



# DEPLOYMENT OF MVC FRAMEWORK AS A MULTI-TIER ARCHITECTURE FOR THE DEVELOPMENT OF A FUTURISTIC COLLEGE WEBSITE (A CASE OF COMPUTER SCIENCE DEPARTMENT, UNIVERSITY OF CALABAR)

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## Abstract

This research paper considered the development of multi-tier architecture for a futuristic College website using the Model-view-controller (MVC) framework. The Department of Computer Science University of Calabar, a case study of this paper, so far has not utilize the advancement in web technology in terms of information dissemination, and has limited publicity on the internet. The aim of this paper is to develop and build a College website using MVC supported Framework. The main goal is to explore and unravel the strength of the MVC architecture in futuristic website design and develop a dynamic college website to provide a platform to exchange ideas and information using a blog where meaningful and thoughtful articles can be shared. The MVC is a pattern used in software engineering to separate application logic from user interface. The system was developed using HTML intermixed with java programming language and script interpreted by an engine (Dynamic web pages).

## 1.0 Introduction

A website is a collection of related web pages, including multimedia content, typically identified with a common name domain and published on at least one web server. Websites have many functions and can be used in various fashions; a website can be a personal website, a commercial website for a company, a government website or a non-profit organization website. Websites can be the work of an individual, a business or other organization, and are typically dedicated to a particular topic or purpose, ranging from entertainment and social networking to providing news and education. All publicly accessible websites collectively constitute the www (World Wide Web), while private websites, such as a company's website for its employees, are typically a part of an internet (Beard, 2015). Web pages are accessed and transported with the Hypertext Transfer Protocol (HTTP), which may discretionarily employ encryption (HTTP Secure, (HTTPS)) to provide security and privacy for the user. The user's application, normally a web browser, renders the page content according to its HTML markup instructions onto a display terminal. (Castle design solution, 2016).

Apart from academic website being a marketing tool, conveying information to students and prospective students, one of its most important benefit is as an valued means of communication to existing families of the school keeping them informed of school policies, events ,etc (school trend, 2016). Studies have shown that, in a survey conducted, 46% of respondents said internet is important in the choice of school, while 33% said the internet was the first place they learned about their schools. A lot of people got to know the location of their intending schools, facilities, courses, admission requirements and staff strength through internet (Beard, 2015).

Contemporary web pages are becoming more dynamic, supporting scripts, and user interfaces are design using technologies such as AJAX to replace the traditional page reloads. The source explorer's issues of security, scalability, and cross-browser are supported and enterprise-level development of websites, as well as third party hosting virtualization, collation in data centers, firewalling and load balancing are far appropriating the trend of contemporary web pages (Malan, 2012).

According to mahmoud (2003), java developers love java server pages (JSP) and Java Servlet technologies because servlets and JSP pages help separate prevention from content, and one of the best practices is Model View Controller (MVC) design pattern. Model-view-controller (MVC) is a pattern used in software engineering to separate the application logic from the user interface.

As the name suggest the MVC pattern has 3 layers. The model defines the business layer of application and the controller manages the flow of the application. In web application with java, the model consists of simple java classes, the view consist of JSP and the controller consist of servlets (Oscar's code, 2015).

## **2.0 Multi – tier Architecture Framework in Web Base Application**

In software engineering, multi-tier architecture, normally called n-tier architecture, refers to a client–server architecture in which the presentation, the application processing, and the data management are logically separate processes. An application that uses middleware, for instance, to service data requests between a user and a database employs multi-tier architecture.

The most commonly use of multi-tier architecture is the three-tier architecture. N-tier application architecture provides a model for developers to create a flexible and reusable application. By breaking up an application into tiers, developers only have to modify or add a specific layer, rather than have to rewrite the entire application over (Panday, 2013).

There should be a presentation tier, a business or data access tier, and a data tier. The concepts of layer and tier are often used interchangeably. However, one fairly common point of view is that there is indeed a difference, and that a layer is a logical structuring mechanism for the elements that make up the software solution, while a tier is a physical structuring mechanism for the system infrastructure. Today website should be design in such a manner so that graphical user interface (UI) will be separated from the business logic, and can be created independently by any designer or developer. One more imperative conception is to separate data access layer from any business logic, in most cases by using Entity Framework this is less of a problem as Entity Frame already have this end separate (Panday, 2013). The architecture of the website following this separation concern looks in form of the layout below.

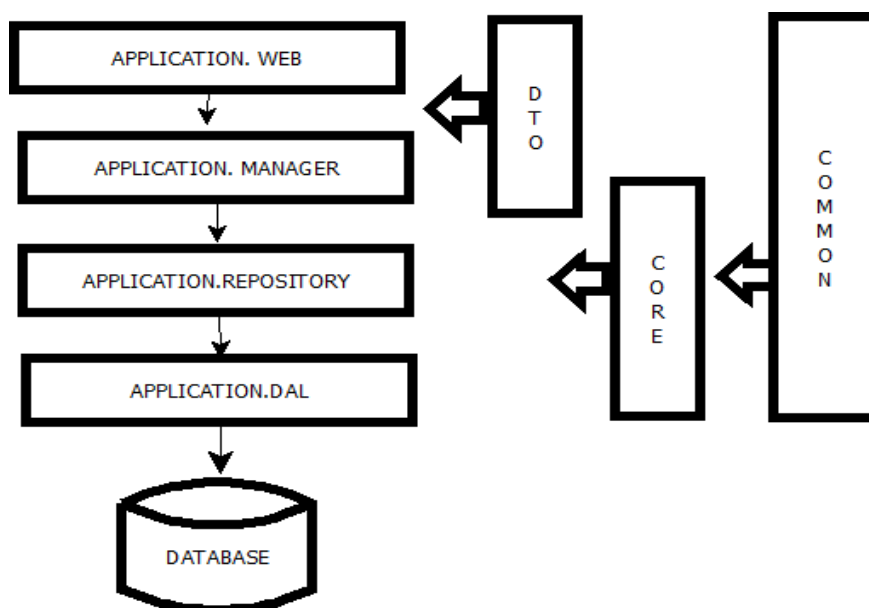


Figure 1: Entity Frame Architecture

The benefits of using web framework is that it removes the need of boilerplate code (that is, getting HTTP Request parameters, validation and conversions, update and models); use for standard code level design for multiple applications in an enterprise navigation flow and validations; no web application component design, but uses web framework as design templates and plugin the view, model and controller; and it speed the development (Chintalcheru, 2013).

### 3.0 Web MVC Framework

Because of the expedition for developers over the years, to separate style from substance in website development, and user interface from application logic, the need for the EF is inevitable for a college website implemented in Object-Oriented style. The Model View Controller (MVC) design pattern is a way of separating the user-interface from the substance of the application. Among of the biggest changes that happened in the recent years, is the use of MVC pattern for developing software or web application. The Model-view-controller shortly known as MVC is a software architectural design for implementing user interfaces on computers. The MVC pattern is a great architecture no matter whatever the language you are using for the development (Pardaz, 2016). Figure 2 shows a typical MVC framework with three tier architecture.

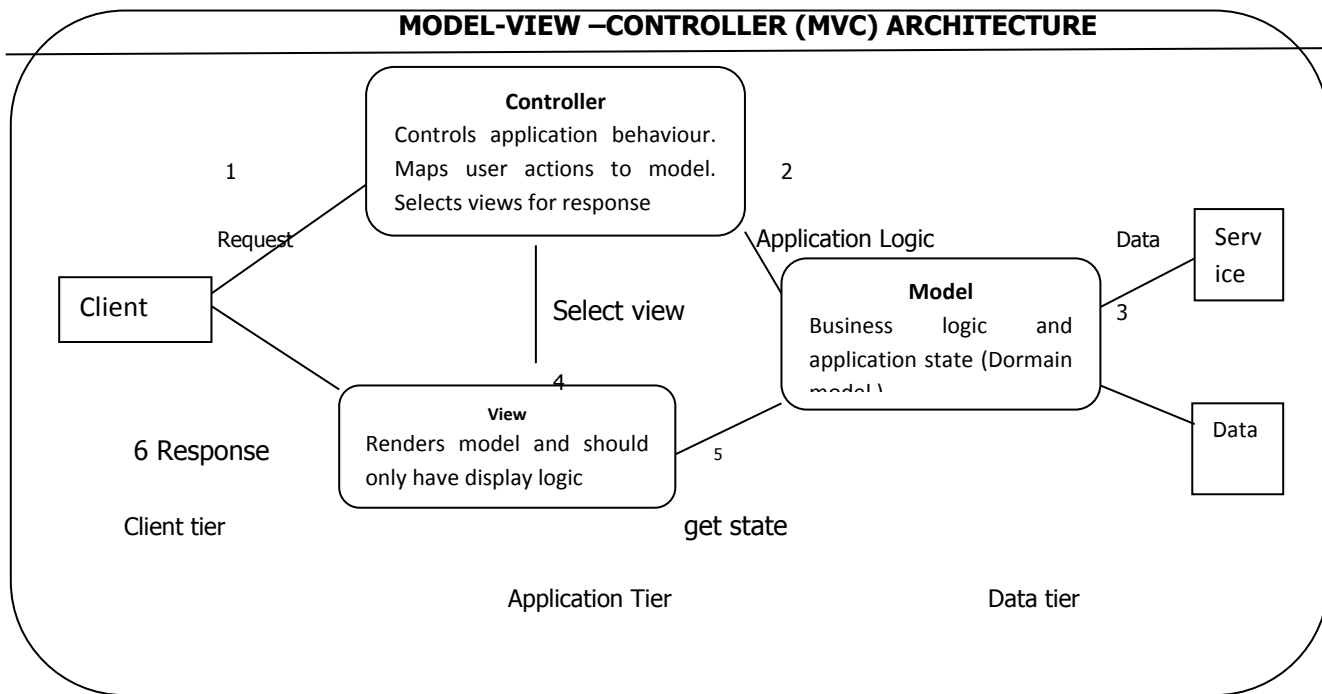


Figure 2: MVC Framework with Three Tier Architecture

Web MVC Framework includes Struts, JSF, Wicket, DDUI and SpringMVC. The SpringMVC is an action-based or request-based framework similar to Struts. JSF is a component-based framework. The action-based and component-based MVC framework architecture and code structures are shown as follows.



Figure 3: Action – Based MVC Framework

```
Public class LoginAction. . . {
    Public view execute(HttpServletRequest request, HttpServletResponse) {
        ...
    }
}
```

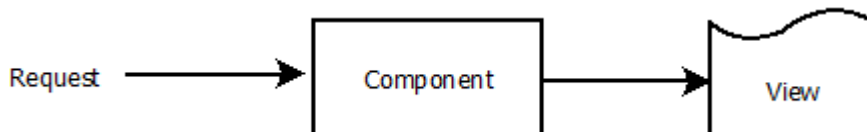


Figure 4: Component – Based MVC Framework

```
Public class ActionController. . . {
    Public view Login(String username, String password) {
```

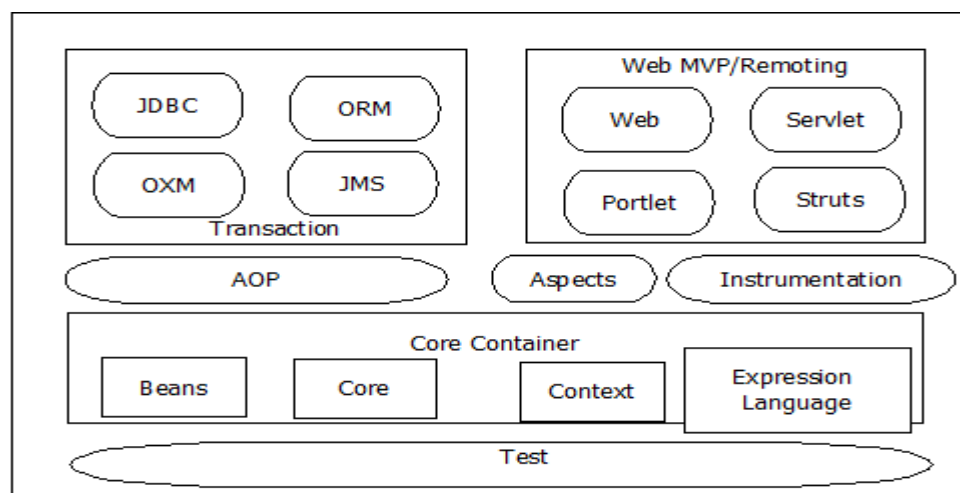
```

...
Public view Logout {
}
Public view getAccount() {
...
}
}

```

SpringMVC forces concrete inheritance of Action/ActionForm, taking away single short of inheritance in java. A S

Spring MVC is based on Interface and Annotations. It is truly view agnostic. It uses Spring IoC container from presentation Tier to Integration Tier. Spring MVC is only one module in the Spring Framework. JSF is part of a JEE specification. It is based on component architecture. Limited HTTP GET method support in JSF, while REST web Service supports in Spring MVC (Chintalcheru, 2013).



**Figure 5: Spring MVC Action Flow**

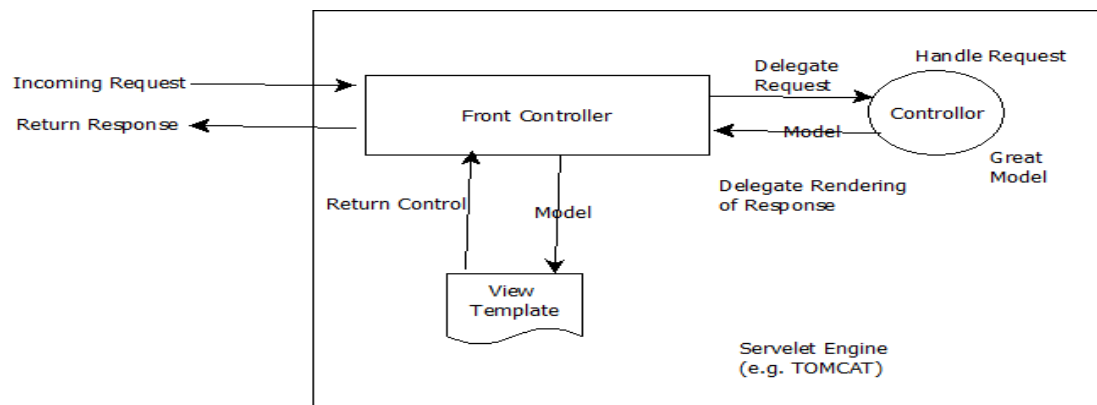


Figure 6: Spring MVC Request Flow

Controllers are components that are being called by the Dispatcher Servlet for performing page level logic and delegate to service objects.

#### 4.0 System Design and Methodology

System design is the process of defining the architecture, components, modules, interfaces and data for a system to satisfy specific requirements. In this paper, the proposed system is developed based on the concept of Extreme Programming (XP). Extreme Programming empowers your developers to confidently respond to changing customer requirement, even late in the life cycle (Edim, 2015). Extreme Programming is one of the several popular Agile processes.

The gathering of information needed for the prototype development in this paper was done through both quantitative and qualitative methods. Interviews were conducted with NACOSS executives and members including other stakeholders in the Department. Data were also gathered from the internet, books, magazines and journals. Following the application of MVC framework, a software architectural design for implementing user interfaces on computers, in the development of the website, the prototype website was developed using object oriented methodology. The unified modeling language (UML) as a standard visual modeling language was used as the modeling notation to specify the behavior of the system (Ele et al, 2017). The system was implemented using HTML inter-mixed with java programming language and script interpreted by an engine (Dynamic web pages).

## 4.1 Database Design

A Database management makes it possible for Administrator to create, read, update and delete data in the database. Among several other records, the following entities exist in database, Admin, User, Time\_Table, and courses.

### Login\_Table

S/N	FIELD	DATATYPE	WIDTH	NULL	PRIMARY KEY	FOREIGN KEY
1	USER_NAME	VARCHAR	15	NO	NO	NO
2	PASSWORD	VARCHAR	100	NO	NO	NO

### Admin\_Table

S/N	FIELD	DATATYPE	WIDTH	NULL	PRIMARY KEY	FOREIGN KEY
1	Adm_ID	INTEGER	15	NO	YES	NO
2	NAME	VARCHAR	100	NO	NO	NO
3	DATE_OF_BIRTH	DATE	20	NO	NO	NO
4	SEX	VACHAR	7	NO	NO	NO
5	ADDRESS	VACHAR	255	NO	NO	NO
6	EMAIL	VACHAR	50	NO	NO	NO
7	GSM	INTEGER	15	NO	NO	NO

### User\_Table

S/N	FIELD	DATATYPE	WIDTH	NULL	PRIMARY KEY	FOREIGN KEY
1	REG_NUM	INTEGER	15	NO	YES	NO
2	NAME	VARCHAR	100	NO	NO	NO
3	DATE_OF_BIRTH	DATE	20	NO	NO	NO
4	SEX	VARCHAR	7	NO	NO	NO
5	ADDRESS	VARCHAR	255	NO	NO	NO
6	EMAIL	VARCHAR	50	NO	NO	NO
7	GSM	INTEGER	15	NO	NO	NO
8	DEPARTMENT	VARCHAR	50	NO	NO	NO
9	LEVEL	INTEGER	5	NO	NO	NO



**Time\_Table Table**

S/N	FIELD	DATATYPE	WIDTH	NULL	PRIMARY KEY	FOREIGN KEY
1	Time_ID	INTEGER	15	NO	YES	NO
2	TIME	TIME	15	NO	NO	NO
3	COURSE_CODE	VARCHAR	10	NO	NO	NO
4	COURSE_TITLE	VARCHAR	100	NO	NO	NO
5	COURSE_VENUE	VARCHAR	50	NO	NO	NO
6	DAYS	VARCHAR	15	NO	NO	NO
7	CLASS	VARCHAR	20	NO	NO	NO

**Time\_Table Table**

S/N	FIELD	DATATYPE	WIDTH	NULL	PRIMARY KEY	FOREIGN KEY
1	COURSE_ID	INTEGER	15	NO	YES	NO
2	COURSE_CODE	VARCHAR	15	NO	NO	NO
	COURSE_TITLE	VARCHAR	50	NO	NO	NO
	COURSE_LCT	VARCHAR	10	NO	NO	NO
	COURSE_VENUE	VARCHAR	100	NO	NO	NO
	COURSE_UNIT	VARCHAR	50	NO	NO	NO
	CORSE_TIME	TIME	20	NO	NO	NO
	DAYS	VARCHAR	15	NO	NO	NO
	LEVEL	VARCHAR	20	NO	NO	NO

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## 4.2 Use Case Diagram

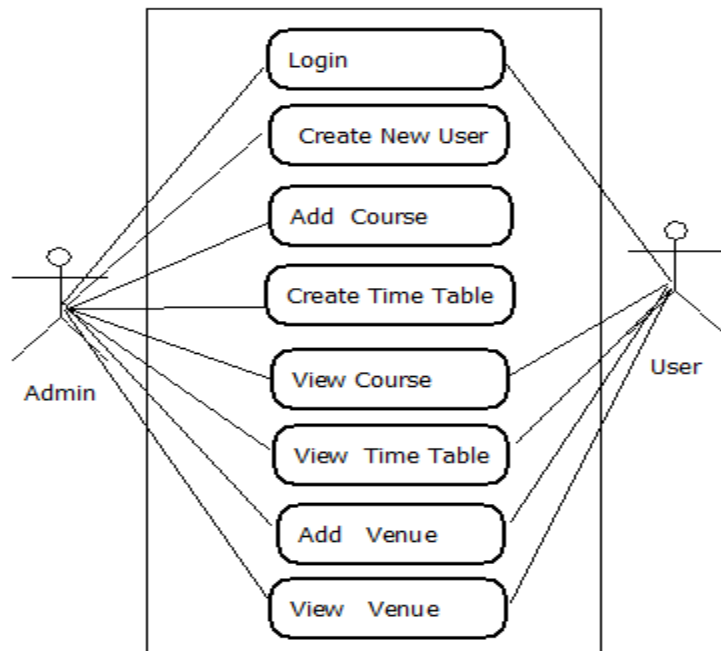


Figure 7: MVC Web application Use Case Diagram

## 4.3 Activity Diagram

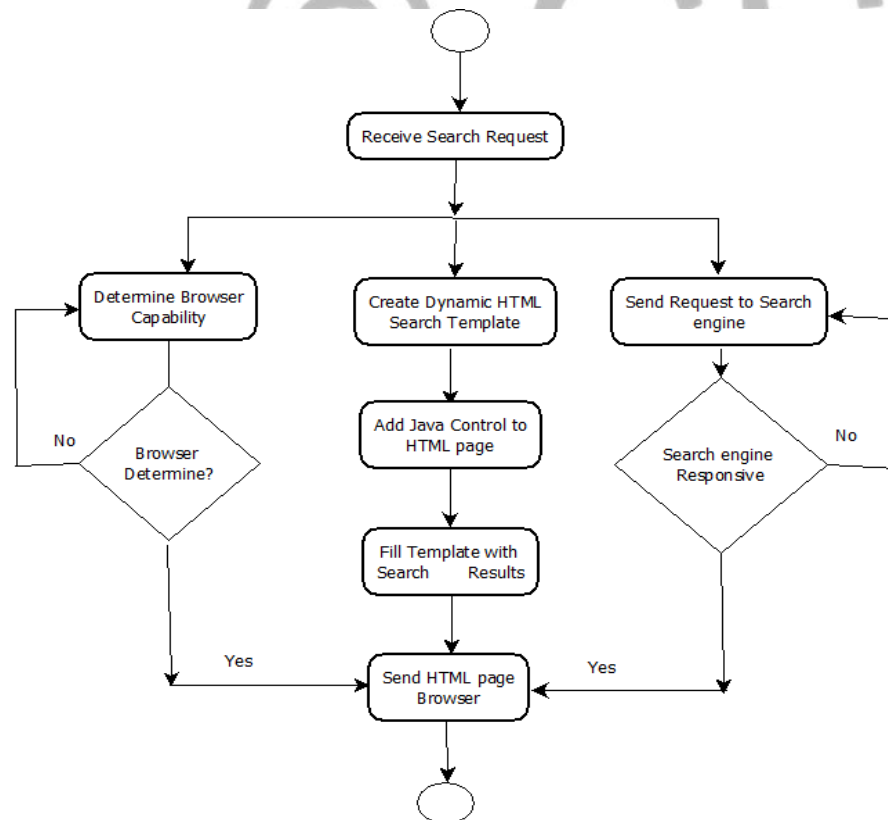


Figure 8: MVC Web application Activities Case Diagram

## 4.4 Sequence Diagram

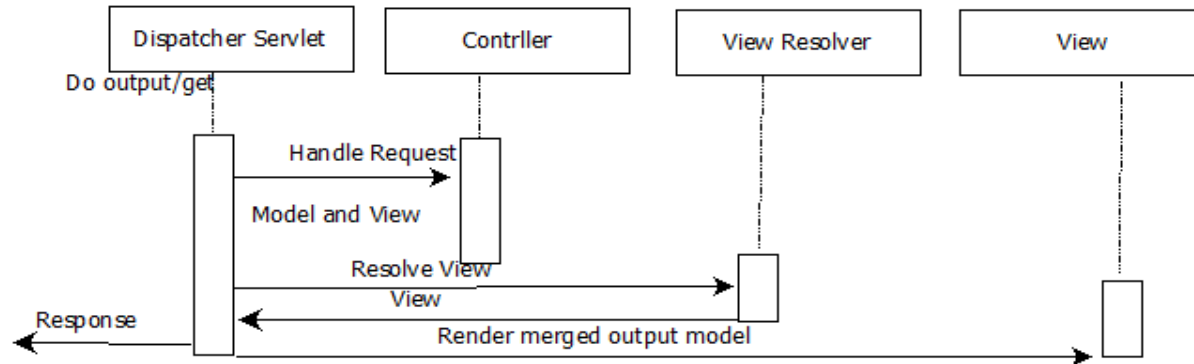


Figure 9: MVC Web application sequence diagram (from Walsh, 2010)

## Implementation and Results

The MVC College website has been implemented using HTML inter-mixed with java programming language and script interpreted by an engine. The application have been tested using different test data and by several stakeholders. The output results are shown in the screenshot below.

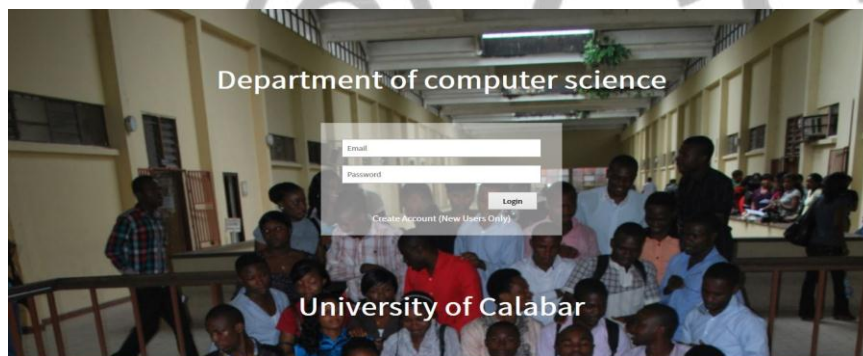


Figure 11: Login window

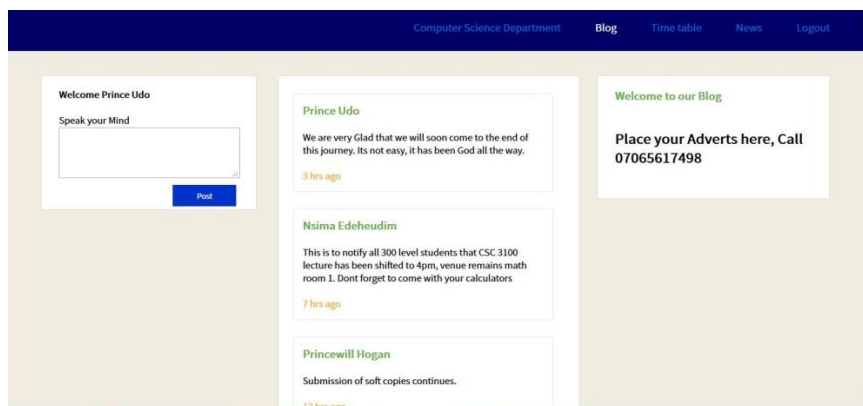
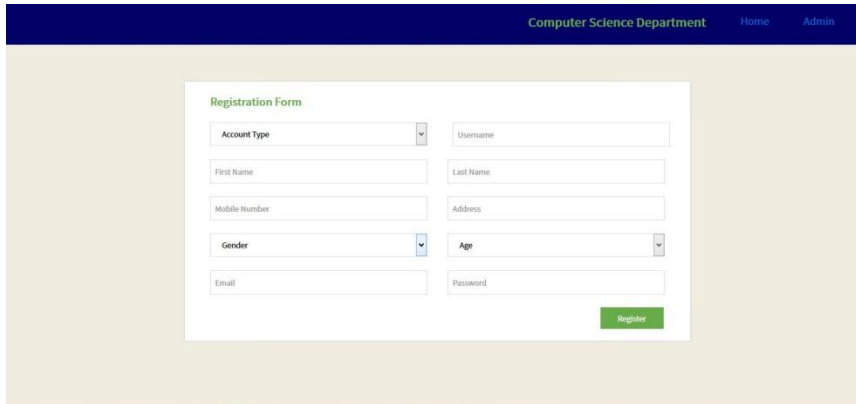


Figure 11: Main window



**Figure 10: Screen shot of the registration page**

## **Conclusion**

The proposed system has been developed using the MVC framework. The prototype website was developed using object oriented methodology. The unified modeling language (UML) as a standard visual modeling language was used to model the notation and specify the behavior of the system. The Department of Computer Science University of Calabar has a static notice board where information is posted regularly, the website developed in this paper will enable the administrator to handle the management of information on the website and will allow user to login to the website and browse through various web pages as opposed to the current method of information dissemination.

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