A Collaborative Learning Approach for Integrated Time Based Online Environment

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A Collaborative Learning Approach for Integrated Time Based Online Environment

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***Abstract*—this paper is based on the use of group work to facilitate learning in tertiary institutions. A collaborative learning approach for integrated time based online environment is developed for both students and their project supervisors to eliminate or reduce lapses. The web application enables a project supervisor or lecturer to create and assign tasks to students in groups, specifying the time for collaborative activities at which the members of the group are expected to login to the website and work cooperatively and collaboratively under the supervision of the supervisor or lecturer. Rapid Application Development (RAD) methodology is used. The model is implemented with the PHP Framework which handles the server side and Bootstrap for HTML, CSS, JavaScript and jQuery which handles the frontend. MySQL is employed for the database management. After the implementation of the system, it was tested with some input queries and the result shows that the system is effective and realistic. Hence, the proposed system offers a solution to the defects of the traditional collaborative learning to lecturers as well as students.**

Keywords— Collaborative learning, time based, learner-centered approach, online learning environment

I. INTRODUCTION

Nowadays, problems faced in industries and academics have become increasingly complex. The ability and skills needed to solve these problems are often not taught in the usual teacher-centered approach. Problems typically taught in schools often are well-structured that lead to predetermined or fully predictable results. The ability to solve well-structured problems does little to increase the relevant and critical thinking skills, which are very important for students to solve problems they will face in their future work, community, and personal lives. In addition, problem solving today is often the collaborative activity of a multi-disciplinary team [1]. Unfortunately, learners taught in a teacher-centered learning approach are not adequately prepared when they face real-world problems. A revolution in education is taking place, in which we see a shift from the teacher-centered approach to the learner-centered approach [2}. The underlying philosophy is that people learn best when they actively engage in acquiring the knowledge and skills, which they need to solve the problem at hand. Learner-centered is often accompanied by a problem-based approach [3]. In the past decade, many systems have been developed to support collaborative learning approach in computer-based learning environments. This paper aims to develop an approach and a computer-based learning environment for the support of collaborative learning, a typical learner-centered approach.

II. LITERATURE REVIEW

In this section, we review related works in the literature on collaborative learning.

The improvement of e-learning education has already been executed in many institutions. Computational system was proposed to resolve the difficulty of learning programming by examination of several educational computer tools [4]. Mindstorms as a case study was proposed in [5]. This method provided an educational environment to motivate students to learn computer programming and robotics. Visual based-programming language and an online community where students can create their own interactive stories, games and animations is proposed in [6]. It helps the students to learn how to think creatively, to resolve systematically and to work collaboratively. Although, systematic learning support environment is required, learning motivation of each student is essential important to learn in earnest. The use of e-learning system and contents learning in order to address the problem that occurs in actual classes teaching programming is presented in [7].

III. THE EXISTING SYSTEM

In the past decade, a lot of systems for supporting education have been developed and used. Most of them were developed to realize teacher-centered learning as on-line services. That is, the knowledge to be transferred is prepared by teachers or experts before delivery. Some systems allow learners to access the prepared online

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information by browsing or following the predefined structure of the information such as Computer-Based Training (CBT), Web-Based Training (WBT), and Education MUD/MOO [8]. Some systems use artificial intelligent technology to develop intelligent agents that act as teachers or experts to teach students, such as in Intelligent Tutoring Systems (ITS) [9]. Some systems are developed based on computer-mediated communication (CMC) technology (e.g., e-mail and electronic bulletin board) and intend to replace traditional classrooms by conducting an asynchronous class, such as in the Virtual Classroom (VC) approach [10]. Some systems enable on-line synchronous lectures by providing real-time communication channels (e.g., application sharing, chat room, shared whiteboard, and audio/video channels), such as in the Electronic Meeting System (EMS) [11]. All these types of teaching and learning support systems didn't attempt to support learner-centered learning. Most requirements to support collaborative/group learning cannot be met by these types of systems [12].

A. *Problems of the Existing System*

1) The Free-rider problem: whereby the non-performing group member reaps the benefits of the accomplishments of the remaining group members with little or no cost to the student.

2) Social loafing: leading to reduction in effort due to not being noticed or lack of identification in a group task.

3) The Sucker effect problem: this tries to make the competent students to avoid being "suckers". They make a calculation of whether or not they are the subject of free-riding from others in the group. If they are, and they feel it unjustifiable, they try to avoid being a "sucker" by reducing their own input to the task.

4) It leads to social dilemma.

5) These systems support large and loosely organized groups such as web user community. Hence cannot support intentional and scheduled collaborative learning activities.

6) There is little or no moderation of the topics discussed in the group.

IV. Proposed System

This paper proposes a collaborative learning approach for integrated time based online environment to combat the bottlenecks in existing systems and hence improve the quality of education.

A Collaborative Learning Approach for Integrated Time Based Online Environment (CLAITBOE) is a web based application designed for both lecturers and students. It will help lecturers to create and assign group task to students, track the progress of the group, hence enabling them to grade the students appropriately.

A. *Advantages of the Proposed System*

The benefits of the proposed system include the following:

- The proposed system will make the work of a project supervisor/lecturer easier by allowing the supervising of the students from the convenience of his home or mobile phone.
- It increases the sense of responsibility and hard-work because each member of the group will have a particular task assigned, thereby preventing free-riding, social loafing, sucker effect and social dilemma.
- Increases the students' interest in learning. The CLAITBOE will help students to actively exchange information, debate and negotiate ideas within their groups.

B. *Disadvantages of the Proposed System*

The limitation of the proposed model includes the following:

- This proposed model does not offer a virtual-based multimedia feature for conferencing

C. *Expectation of the Proposed System*

Since it is a time based system, the time for collaboration (i.e., usage of the web application) will be stipulated by the admin/supervisor. This will reduce the possibility of impersonation to an extent because the supervisor can direct questions to a student just to confirm his/her identity in a case of any suspicion. The new system will give the supervisor the ability to create work groups and assign task to students with a specified deadline. The system will also enable the supervisor to map/assign task to each member of the group thereby preventing free-riding in the group.

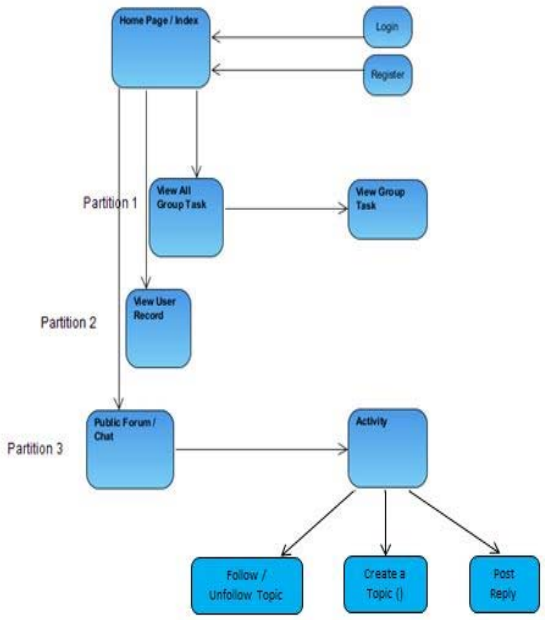

Fig. 1. High level model of the proposed system

V. Methodology

RAD model is Rapid Application Development model. It is a type of incremental model In RAD model the components or functions are developed in parallel as if they were mini projects. The developments are time boxed, delivered and then assembled into a working prototype. This can quickly give the customer something to see and use and to provide feedback regarding the delivery and their requirements.

The phases in the rapid application development (RAD) model are:

1) *Business Modeling:* The information flow is identified between various business functions.

2) *Data Modeling:* The information gathered from business modeling is used to define data objects that are needed for the business.

3) *Process Modeling:* Data objects defined in data modeling are converted to achieve the business information flow to achieve some specific business objective.

4) *Application Generation*: Automated tools are used to convert process models into code and the actual system.

5) *Testing and Turnover:* Test new components and all the interfaces.

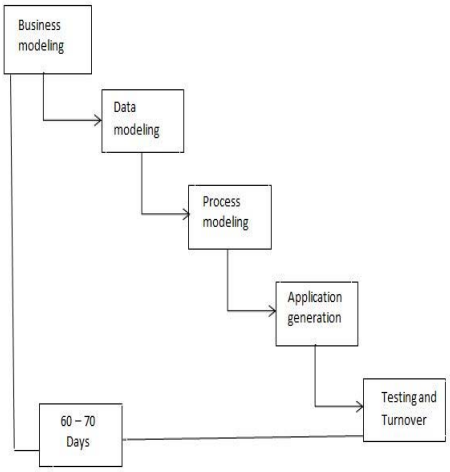

Fig. 2. Rapid Application Development Model

A. Justification of using Rapid Application Development Methodology

RAD is most appropriate development methodology for this paper, because of the following reasons:

- RAD encourages the development of systems that need to be modularized in 2-3 months of time.
- It is used in producing systems that has a development time of 2-3 months.
- It Increases the reusability of components.
- Reduces the development time.

VI. System Design and Implementation

The design of any system involves the three components of a computer system, which are input, process and output. The input and output are represented by the graphic user interface whereas the process design is depicted using design tools like flowcharts, algorithms and data flow diagrams, which show how the procedural flow of the system and how data is transferred between the components of the system and the conversions which are involved for the final output obtained.

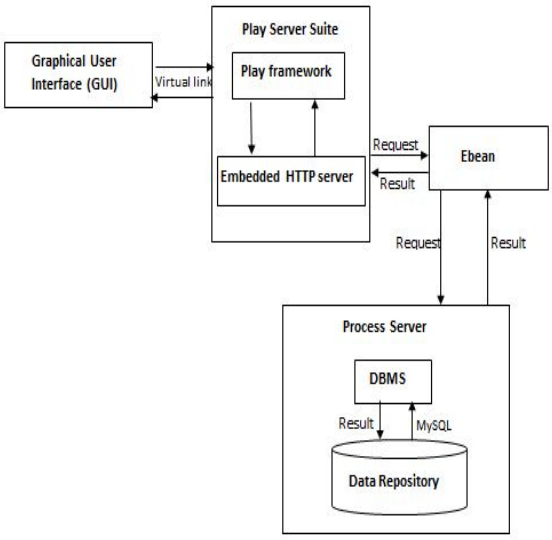

Fig. 3. Conventional System Design

A. Components Description

1) Graphical User Interface: This component of the system enables the user to interact with the system. They include: Login page, Home page, Navigation bar, Create Task View, etc. Tools for developing this component include HTML5, CSS and JavaScript and Bootstrap framework.

2) Server Suite: The server suite comprises of PHP. Its architecture embraces HTML5 client technologies; and Embedded HTTP Server which manages the entire network processes in the system and also all processes linking the system to another network.

3) Process Server: This comprises of the two components DBMS (Database Management System) which is responsible for the retrieval, inserting, operation and maintenance of Data in the data repository while data repository stores the actual data in the system.

VII. Architecture of the Proposed System

The new system workability will follow the model in figure 3 above. The activities to be performed by the students and lectures are well represented in figure 4.

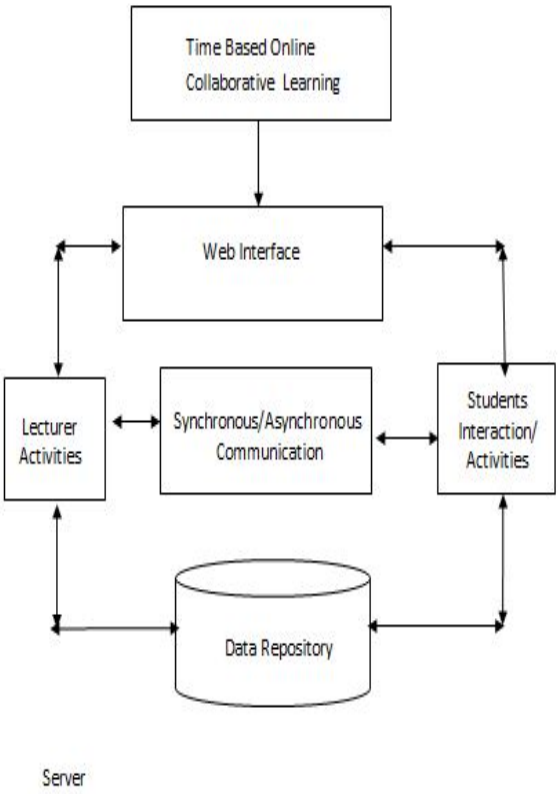

Fig. 4. The System Architecture for Collaborative learning Approach for Integrated Time Based Online Environment

A. Components Description

1) Forum: For an asynchronous communication between users.

2) Assigned Task: Shows the task assigned to a user.

3) Students Activities: Post comment or contribution, collaborate with group member to solve a given problem and ask questions for clarification.

4) Lecturer Activities: Supervises, reviews/evaluates the performances of the groups and members and can assist or suggest materials.

5) Protocols: They are features in the system program used to perform specific activities or functions in the representation based on context.

6) *Storage (MySQL):* A unique remote database for data storage mechanism.

7) *Server Infrastructure (Play framework):* Components communications are enabled here and allow access to privilege users to assess the database.

B. Site Map of the Proposed System

The figure 5 below shows the site map of the proposed system depicting the various means used by the users to access the system.

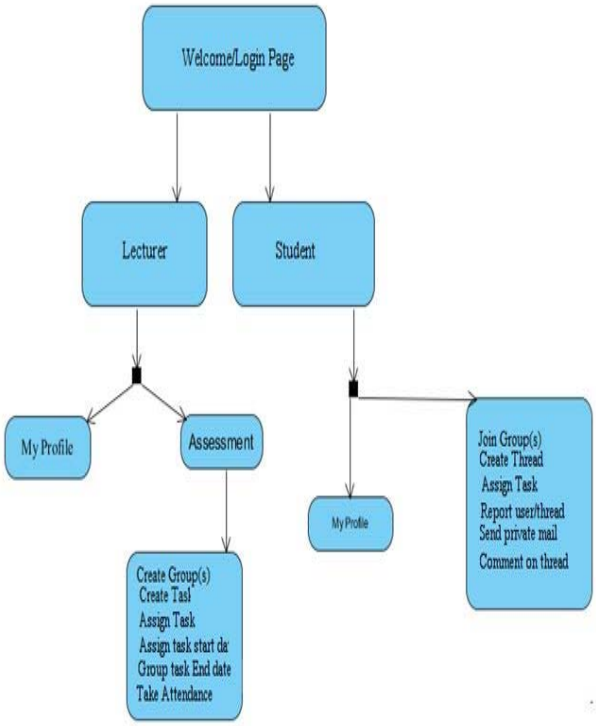

Fig. 5. Site Map for the Proposed System

C. Detail Explanation

1) *Log-in page*: Users will get access to the system with their usernames and password or can sign-up.

2) *Home Page:* This is the interface which the users reference to interact with the system.

3) Logout: Provides us with the change password and sign-out options.

4) *Students:* provides a platform where the students will be able to answer the questions, and carryout collaborative activities.

5) *Lecturer:* this provides the platform where the lecturers can view their profiles, create an assessment, set questions and then mark the questions.

6) *Create Task*: a platform where the lecturer can create and assign task.

VIII. Program Design

A. Database Design

The DBMS used in this paper is MySQL. The combination of PHP and MySQL database makes the program easily to work with and of better results.

1) LecturerDetails.dbf: This database file structure captures and stores lecturer/supervisor's details.

TABLE I. Lecturer Database File Structure

S/N	Field Name	Data Type	Size
1	lecturerName	Varchar	50
2	lecturerCourseTitle	Varchar	50
3	lecturerCourseCode	Varchar	10
4	lecturerDepartment	Varchar	20

5	lecturerSchool	Varchar	50
6	lecturerCurrentPosition	Varchar	15
7	lecturerEmailId	Varchar	20
8	lecturerOfficeAddress	Varchar	100
9	lecturerPhoneno	Varchar	11
10	NoOfStdentsAssigned	Integer	11

2) StudentDetails.dbf: This database file structure captures details of the students as shown below:

TABLE II. STUDENT DATABASE FILE STRUCTURE

S/N	Field Name	Data Type	Size
1	studentFirstname	Varchar	30
2	studentSurname	Varchar	30
3	studentMiddleName	Varchar	30
4	studentRegNo	Varchar	20
5	studentGender	Varchar	5
6	studentEmail	Varchar	20
7	studentPhoneno	Varchar	15
8	studentPhoneNo	Varchar	15

3) TaskGroup.dbf: This database file structure captures information about a task group.

TABLE III. TASKGROUP DATABASE FILE STRUCTURE

S/N	Field Name	Data Type	Size
1	groupId	Varchar	10
2	courseTitle	Varchar	15
3	courseCode	Varchar	12
4	groupQuestion	Text	500
5	AssignedTo	Text	200
6	groupNumber	Integer	11
7	taskStarttDate	Date	
8	taskEndDate	Date	

4) Topic.dbf: This database file structure that will contain top news of the system. Below shows a table describing the database file structure

TABLE IV. TOPICS DATABASE FILE STRUCTURE

Field	Data Type	Size	Default
Id	Int	11	None
Course	Int	11	None
Topic	Varchar	255	None
Date	Date		

5) PrivateMessages.dbf Structure

TABLE V. PRIVATE MESSAGE DATABASE FILE STRUCTURE

Field	Data Type	Size	Default
Id	Int	11	None
Senderid	Varchar	30	None
Subject	Varchar	100	None
Message	Varchar	100	None
Xdate	Date		

IX. ENTITY RELATIONSHIP DIAGRAM

An entity-relationship diagram is a graphical representation of entities and their relationship to each other; the components of an ER diagram include the entities, relationship between the entities and the attributes of the entities. The entity relationship diagram of the proposed system is shown in figure 6.

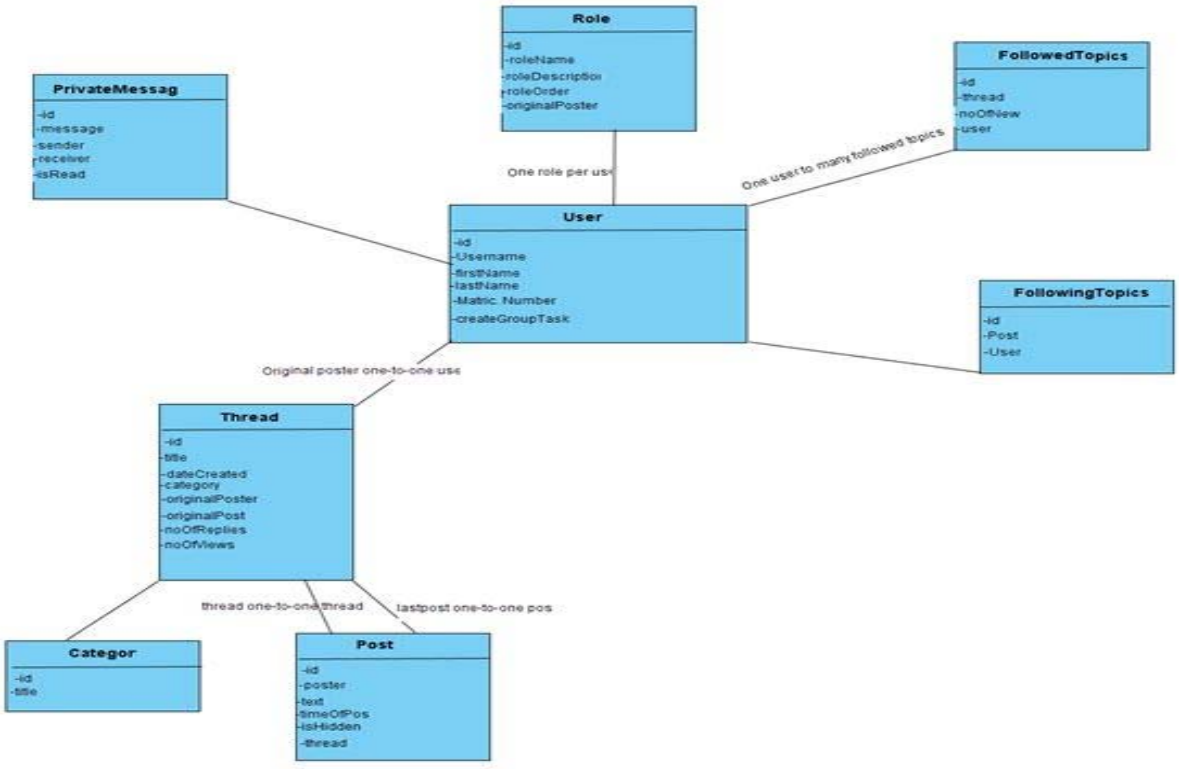

Fig. 6. The Entity – Relationship diagram of the proposed system

X. System Testing

Testing is done to verify if the system achieves the goal set for it. The testing phases include:

- Unit testing
- Integration testing
- System testing

XI. System Design

The Input/output modules are the platform through which the user and the system interact. Thus, the input design is illustrated below;

A. Input Design

All user interfaces for providing the system with inputs which it uses for its processing are shown in this section.

1) User Interface Requirements: A first-time user of the application should be met with a registration page when the student loads up the application see figure 7. If the student is already registered the student should be able to log in. If the user has logged in recently or has student details stored in the browser, the student should be able to enter one of two sections: the forum or the group task area see figure 8. Every user will have a profile page where they can view their email address, password and others. Figure 9 for information editing.

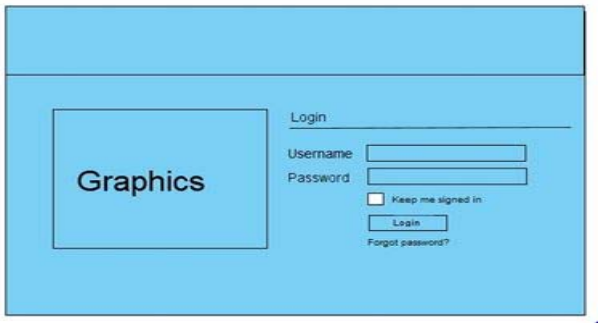

Fig. 7. Welcome/Login Page

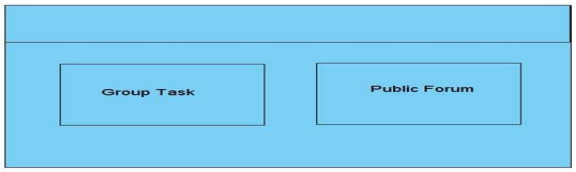

Fig. 8. Home Page

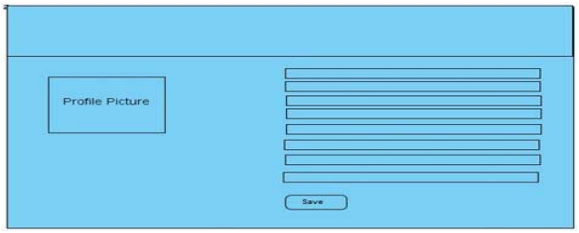

Fig. 9. Profile Page

Fig. 10. Navigation Bar

The navigation bar (at the top of the screen) is the same on every screen in Time based Online Collaborative Learning Environment. It contains links which gives quick access to some useful functions. The navigation bar also contains the username of the student and finally the log out button.

Fig. 11. Group Task Page

The group task page which contains a list of assigned task(s)/group(s) first and then other groups below; this is triggered by clicking the Group Task button in figure 8 above. The student can search/filter group tasks using the search bar at the top right corner of the page. The search results are populated depending on the title and the description of the tasks. Each result item contains the title of the group task and the description.

Clicking on a topic will take the user to the topic page (figure 12). This page contains all the posts on the topic. Each post has the time of post, the post text and the username of the user who posted it. Clicking on the username will open the user's profile (see figure 9). Each post can also be liked or shared. At the beginning of every topic you'll see a follow, like and report buttons, which you can click to add the topic to your followed topic list, like a post or report the post to the Supervisor.

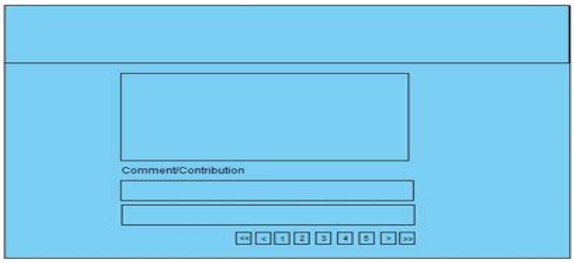

Fig. 12. Comment/Contribution Page

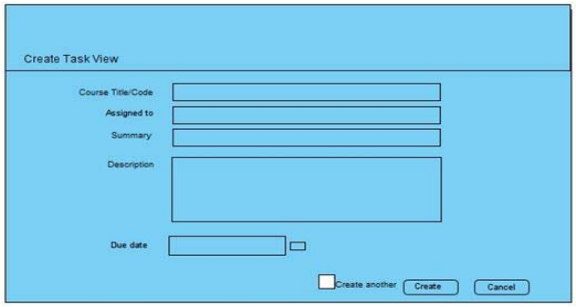

Fig. 13. Admin Create Task View Page

XII. System Implementation

A. Software requirement

1) Operating System: Windows XP Service Pack 2 and above. Linux Mint, Ubuntu, Fedora, Gentoo, and all other major Linux distributions, Mac OS X.

2) Web Browser: Internet Explorer 9 and above, Mozilla FireFox, Google Chrome, Safari, Opera. The recommended PC browser to use for running this website is Google Chrome. For smartphones Opera mobile and UC Browser is recommended.

B. Hardware Specification

No special hardware is used to run the application. The web application was developed on an Acer PC running Windows 7 Starter and Ubuntu 14.04

The minimum hardware requirements for the application are as follows:

1) Processors: Intel Core 2 Duo, RAM: 2GB, Hard Disk.

2) Space: 10GB

3) Operating System: Windows 7 Starter, Ubuntu 14.04.

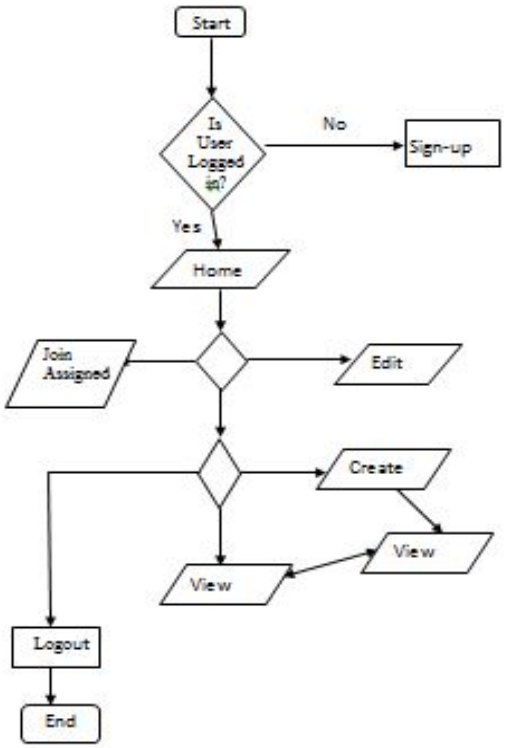

Fig. 14. System Flowchart

XIII. Conclusion and Future Work

This paper describes the combination of e-learning and message forum functions to form an e-learning system that tries to defeat some of the problems involved with the current form of collaborative activities in education. Many factors deter students from collaborating effectively when assigned a group task. With the presence of the tutor in each group acting as a facilitator and a guide, each group member will be enjoined to do his/her best to perform better. The proposed system is achieved and optimized to support mobile devices optimally taking into consideration the fact that most students access the internet via their mobile phones. Further research can be carried out to combine virtual-based feature to this proposed model for a more robust environment.

Acknowledgment

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