, old information systems were developed using computer-based systems. Organizations were willing to spend large amount of money for information system development to stay competitive. In today's world, web technology and the Internet have changed the traditional way of developing information systems to become a Web-based Information Systems (WBIS). A web portal is a type of Web-based Information System.

During the development of the project several research methods were also used. All actions in this project were based on the users' requirements and the goal was to provide a solution in the form a real-time web based job portal. In the following sections, the research methodology and system architecture are described in detail.

#### 3.2 Iterative Software Development Approach

Iterative development approach is a technique of breaking software components in cycles, rather than developing the whole application at the same time. "Iterative Development adds agility to the development process" [32]. It is a methodology of software development that divides a project into many releases. In iterative development, the

features code is designed, developed and tested in repeated cycles. With each iteration, additional features can be designed, developed and tested until there is a fully functional software application ready to be deployed to the customers.

Iterative development adds agility to the development process. Software developers divide their development schedule into several iterations. While developing this job portal application, the main focus was to adopt iterative development techniques. Started with planning stages of the project and moved through each stage in iterative development. The final outcome of a particular iteration around is an iteration release, as stable, integrated and tested partially complete system. The iteration releases are released internally not externally. The final iteration is then release, which is a complete product.

### 3.3 Agile Methodology

Agile software processes are lightweight and attempt to minimize the project failure risk associated in the project by developing and releasing software in short iterations [33].

Agile development is a lightweight framework for helping to provide a constantly evolving functional and technical landscape. The agile software development method is characterized by following attributes:

- Incremental
- Cooperative
- Straightforward
- Adaptive.

Agile methods break software features into small increments, which require minimum of planning and do not directly involve long-term planning. Iterations are short time frames, which typically last from one to four weeks. Each iteration involves a cross functional team working in all software development cycles stages, such as planning, requirement analysis, design, coding, and unit testing and accepting testing. The benefit to adopt this way is to minimize the risks of failure and allows the project to adapt to changes quickly [34].

Agile software development methods focus on keeping the code simple, testing more frequent and encouraging the partners to collaborate actively. Agile methods emphasize on quality and project agility. In order to improve quality and project agility, specific tools and techniques such as continued integration, automated test, pair programming, test-driven development, design patterns, code refactoring and other techniques are often applied while developing of software. Figure 12 shows the whole life cycle of an agile methodology [33].

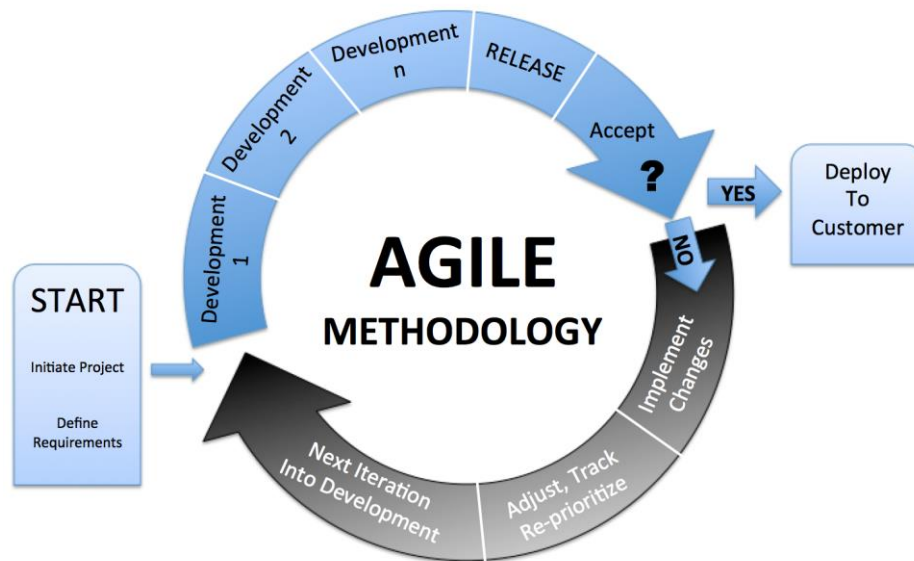


Figure 12: Agile Methodology life cycle

Agile development methodology provides an opportunity to assess the direction of a project throughout the development lifecycle. This is achieved through iterations.

### 3.4 MVC Architecture

Model-View-Controller (MVC) is a software architecture concept considered as an architectural pattern in software engineering, whose idea is to separate the logic of application from presentation. MVC programming pattern separate the application into three main logical parts, to distinct the internal representations of information.

- Model
- View
- Controller

Figure 13 shows the relationship between these components.

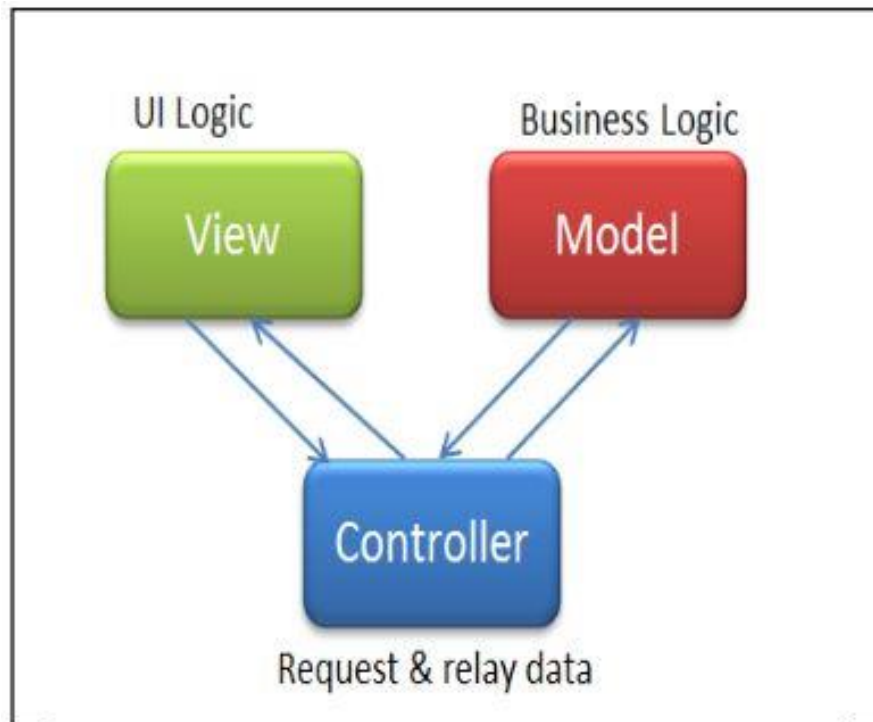


Figure 13. MVC Components

An object is assigned to one of these three roles. MVC pattern specify the roles objects play in application and also it defines the way objects communicate with each other. Every component is built to handle specific development aspects of an application. View and Controller belongs to the user interface. When a user sends request to a controller through a graphical user interface (GUI), the controller accesses model to return the data according to the user's request. After that model returns the data to controller, and controller presents the data to view. The database is used to store data and provide an original data source in the system. MVC is one of the most used industry standard web application frameworks to create scalable and efficient projects. MVC makes model classes reusable without modification.

MVC is central to a good design for a CakePHP. The benefits of using these patterns are numerous. Applications having an MVC design are more easily extensible than other applications [37].



- Model

Model object encapsulate the data specific to an application and define the logic and computation that manipulate and process the data. Model represents the data parts of the applications, more precisely the database tables. In CakePHP each database table has its own model. PHP code for retrieving, editing and deleting data is located in models. It does not depend on the controller or the view. Model object can have one-to-one and one-to-many relationships with other model objects. The main function of a model is to retrieve data and convert it into a useful approach that consists of processing, validating, associating and different several tasks to handling data [25, 35].

- View

View is an object what users can see, it is the presentation part of the application. Typically view is the part of system where the HTML is generated and displayed the modelled data. All views are located in view folder. View does not have any connection with model, and it is responsible to produce presentational interface by using available information. It can display different kind of formats depending on users need for example, music, videos, xml etc.

- Controller

Controllers are the components that handle user interaction, work with the model, and ultimately select a view to render that displays UI. All the business logic of the application handles in controller. Controller manages the user requests that it receives from user in form of HTTP GET or POST. Main responsibility of a controller is to call and coordinate the necessary resources or objects needed to perform the user actions. Controller handles and responds to user input and interaction.

MVC is very efficient and productive method to begin producing clean, scalable, powerful and fast code in the least amount of time with the least amount of effort.

### 3.4.1 MVC Cycle

MVC request in CakePHP start from requesting a page or resource by a user, after requesting this resource it is processed by dispatcher that correspond to the relevant controller to handle it. When the controller receives the request, it corresponds to the model layer for receiving, adding, editing or deleting data. Once the data has been processed as per the user's request, the controller will then select the corresponding view object to generate output resulting from the data provided by the model. When the output is finalized, it is then send to the user [38]. Figure 14 illustrates the relationship between client's request and MVC cycle.

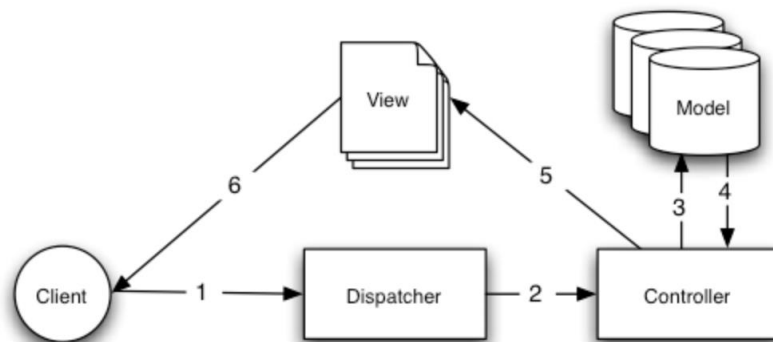


Figure 14: MVC Cycle in CakePHP

Figure 14 explains the MVC cycle after a user requests a resource, a dispatcher that corresponds to the correct controller object to deal with it initially processes the request. After this request reaches the controller, it will correspond with the model layer to process the CRUD (create, read, update and delete) operation that might be needed. After that the controller proceeds to delegate the correct view object for generating output result from data provided by the model [38].

### 3.4.2 MVC Benefits

MVC architecture arranges the code into logical segments. It separates the model-view-controller and converts application code into maintainable, user-friendly, and modular. It is easy to add new functionalities and reuse the same code. MVC architecture made it easy to add new features and functionalities in the application. It also

makes it possible for back-end and front-end developers to work more efficiently. The separation of model, view, and controller makes it easy for developers to make changes in one part of application without affecting the others.

One of the major benefits of using the MVC pattern is that the front-end developers can work on user interface without having to worry about the underlying data management, and back-end developers can focus on the data logic without getting in details of the presentation [36].

In the modern software design patterns where the UI elements, data logic and programming logic are at same place, the maintenance of the application becomes harder as it grows in size. As all the parts in MVC are well defined and self-contained, it makes the changes much easier and efficient.

Its simplicity, documentation, performance and community make it the most popular web framework for PHP developers.

## 4 Software Structure and Implementation

This section describes the detailed implementation of the Job Portal, methods used to develop the application, the structure of the project with its functionalities and screen shots.

### 4.1 Purpose

The main goal of this web application is to offer a service for job seekers and companies to meet for offering and applying to different positions e.g. trainee and internship positions, thesis work, summer time, part-time and full time jobs. The service enables all schools and universities and students from all over the country to meet companies and vice versa.

The purpose of this online web portal is to give a platform for finding the right and satisfactory job according to the requirements and qualifications. It also connects the job seekers with the companies.

Companies and job seekers do not specifically need to register/login themselves to use this application. Companies have limited options to advertise their job advertisement with the capability of editing or deleting the same advertisement. On the other hand job seekers can also apply for any position without any need of login to the application with limited functionality.

### 4.2 Scope

The scope of this application is to introduce a user-friendly web portal that provides the job information, online applying for jobs and many other facilities. The main scope of the application is:

- Job Seeker Module

This module provides functionalities for job seekers who are students or any one from any profession. Registered applicants can post their personal and professional

details with resumes. They can edit or delete their data if required. Job seekers also get email alerts from the employers on the basis of their preferences.

Job seekers can also apply for any job without the need of registration or login to the system to upload their resume and other general information.

- Employer Module

The employer module is for companies or public sectors that are interested in hiring new people for the vacant posts. An employer can post a detailed advertisement for a job and also update or delete it if required.

The employer can also post a new advertisement without the need of registration/login, in this case they can get an email notification if someone applies for the specific job position.

- Administrator Module

This module is for the administrator of the application who has all the control of the system. The administrator manages the whole application and maintains the profile of employers and applicants. Administration features include:

- Creating multiple job categories with subcategories
- Specifying working hours, job conditions and experience levels
- Viewing/editing/deleting job seekers
- Emailing individual job seekers
- Viewing/editing/deleting employers
- Emailing individual employers.

The application is easy to use and it provides flexibility to the users to use the service as they want.

#### 4.3 System Design

The job portal is designed to fulfil the need of jobseekers and also employers. Jobseekers can be any student, fresh graduate or an experienced person who wants to

find new job as per their skills. On other hand the employer can be any start-up company or a medium or large size firm who has difficulties to find suitable candidate to accomplish their needs. The main goal of this job portal is of provide an easy to use web portal where users can facilitate with minimum IT knowledge. Figure 15 shows the project design with the basic functionalities and the flow of all modules.

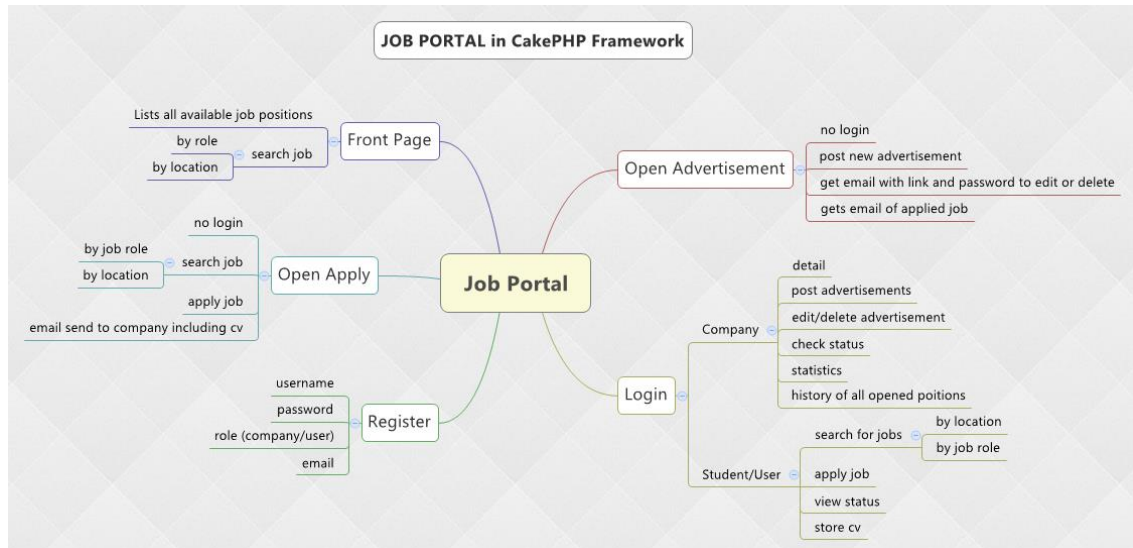


Figure 15: Project Design

Figure 15 shows the schema of the job portal, in illustrating the relationship between the jobseekers and employers and also the role of admin who can control the whole system.

The flow of job portal is very smooth and easy to understand even for new users. There are two main parts of the application, which makes it unique and different from other job portals in the market. These are registered users and non-registered users. The application is well structured for the use and is easily reachable with basic browser from all over the world.

#### 4.4 System Flow

The aim of this project was to develop a user-friendly web based job portal that delivers solution to jobseekers and companies. The job portal supports two kinds of users, ones who do not need to registered themselves and others who register as a jobseeker or an employer. Thus, there are two categories.

- Open Users
- Registered Users

#### 4.5 Open Users

This part of the job portal is very useful for those users who do not wish to share their information over Internet. Users find this option very beneficial while applying for any job and also for employers when posting the job advertisement without the need of login.

##### 4.5.1 Landing Page

The main page of the job portal contains the title links for the jobs, which have been posted. All the jobs on this page have the valid expiration date of apply, after expiration date the job advertisement is removed from the page automatically. It also has the links of login, registration, and posting of a new job advertisement. Users can also filter the search with the help of location and job type. Figure 16 shows the main page of job portal. When the user types the URL in the browser, the page shown below will always appear as of home page. This page contains the latest available jobs and also the search criteria, where user can search any kind with their preferred location or job type. User can also register or login to the system by pressing the relevant button on same page.

**JOB PORTAL** [Login](#)

**Actions**

- List All Advertisements
- New Advertisement
- Login
- Register your self

Location  
Select Location

Job Type  
Select Job Type

Search

**Advertisements**

Job Title

- [.Net Developer](#)
- [Head of ICT Unit](#)
- [L1 Support](#)
- [Electrical Machince Tester](#)
- [Team leader](#)
- [II](#)
- [Php Developer](#)
- [ICT Help Desk](#)
- [Test Engs](#)
- [Testers](#)
- [Web Developpr](#)
- [Network Administrator](#)
- [PHP Developers](#)
- [Java Developer](#)
- [Android Developer](#)

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Figure 16: Landing page

There is no need to login or register for users to access this page, anyone from anywhere can open this page and also see all the jobs posted there. The New Advertisement button takes the user to the page where they can post a new job advertisement without any need of registration or login to the application.

#### 4.5.2 Advertisement Detail

When the user clicks any of the advertisement links, a detail page of that specific advertisement opens with all the information regarding the job and the company that posted the advertisement. It also shows the publishing and expiration date for that specific advertisement. Figure 17 shows the detail page of one of the job posted on the portal.



JOB PORTAL
[Login](#)

**Actions**

[List All Advertisements](#)

[Login](#)

[Register your self](#)

## Advertisement Detail

<b>Company Name</b>	Name of Company
<b>Company Detail</b>	Detail of company
<b>Job Title</b>	.Net Developer
<b>Description</b>	General Purpose Support transformation project to model processes Main Responsibility Area Model Nokia NET product development process with process modeling language BPMN 2.0 Position Description Involvement in project target setting and defining project way of working Developing Process Modeling techniques using process modeling language BPMN 2.0 Follow up project activities with other team members Reports on project stream activities Position Requirements 2-4 years of bachelor / master degree studies. Efficient communication Excellent Planning & Organizing skills Personal Drive Experience on team and/or project work
<b>No of Positions</b>	1
<b>Type</b>	Trainee
<b>Paid</b>	No pay
<b>Salary</b>	0
<b>Location</b>	Vantaa
<b>Published Date</b>	20150224
<b>Expire Date</b>	20170316

[Back](#) [Apply](#)

Copyright © 2015

Figure 17: Job advertisement detail page

This page contains all the necessary information about the job advertisement where user can view the post and can apply for the position with Apply button at bottom.

#### 4.5.3 Applying for Job Post

When the job seekers click on the apply link, they are redirect to apply for the job position page where they can simply give their basic information without any need of registering themselves. Users need to provide their name, email address, cover letter, attach a resume and provide the captcha value. Captcha is used to make sure they are real users. Figure 18 shows the apply page that consists of a web form with different fields that user needs to fill in.

**JOB PORTAL** [Login](#)

**Application for .Net Developer**


Actions  
List Advertisements

**Full Name\***

**Email Address\***

Cover Letter

Resume (pdf)  
Browse... No file selected.

Prove you are a human  
 [Reload image](#)  
 Please enter the numbers

Submit

[Cancel](#)

Copyright © 2015

Figure 18: Apply for job without login

The page shown in Figure 18 only appears if a job seeker is not a registered user and he/she wants to apply for any specific job without logging in to the application. This will limit their access to a basic user, and they need to fill every time all their information including resume and also they are not able to keep the record of all applied positions. The email address the user provides should be a valid address, so that if an employer wants to contact them, it is possible via this specific email address.

#### 4.5.4 Job Application Email

After a job seeker has applied for a job, the employer will receive an email with all the details of the applicant. It also contains the resume as an attachment in the .pdf format. Figure 19 shows a sample of an email an employer receives including the email address, message from applicant and an attached CV in the .pdf format.

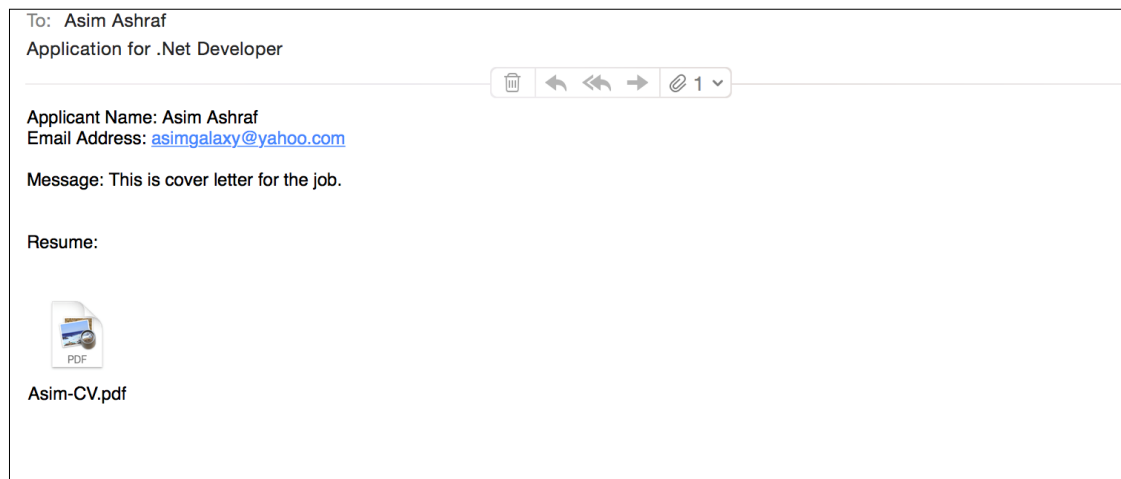


Figure 19: Job application email

The employer can then go through the CV and contact the applicant with the email address in the email.

#### 4.5.5 New Advertisement

When government agencies, private businesses, universities and non-profit organizations want to post a new job advertisement they need to click the new advertisement button on the main page. This button opens a new page where they can fill in the information regarding the job post including the publishing and expiration date of the advertisement. Figure 20 shows the web page that an employer needs to fill. All the fields that have (\*) sign are mandatory and in the end employer should provide their valid email address where they will get the email including the URL link to the specific job post.

Figure 20: New advertisement page

Usually companies fill out this page to make a new advertisement of the job position. This page also contains list advertisements button that navigate the user to the main page of job portal.

#### 4.5.6 New Advertisement Email

After the employer successfully fills in all the information on the new advertisement page, an email containing a URL link and a password is sent. Figure 21 illustrates the email that an employer receives after publishing a new job post.

Figure 21: New advertisement email

Figure 21 above shows the link that the employer clicks to update or delete the post. To access that specific post, the user needs to enter the password that comes in the email. Figure 22 shows the page that will appear when employer clicks the link from the email.

The screenshot shows a web interface for a 'JOB PORTAL'. At the top, there is a dark blue header with the text 'JOB PORTAL' in white. Below the header, the main content area has a white background. On the left side, it says 'Login to Edit post'. On the right side, there is a blue link labeled 'Login'. In the center, there is a large, empty white rectangular input field for a password. Below this field, there is a green button with the word 'Login' in white text.

Figure 22: Login page to edit/delete job post

After the user enters the password he/she will be redirected to that specific job advertisement to perform either edit or delete function.

#### 4.6 Registered Users

The other part of this job portal is as of registered users. Here the user needs to register before being able to use the full service of this web application. One-time registration helps the users to log in with their credentials (email and password) and use the service.

When users register themselves as jobseekers or employers, they can access and update/delete their personal data what they provide only at the time of registration. The registered users can log in and log out from the job portal and can access the relevant information based on their membership type i.e. either jobseeker or employer.

When users sign in as a jobseeker they can have access to special facilities that the non-registered users are deprived. These facilities are:

- **Security management:** Users can change their old password and replace it with now one.
- **Profile management:** The registered users are able to view their profile and can edit or delete it, if necessary.

- **Resume management:** The registered jobseekers create their resume to indicate their skills, abilities, and qualifications.
- **Upload CV:** The jobseekers can upload their CV as a pdf file to show it to the potential employers.
- **Search and save jobs:** The search option is most important feature of this job portal where registered jobseekers can search for any job which have been uploaded into the portal by the employers and have the facility to save any number of jobs for apply later.
- **Apply for job:** When the users find a suitable job as per their qualification and skills, they can apply for it online.
- **Logout:** User can safely exit from the job portal by clicking the logout link and return to the main page of job portal.

Employers, who are registered with the job portal, also have more features as compared to open users. The security, management profile, search and logout functions are similar to that of the jobseekers, functions that differ from jobseekers are:

- **Job offer management:** The registered employers can create and publish new job advertisements on the job portal, and they also can edit or delete any of their published posts.
- **Review applications:** Employers can view the CV and job applications of registered jobseekers and also contact directly the jobseeker if he/she is found suitable for the position.

Registered users always have more control on the system as compared to open users, as they just need to enter their information only once.

### 4.6.1 Registration

Both employers and job seekers have the opportunity to register themselves to get the benefits of the application. They can register by providing basic information including name, email, password and role.

Registered employers have the opportunity to see all the record of their posted job advertisements, browse the resumes of registered job seekers, and keep track of statistics of the applied jobs. They also have the facility to edit or delete their job advertisement.

Registered job seekers need to upload their details only once with their resumes and other attachments. After one-time registration, they only need to login to the system, search for jobs and then simply apply to any job post with only one click. Figure 23 shows the Add new user page when the user clicks the Register your self-button.

The screenshot shows a web interface for adding a new user. The header is dark blue with the text 'JOB PORTAL' and a 'Login' link. On the left, there is a sidebar with the heading 'Actions' and two buttons: 'List Advertisement' and 'Login'. The main content area is titled 'Add User' and contains the following fields:

- Display Name\***: A text input field.
- UserName (Email)\***: A text input field.
- Password\***: A text input field.
- Repeat Password\***: A text input field.
- Role\***: A dropdown menu with the text 'Select a role' and a downward arrow.

At the bottom of the form is a green 'Submit' button. The footer of the page is dark blue and contains the text 'Copyright © 2015'.

Figure 23: Registration page

The user needs to provide their name, a valid user name which will be their email address, password to access their account on the job portal and most important their role i.e. either jobseeker or company.

## 4.6.2 Activate Registration

When new users register to the system, they receive an email containing a link to the user activation page. This link works only once, as this is to check if the registered user is the actual user. Figure 24 shows the confirmation page after user registered, this page acknowledges that the user successfully registered on the system and an email has been sent to the user on their given email address.

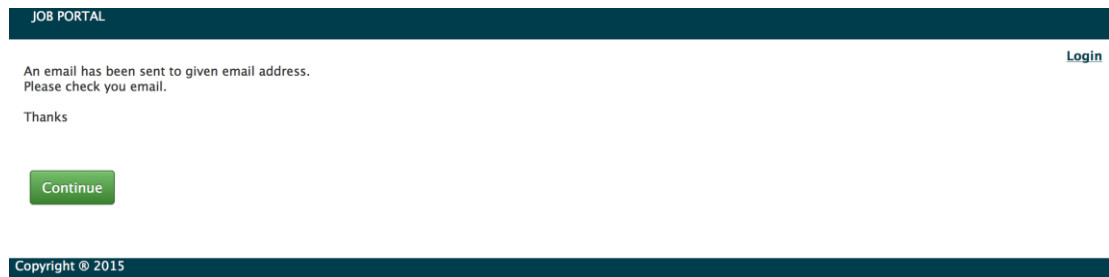


Figure 24: Activation page

The user will get an email to their provided email address with the URL link. They just need to click that URL link to activate the registration process. Figure 25 shows the email example the user gets.

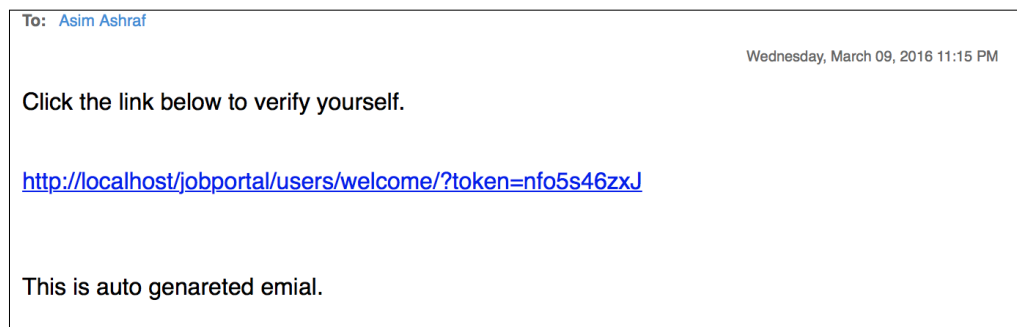


Figure 25: Activation Email

The URL that comes in an email contains the token with unique value that will be expire after the user clicks the URL.

## 4.6.3 Login

After successful registration, users are able to login via the login button. The login page simply lets the registered users to log in the system after authenticating them by match-



ing their username (which is their email address) and the password. See Figure 26 for the login page.

JOB PORTAL Login

**Log in**

UserName (Email)\*

Password\*

Login

[Forgot Password](#) / [Register](#)

Copyright © 2015

Figure 26: Login page

This page contains the forgot password link, if the user cannot remember or has lost the password and also has the register link to register new user.

#### 4.6.4 Forgotten Password

This functionality facilitates the users to get a new password if they lost or forgot their password. The user needs to provide the same email address which was used while registering. The user will get the new one time use random password in their email. Figure 27 shows the web page the user sees when clicking the Forgot password link.

JOB PORTAL Login

**Forgotten Password**

User Name (Email)\*

Recover

OR

[Register your self](#)

Copyright © 2015

Figure 27: Forgotten password

This is an important feature in any web application where the user needs to login and give their username and password.

#### 4.6.5 Registered Jobseeker

After the users register themselves as a job seeker, they can login to the application with their credentials, which they provide during the registration phase. Job seekers need to provide their personal and academic information and also upload their resumes only once. They can then search for the job position and can apply to any job with their information that is stored in database. They can edit or delete their data anytime they want.

Registration helps the user to post their information only once, and this is very handy for the employers as they can only see the registered job seekers information in the system. Job seekers can keep the track of their applied positions and they also have the option of receiving the interesting jobs email to their email address. Figure 28 shows the page after user login to the system.

The screenshot shows a web interface for a 'JOB PORTAL'. At the top right, there is a user profile link: 'Test Job Seeker (Logout)'. On the left side, under the heading 'Actions', there are two buttons: 'List Advertisement' and 'Own Record'. The main content area is titled 'Users' and contains a table with the following data:

Display Name	User Name	Role	Actions
<a href="#">Test Job Seeker</a>	Student	asim.ashraf@metropolia.fi	<a href="#">View</a> <a href="#">Edit</a> <a href="#">Delete</a>

At the bottom of the page, there is a footer: 'Copyright © 2015'.

Figure 28: Registered jobseeker page

After login, the users can find their information page where they can check their own profile and CV, they also have the option of updating or delete their personal data from the job portal.

## 5 Testing

Testing is the process used to validate and verify the system. It is one of the main phases in the development of the job portal to ensure that they system runs successfully, fulfill the requirements and achieve all the objectives. With the help of testing any bugs and errors in the system can be removed. A test plan is required to test the entire system or a component of the system and identify the client requirements. The main objectives of testing are:

1. To establish the software worked satisfactorily as per client's requirement.
2. To be sure that the application is error free and user friendly with proper validations.
3. To certify that all the components of application function correctly and could be used in production.

A web-based application is mainly related with web user interfaces (UIs). The black box testing methodology is used to check the UIs functionality according to the test plan.

### 5.1 System Testing

The testing was carried out on the fundamental parts of the application design and implementation. The following cases were tested:

- Browser compatibility
- Form submission
- Login request
- Responsive table
- Add New Advertisement
- Register as a new user
- Login as job seeker / employer.

Figure 27 shows the test scenarios with their respective test steps, expected results and actual outcomes.

<b>Scenarios</b>	<b>Test step</b>	<b>Expected result</b>	<b>Actual outcome</b>
Browser compatibility.	Tested application on all popular web browsers like Chrome, Firefox, IE 11 and safari	All pages should load in clean manner with no overflow.	Application runs smoothly in clean manner with no overflow.
Form submission	Forms need to be filled with correct and incorrect values	Validation should display error to the user and accept correct input.	Validation worked fine on all form fields.
Login request	Provide all kind of values to the login page.	Login should be successful only for the registered users.	Login page test passed.
Responsive layout	Run the application on different devices (mobile, tablet and pc)	Display should be responsive and shows all the required fields	Application works fine with all screen resolutions.
Add new advertisement	Add a new job advertisement without login as employer.	Job advertisement should be added to system and user should get email with edit/delete link.	Post added into system and user got email with working URL link.
Register as new user	Basic information for registration page has been provided.	User registration should be working properly with username as a valid email address, and user should get email to confirm their identity.	Registration successful and user got email with confirmation link.
Login as job seeker / employer	Username (email address) and password has been provided and user was successfully	User should be able to login successfully after providing their login credentials.	Login to the system was successful.

	logged in to system.		
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Figure 27: Table for test scenarios

As can be seen in Figure 27, various tests were carried out throughout the development of the application, these tests were accomplished in different cycles. The first test was carried out in the coding phase, using the Mozilla developer toolbar that allows the simultaneous inspection for code elements. The job portal responsiveness was also tested using the Mozilla responsive view, different devices were simulated and a close behavior was predicted in what the outcome would look like. The outcome of the testing phase helps a lot in fixing any errors and bugs in the application.

## 5.2 End User Testing

In the final phase, end user testing has been carried out to evaluate whether the developed system satisfies the user's requirements. End user testing took place in different parts of the job portal:

- **Interface:** This includes the graphical part of job portal such as use of style sheet, font, icons, buttons, tables and web forms in designing the interface.
- **Usability:** A common technique, that can be used to evaluate a system by testing it on the users, is usability testing. With the help of this technique it was easy to measure a human made product capacity to meet its expected goal.
- **Performance:** Performance testing is used to determine the speed and effectiveness of the software. The job portal was designed to help jobseekers to choose the relevant jobs to their intended field.

It is crucial to have end user testing before the system is released. This can provide help to identify problems that the target user might face. In addition, any small change to improve the application might make a big difference to the quality of the system.

## 6 Conclusion and Future work

It can be concluded that the job portal web application was a true learning experience. The principles of software development were well implemented throughout the system. The job portal was made as user friendly as possible making it more flexible and reliable.

The major goal of the research was to understand the meaning, features and categories of web portal as a knowledge management. This objective was achieved with the help of analysing the literature review that provide knowledge on the components of web portal.

The project involved the practical work of designing and developing the web based job portal application. The main challenge for the project was the complexity of the whole system architecture. The use of the CakePHP framework as the backend tool was very beneficial because there is a lot of online support and also in form of books. This information made it easy to overcome shortcomings during the application development. Another great feature of using CakePHP was that it is very easy to use with MySQL, as the job portal application depends on data manipulation the database part of the application was relatively easy to develop and manage with PHP and MySQL.

In the process of developing the system the required knowledge was gained in several aspects, e.g. software development, software testing, writing test cases and documentation. The biggest advantage of developing this job portal using the CakePHP framework was the learning phase of a PHP framework that made it very easy to use all the libraries and classes that come with the framework.

The job portal also provides a unique feature while acting as online-recruitment system, that links to the industry to allow companies to publish their job vacancies on the job portal. In this way jobseekers can obtain enough information to make good decision regarding their future career. Information has been collected from journal articles, books, research papers and Internet to achieve the goal. During the study, many different job portals were visited online to analyze and compare their features.

## 6.1 Limitations

Every system has some weakness and drawbacks; no system can satisfy the user's entire requirements. The research identified the main limitations in the study. By comparing the new job portal with the well popular job portals in the market, such as monstor.com, uranus.fi, cv.ee or eurojobs.com, the research concludes that the developed job portal can be further improved with additional services. For example, there are various tests in some job portals to determine the abilities of the jobseeker in different fields. In addition, the system needs an extra feature to amplify the communication between users and the portal such as embedding an alert service into the job portal. For example, cv.ee sends updated information and job vacancies to the registered jobseekers every day through email based on their resume and skills.

## 6.2 Future Work

Future work focuses on the areas that have to be developed further so the job portal can be more beneficial with further enhancements. Such features, amongst others, are as follows:

- **Graphic improvements:** The design of interface needs to be improved to make the user interface more attractive.
- **Mobile application:** A native mobile application can be made in future to facilitate the users to use the job portal easily and more effectively.
- **Payment based:** A payment method should be introduced to earn money from companies and also through advertisements.
- **Data Backup:** Data should be backup properly on daily basis to make sure that the user will not lose any data in case of system crash.

Although the research objectives were achieved, the job portal can be further improved by adding chat and reporting facilities. The system was developed and evaluated by the end users.

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