EMMCGID: A METHODOLOGY FOR E-LEARNING UNIVERSITIES

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ABSTRACT: E-learning uses a number of communication tools and technologies over internet to send/receive assignment and quizzes, conduct examinations and interaction between teacher and students. These tools and technologies include chat applications with audio and video features, discussion forums and emails. In spite all of these communication tools, e-learning faces the problem of communication gap and interaction delay. Chat applications like Yahoo or MSN messenger may help to overcome this problem but they are not meant for an e-learning university, so, they are not suitable to be used for an e-learning university. In this paper we propose an e-learning methodology to minimize communication gap and interaction delay between students and teacher. The proposed methodology is an idea of virtual class, as its major component to conduct both an audio and text chat sessions with the students. It gives the impression of a real world class: the instructor allows students one by one to ask their questions and all other students watch or listen to them. The developed system also includes other features: recording the chat session which may be published on the university web site and send it automatically to all participants of virtual class.

Key words: e-learning, distance learning, online learning, virtual class, tutorial session, communication and interaction gap.

INTRODUCTION

To educate people at low cost and at their door steps is a challenging task. To address this challenge some universities are using Distance Learning (DL) mode of teaching and some have incorporated information and communication technologies into DL mode of teaching to enable people to get education at an affordable cost, at their domiciles rather than moving to big cities (Maria and Rabelani 2004; Vrasidas 2004). The later mode is based on Electronic Learning (EL) concept. Both DL and EL have similarity of involving distance between teacher and students and the written communication. As compared to verbal or face to face communication which is a necessary part of non EL universities, written communication has the disadvantage of being difficult and time consuming to understand a written material and it may cause a delay in reaching to the recipient. We call these two problems together as the problem of Communication Gap and Interaction Delay (CGID).

EL introduces new horizons in education sector and eradicates obstacles of time, distance, and socioeconomic status. As a result, it presents new mode and style of learning. Being a fast and effective learning technique, it helps many people to improve and share their knowledge, skills, and experiences. On the other hand, it also has some issues about its effectiveness. Many universities, who claim that their approach is "e-learning-compliant", adopt this mode of teaching without eliminating the issues of CGID between students and teacher. These universities automate their services and deliver their courses online. They only help in saving time, expenses of travelling and shortening the distance etc. Therefore these universities are not fully EL compliant (Robert and Chao, 2006).

Some EL universities use modern communication modes to eliminate the problem of CGID. These modes of communication are chat applications with audio and video features, moderated discussion boards and electronic mails. In spite all of these communication tools; EL universities face the problem of communication gap and interaction delay. Chat applications like Skype (Skype, 2010a), Yahoo messenger (Yahoo!, 2010a), MSN messenger (Microsoft, 2010a) and DimDim (Dimdim, 2010a) may help to overcome this problem but they are not meant for an e-learning university, so, they are not suitable to be used for an e-learning university. If one tool lacks controlling and coordination mechanism then the

other does not have white board. Similarly, some tools do not provide feature of raise hand and some tools restrict on the number of users in a group, room or conference call. We propose an E-learning Methodology to Minimize Communication Gap and Interaction Delay (EMMCGID) between students and teacher. The proposed methodology is an idea of Virtual Class (VC), as its major component to conduct both an audio and text chat sessions with the students. It gives the impression of a real world class: the instructor allows students one by one to ask their questions and all other students watch or listen to them.

In section 2, problem statement is presented. In section 3, we present related work. Section 4 presents the materials and methods of the proposed system. Section 5 describes results and discussions. Section 6 presents comparison of four chat software application with our methodology and section 7 gives conclusion and future directions.

Problem statement: Virtual University of Pakistan (VUP) is an EL university. Current mode of teaching in VUP is that lectures of all courses go on air and students listen to them on TV either in their homes or in the university campuses. After listening to the lectures, queries may arise in the minds of students. Students use discussion forum type platform called as Moderated Discussion Board (MDB), provided by VUP, to get replies of their queries. This technique creates the problem of CGID. The problem of communication gap is created, in the sense that students, sometimes, do not understand reply of the teacher even if the teacher has very good writing skills. The problem of interaction delay rises when students have to wait for the next day if they have put query after working hours and sometimes they have to wait for several days if there are some national holidays. To overcome the problem of CGID we propose EMMCGID.

Related work: A lot of tools are available in the market for text and audio/video chat. But they are not suitable for VC. In this section, we give a brief overview of four popular chat software applications.

Yahoo Messenger: The yahoo messenger is one of the most commonly used chat software applications. It provides a lot of features like one to one chat, group audio/video chat, instant messaging, photo sharing and conferencing etc. Maximum number of people that can join a chat room is 50 (Yahoo!, 2010b). However, in a conference room this strength raises to 500 (rsd2005, 2009) One can call his friends or family members on their landline phone at the rate of 1¢ per minute. Short text messages can also be sent to the mobile phones for free. It also provides the feature of plugging in webcam to have live video. It can send a file of 2GB to contacts and also helps to search the web. It also enables us to view and edit Address Book right from Messenger (Yahoo!, 2010c).

MSN Messenger: It is also one of the most common chat applications. A user can enjoy a lot of features like changing background scenes, layout of the contact list, going directly to inbox from the messenger, creating a group and doing chat simultaneously with 20 people (Microsoft, 2010a). However, in a conference call 500 persons can participate (rsd2005, 2009) It also provides PC to PC audio and video chat options. A user can stay simultaneously signed into Messenger from up to four separate devices and the messenger sends conversations to all the devices at once (Microsoft, 2010b). It also has the features of whiteboard, remote assistance and application sharing. To use white board feature, you need permission of the other party (Microsoft, 2010a).

Skype: It is one of the most popular tools to do audio/video chat. It provides us with an opportunity for voice communication over the internet. Its distinguished feature is a clear and consistent voice over the internet. It has overcome many obstacles to communicate that's why a user does not face voice delay while talking with the contacts. Using Skype, a user can also make local and international calls to landline and mobile phones, through PSTN (Nadeem, 2010a) networks and he can also receive calls from these phones on his PC. This is not absolutely free, but is very cheap compared to traditional landline and mobile international call rates. These services are called SkypeOut and SkypeIn respectively (Nadeem, 2010a). In Skype a group of 100-200 persons can communicate (Villu, 2007, Skype, 2010c). Skype allows 25 people to join a conference call (Skype, 2010d). A list of features and functions provided by Skype can be found at (Skype, 2010b).

Dimdim: It is a web based conferencing tool. This tool helps users to deliver harmonized live presentations, whiteboards and web pages. It also provides the feature to share their voice and video over the Internet. This tool requires no download. Simply go to web and enjoy a lot of features without the need of downloading and configuration. It is also free for up to 20 people

(Dimdim, 2010b). However, range of total number of people participating in a conversation can be up to 1000 for $75 per month (Dimdim, 2010c).

Materials and Methods: In this section we describe the proposed methodology which is very distinct and specific to e-learning universities. First of all, we present major features of the proposed methodology. Then we present its architecture with a detailed discussion of its major components.

Distinguished Features: Following features might have been supported by other chat applications but they are not present as a whole in a single application. These features make our methodology very specific and beneficial to an EL university.

Separate Lists of Class Participants and Questioners: Our methodology provides two types of lists named List-A and List-B. List-A shows participants of the VC i.e. list of online students and List-B displays only those students who want to ask a question. List-B is developed in chronological order i.e. the first student who wants to ask a question, is given a place on the top of the list and the second student is listed under the previous student and so on. Advantage of List-B is that the teacher is not disturbed by the students who want to ask a question. They are just listed in the List-B and then teacher allows them to ask a question as per list order.

Raising and Dropping Hand: This feature is used by a student enquiring teacher to grant permission for asking a question. When a student raises hand his name is appended to List-B and when a student drops hand his name is excluded from List-B.

Controlling and Coordination Mechanism: This mechanism is for teacher to control the VC. In the start, all of the students can just listen or see (text chat) ongoing conversation between teacher and student. None of the students can use white board, text chat controls or speak. In order to use white board or ask a question using text or audio chat, a student requires permission from teacher. In order to allow a student ask a question, teacher selects a student from List-B and then clicks the 'Allow' button. When the teacher clicks the 'Allow' button, all components on the student interface become enable and now a student can ask a question either by audio or text chat mode. Similarly, teacher has the privileges to block or remove a student. A blocked student means that he has been forcefully blocked by the teacher to ask a question. These are very important features to control and help in the smooth running of VC.

This mechanism is provided only by the 'Dimdim'; one of the application described earlier.

White Board: Provision of a white board is very important feature for VC. Our methodology provides this feature to share such things which can not be typed or got in a verbal communication. For example, some complex mathematical notations symbols can be easily drawn and communicated using the white board which may be difficult in other ways.

Unlimited Users: As stated above in section 2, other software applications impose restriction on the maximum number of people in a group. For example, MSN messenger allows 20, Yahoo messenger allows 50 and Skype allows 20 to 200 persons to join a group. In case of our application there is no limit on maximum number of students to join the VC.

Explicit Registration Not Required: To use other chat applications, one has to create an account, but in case of our methodology a student automatically gets registered at the time of his enrollment in the university. For example, in VUP, a student of BSCS is issued 'BS1001233' as a registration number at the time of admission. This ID will also be used to get login into our application. Our methodology authenticates the user by interacting with the university database. Therefore, a separate registration is not required for our application.

Security: Only a university student who has been issued a registration number can use EMMCGID. So, our methodology is very secure comparatively to other chat applications where any person can create an ID to use the application.

Display of Teacher Name: When we do text chat via MSN or Yahoo messenger, it is very difficult to distinguish between teacher and student. To eliminate this problem, our methodology displays the word 'teacher' as a prefix of the teacher's reply as well as teacher's name is displayed the menu bar of the window of each student and his name is also highlighted in list of class participants. This feature removes ambiguity to identify the teacher.

Reusability: Our methodology provides an interface to integrate it with the university database. This feature has made our methodology a reusable component. It enables our system to validate students' identity, populate teacher and students' 'Virtual Class Rooms' by connecting with the university database.

Architecture of the Proposed Methodology: Software architecture shows the overall structure

of a software system. It reveals the relationship among major components of the system. One of its major objectives is to reduce the development cost and establish the consensus among the developers and clients of the system (Mary, 2001; Nenad et al., 2002). Figure 1 shows architecture of the proposed methodology. Following are the major components of our methodology.
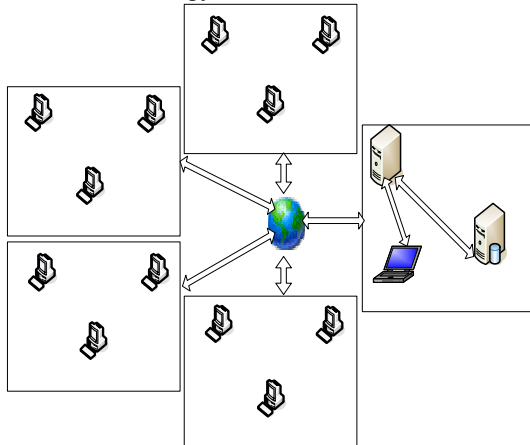
Figure 1. Architecture of the Proposed Methodology

Students: Both the local and overseas students are participant of the VC. Students get login into our application using their IDs issued to them at the time of their enrolment in the university. Hence, our methodology doesn't require registration process and permits only the students of the university to login. Therefore, this system is very secure, safe and specific. There are two types of students: 1) Students listed in List-A. 2) Students listed in List-B. In List-A, all online students can be viewed. List-B shows only those students who want to ask a question. List-B is developed on first come, first serve basis.

Teacher: The teacher replies queries of the students. He also acts as coordinator. He permits only one student at a time to ask a question. This means, students can not ask query at their own. Student raises hand and teacher allows him/her to ask a question. This feature of our methodology is very important and enables the teacher to control the VC

Server: This is a software component that handles requests of all students and let the teacher to control the class. This tier of our application propagates text messages and voice reply of the teacher to all the students and vice versa, and verifies students' identity. Actually this part acts as a middle man between the students and the teacher.

Database Server: This is the database server of the university. It has all the information about students' IDs, passwords, students' personal information and academics relevant data. Sever connects with this database to verify the student's identity.

Tools and Technologies: Following Microsoft tools and technologies are used to develop the application: 1) DirectX. It gives support for game programming, video, audio and 3-D animations (Shinichi et al., 2007). 2) C#. It is an object oriented language backed by Microsoft (Soleda, 2006). 3) Visual Studio 2005 as an integrated development environment (IDE) provided by Microsoft (Luiz and Daniel, 2006).

RESULTS AND DISCUSSION

Our methodology provides several features which may be required by an e-learning university to conduct a VC. It is an interface between a teacher and a student. Its major purpose is to provide an environment to students so that they can communicate with their teachers to clear ambiguities regarding various concepts of any course. Our methodology has following three major interfaces.

1. Teacher interface
2. Student interface
3. Configuration interface

Teacher Interface: This interface (Figure 2) helps a teacher to initiate, control and coordinate VC. It also provides privileges to a teacher to block or remove a student from List-B. The interface has the following six major parts.

Menu bar/Tool bar: 'Menu bar/Tool bar' provides various options to the users. These options are: a) Connect b) Disconnect c) Erase drawing d) Select color e) Server stats and f) Record. 'Connect' option is used to connect with chat server. Without connecting to chat server, neither a teacher nor a student can join the VC. When a user selects this option a dialogue box appears and prompts the user to enter his ID and password. The IDs and passwords are verified by chat server with the university database server. If verification is done successfully, the user is allowed to join the class or he/she is informed that the provided information is incorrect. 'Disconnect' option is used to leave the VC. 'Erase Drawing' is used to wipe up the white board. 'Select Color' option provides privilege to change color of drawing in the white board.

'Server Stats' shows the statistical information like running time of chat server, total bytes read or written etc. 'Record' option can be used for recording of VC session.

Class Participants : This is List-A, which shows the total number of students present in the class.

This list is developed in chronological order. It gives an idea of total number of class participants to both teacher and students. The name of the teacher i.e.; John is listed on top of the list and highlighted to distinguish from students as shown in figure 2, label 2.
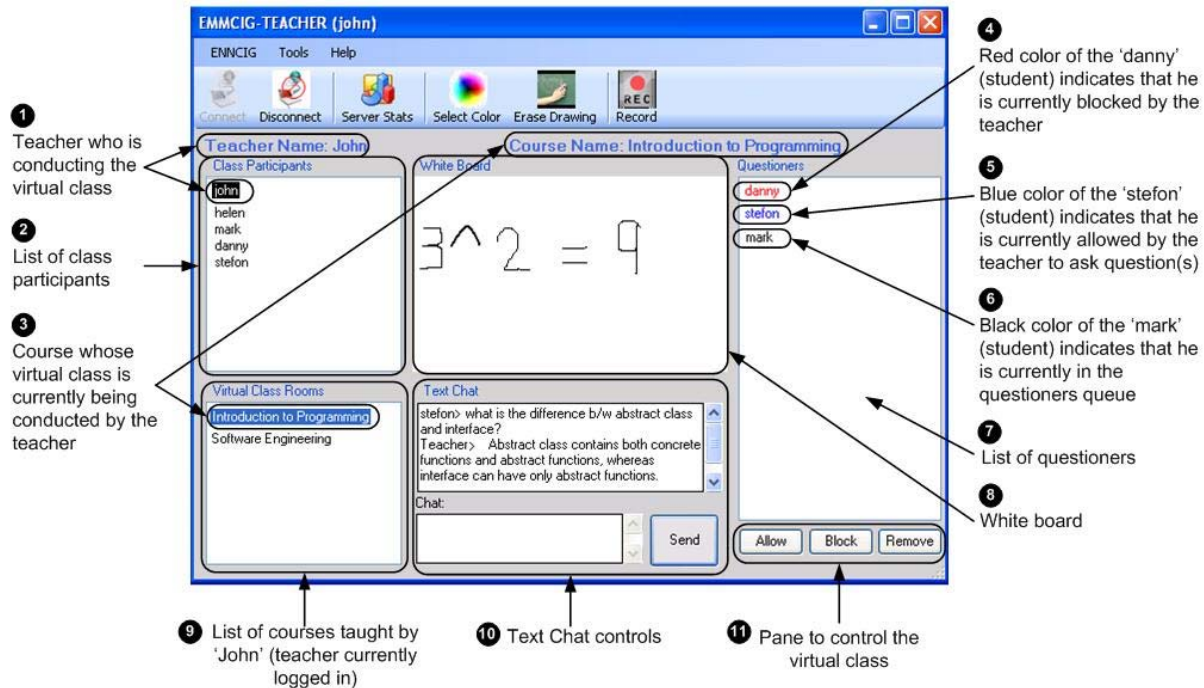

Figure 2. An interface for teacher to initiate and control the VC

Questioners: This is List-B which shows students who want to ask a question (Figure 2, Label 7). This list also grows in chronological order. Teacher selects the student from this list and allows him to ask a query by audio or text chat options by clicking the 'Allow'. Teacher uses 'Block' button to stop him forcefully from speaking and 'Remove' button to exclude a student from this list (Figure 2, Label 11). The red color of the students in this list shows that they have been block by the teacher (Figure 2, Label 4). The blocked students can not put a query. Their components for text or audio become disabled. These blocked students can be again activated by the teacher. Blue color in this list shows the student whose query is being entertained (Figure 2, Label 5). Black color shows that these students are in queue waiting for their turn to be entertained (Figure 2, Label 6).

Virtual Class Rooms: This is a list of subjects/courses that are assigned by the university

to the teacher (Figure 2, Label 9). This list is populated by our server after fetching data from the university database. At a time, only one VC can be started just like the real world class. Highlighted text shows that currently VC of the subject of 'Introduction to programming' is going on (Figure 2, Label 3). On the other end, students who have registered 'Introduction to programming' can join VC of this course. For the sake of clarity, the name of the course is also shown on the right side of a bar that is below the Manu bar (Figure 2, Label 3).

Text Chat: 'Text chat' part provides an option to do text chat (Figure 2, Label 10). Text chat may be an option when there are problems of bandwidth, network speed or lack of microphone on either side i.e. the teacher and the student side. 'Send' button provides a privilege to send text to the other side. Text written in the text field, below the caption of 'Chat', can also be sent to the other side just by clicking the 'Enter' key on the keyboard. Whole conversation of teacher and student is

shown in the text box just above the caption of 'Chat'. Here again we followed the tradition of keeping the things clear. Our system writes the word 'Teacher' instead of 'john' to show the message from the teacher. Thus all students can easily recognize the text/reply of teacher.

White board: White board is used for hand free writing (Figure 2, Label 8). During conversation, a teacher or a student may need a white board for wiring mathematical symbols or equations and to draw pictures or graphs.

Student Interface: Using this interface a student can attend the VC. Initially all components of this interface are disabled and a student can not send text message, draw any thing on the whiteboard or speak. He can just watch or listen to conversation being conducted between teacher and students. This interface is very similar the teacher's interface. Difference between teacher interface and student interface is that in place of pane to control VC (Figure 2, Label 11) on teacher interface, there is an option to raise and drop hand on student interface (Figure 3). Raising hand is a signal that the student wants to ask a question. This option is provided by a 'check box' control. When first time it is selected by a student, its state changes to selected and name of the student is appended to the list of 'Questioners' (Figure 2, Label 7). When it is clicked second time, the state of this check box changes to unselected and now the student is excluded from the list of questioners.

Figure 3. An option for raising and dropping hand

Configuration Interface: It provides a mechanism to integrate our system with the university database. This interface (Figure 4) provides six text fields and one button. Six text fields are for various purposes which are as follows: 'User Name' and 'Password' text fields require ID and password of university's database that is going to be integrated with our system. Database URL text field requires URL (uniform resource locator) (Berners-Lee et al., 1994) of the database. Database URL is an address of the physical location of the university database. DB driver (Emmaneul and George, 2009) text field demands database driver which is used to connect with university database. In next two text fields,

labeled as 'User Authentication Query' and 'Course Selection Query', administrator writes queries which are embedded in our system to fetch data from university database for authentication of student/teacher who wants to join the VC and to fetch registered courses of the student/teacher. 'Save' button saves all the provided information and now our system is integrated with the university database.
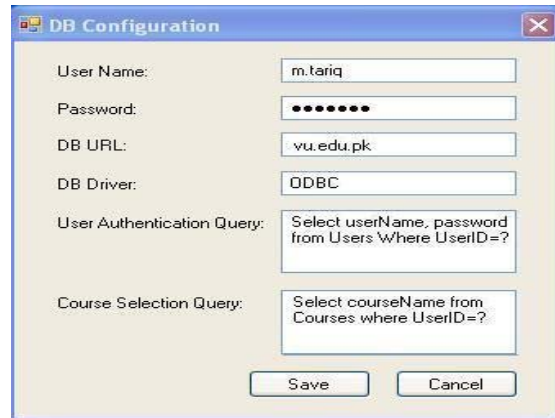
Figure 4. An interface to integrate our methodology with the university database

Comparison of the four chat software applications: In this section, we compare the four chat applications described in section 3 with our application only with the perspective of requirements and features which is essential or helpful for a VC. We summarize the comparison of the four applications in Table 1.

Conclusion and future work: Currently, e-learning universities lack a system that mimics the real world class and minimize the CGID. Our methodology does this by providing a tool that enables the teacher and the students to come in a VC to share knowledge and it provides an opportunity to the students to clear various concepts of his registered courses by communicating directly with their teachers. It provides both text and audio chat options. Audio chat saves time but text chat option is an alternate when there is a problem of bandwidth, network speed and micro phone issues on either side. Main features of our system are controlling mechanism, raise hand, configuration interface and white board. As a future work we plan to work on touch screen based white board. We also want to add feature of a shared region to display a document or an image on each student interface.

Table 1. A comparative summary of the four chat software applications with the proposed methodology.

Criteria	Yahoo	MSN	Skype	Dimdim	EMMCIG
Whiteboard	No	Yes (Permission required)	No	Yes	Yes (No Permission required)
Controlling Mechanism	No	No	No	Yes	Yes
Users per chat group	Room chat = 50 Conference chat = 500	Group chat =20 Conference chat = 500	Group chat = 100 to 200 Conference call = 25	20 to 1000	Unlimited
Questioners' List	No	No	No	No	Yes
Registration Requirement	Yes	Yes	Yes	Yes	No
Subject wise Virtual Class	No	No	No	No	Yes
Display of teacher's name	Not Prominent	Not Prominent	Not Prominent	Not Prominent	Prominent

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