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UMES-CHAT: A Campus Mobile Social Application for Improving Study Experience of Students, by Students, and for Students

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Abstract

Social networking apps have penetrated every aspect of students' daily life. However, many students are experiencing communication difficulties in their learning process. In this paper, we present our work, 'UMES-Chat', a mobile social network application that serves mainly for education purposes. It is developed with Xcode© on the iOS platform and utilizes XMPP protocol to communicate with the phone. By the use of the app, college students can effectively communicate with each other and faculty, to discuss, share information, solve learning issues, and work in teams on course projects. In addition, the mobile application is being proposed, designed and developed by students as the senior design project. Students' engagement and professional development are greatly improved through this process. Moreover, the project is also developed as a teaching tool for related courses such as Programming Languages and Embedded Systems, and can be used as a template for many software/hardware projects for students in the future.

Keywords

Social Networking App, Education Chatting, Student Engagement, Professional Development

1.   Introduction

Social networking apps have penetrated every aspect of students' daily life [1]. They communicate, share experiences, follow interests in cyberspace. On the other hand, mobile apps have shown a great potential on improving education effectiveness [2-4]. On the other hand, practically, many colleague students are experiencing communication difficulties in their learning process, especially on how to effectively communicate among themselves for group assignments, campus activities, and general questions. They are also having trouble on how to efficiently find and share information about internship, fellowship, scholarship, and job opportunities. It's quite common that information they found are either inaccurate or out of date.

Undergraduate students in our engineering department perceived this situation by themselves. With the faculty's guidance and approval, they organized a versatile team to tackle this issue as their senior design project. First a survey was specifically developed to collect students' opinions about their needs. And the result from the survey showed a strong desire for a rapid communication application. Based on this observation our students' team proposed the project 'UMES-Chat', a mobile social network application that serves mainly for education purposes and focuses on academic activities.

1.1 Overview

The UMES-Chat has three basic functions. The first is course associated group chatting. A group will be created for every on-going course, for students to discuss, share information, and team-

working on course-projects. The second is academic activity and event related group chatting, such as textbook sale, workshops and job openings and the third is messaging, in which a student can create contact list and communicate at all times and places via texting.

The UMES-Chat is designed to enhance college students' studies in their educational endeavors. The UMES-Chat application creates a central place for communication and collaboration between the students while benefitting students who want to be competitive with the advances in technology. Through the application they can reach each other span time and space, to improve the opportunity for learning within the group. In addition, students will acquire good experience and training on communication skills and team-working, which may greatly contribute to their future success. Above all, the mobile application is being proposed, designed and developed by students, who know their needs the best.

On the other hand, both engineering students and faculty members will benefit from the project. The project will also be developed as a teaching tool for related courses such as Programming Languages and Embedded Systems. Moreover, this project does not only serve as a guideline for chatting applications but also for any programming based project that students and faculty can consider in future.

The mobile application utilizes a shuttle computer as the server, SQL to communicate with the database, and the standardized XMPP protocol to communicate with the phone. Xcode© [5] is used for mobile application development on the iOS platform.

1.2 Existing Apps

There are a couple of mobile apps that share similar concepts to our work, for example the 'CampusQuad' [6], which is considered by reviewers as "MySpace for college". CampusQuad focuses on the social aspect of college life. As stated by it developers the CampusQuad "discovers what's happening on campus" and "instantly create photo-based posts about anything and everything from activities and events to announcements". However, although the CampusQuad aims to improve students' access to educational experiences, it has only achieved an increase in communication between students. Moreover, our work, UMES-Chat, has much more functions and capabilities to improve students' academic experiences beyond that. The UMES-Chat App will provide a tool for students to centralize student communication and organize information for students. We want to ensure a better educational experience by helping students get more familiar with each other. This app will provide up to date information on internships, scholarships, tutoring, workshops, and etc. it also provides the opportunity to cut across social and cultural boundaries for a better knowledge of an integrated society.

1.3 Paper Organization

Section 2 introduces the app which presents the software and hardware structures and its functions. Section 3 focuses on the educational aspect of the app development, which also includes students' experience throughout the app development process. And Section 4 concludes the whole work.

2. UMES Chat the App
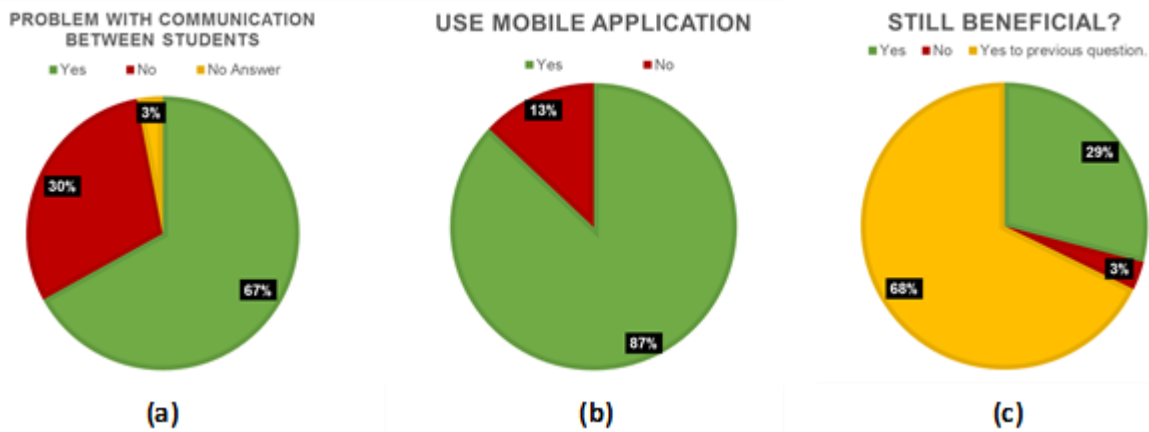
2.1 Pre-Survey

To better serve our purpose, first of all, student developers conducted a survey both inside and out of the campus regarding to the academic communication issues. A total of 67 answer sheets were collected over more than 100 survey sheets distributed to college students, faculty, and alumni. While

this might seem as a small sample, it heightened the need for the project by aggregating the responses into functional needs to address the senior design project formulation.

Our main focus was to find out if our problem really existed. We asked the question: "Do you find that there is a problem with communication between students in college?" i.e. class assignment collaborations, group projects, and etc. The survey results can be seen as shown in 0(a).

Our next question asked the following question: "Would you use a mobile application that would create a central place for better communication between students?" This was a possible solution we posed to the respondents. The survey results can be seen as shown in 0(b).

We also asked the following question: "If you would not use the mobile application, do you think other students would benefit from this mobile application?" This is to ensure that our design idea would still solve the problem. Those who answered yes to the previous question are those who would use the mobile application if there is one made. The survey results can be seen as shown in 0(c).

Survey results [18].

Based on the result of the survey, we concluded that the communication, especially academic related communication and information sharing, are still a critical issue to many undergraduate students. Most of students surveyed agreed on the effectiveness of smartphone based application in improving communication efficiency. Based on the survey results, the student team confirmed their decision to develop the academic social network application, UMES-Chat as their senior design project.

2.2 Overview of the Application UMES-Chat

The mobile application is designed to improve students' educational experience while attending college. Currently there's no such central place that students can easily communicate with each other. They have to go over a range of different social media, cellphone, or over email to reach other students, which is neither convenient nor efficient. Consequently, students continue to struggle to complete team assignments that requires contributions from other students.

In targeting this problem, our student team engaged on developing a college chat application, UMES-Chat, to improve the communication experience of students. This app will not only provide a tool to improve students' communication skills but also provide a guideline of how other students can get involved in similar projects.

The student development team is well trained and equipped. They have been working together with industry design team on developing applications for Apple© Products. Through that process they learned the advanced knowledge and programing languages required to design mobile applications on the native iOS platform.

Briefly, the app UMES-Chat offers the following major functions:

▪ First is the user registration with the required information, including academic email and password. They will also be able to input their department and major, which will help the customization of the rest of the functions.

▪ Second is a database for students to search for the group of the desired class. In the class they can join group chatting to communicate with everyone in the class. The student can also add the class to the 'Added Classes'. That is where they will receive messages for that class. Once the users add themselves to the class, they will then start to receive messages for that class.

▪ Third is the posting of academic events. This will give anyone that logs into the app the ability to see and post events related to students.

▪ The next function is the 'buddy list'. This will provide a user an easier way to add other users as friends.

▪ Last but not the least, the app provides the function of Private Messaging to enable a user sending message to an individual student besides the group chatting. To ensure on-time messaging, a user can check others' status by going to the 'Who's Online?' tag at the top of the app page.

2.3 Hardware Structure

The basic organization of the hardware for hosting the app is shown in 0. The Chat server processes all chatting events, while Database server manages all user data and history records. Each user will communicate to both servers with the mobile device. The two servers will communicate to each other only on the new user registration process. When the user registers, the Chat Server is accessed first. The Chat Server then communicates to the SQL Server to queue the email verification. Once the email verification is complete, the user will be able to log in.
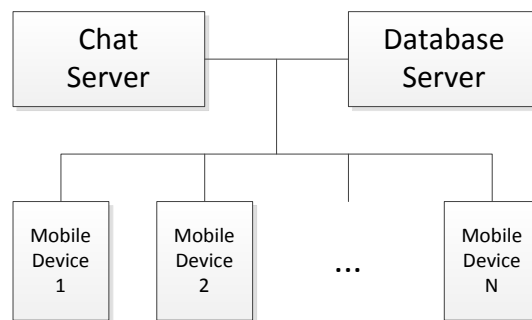
Hardware Flowchart

2.3.1   Chat Server

The Chat server is a MongooseIM [7] and is a fork of ejabberd [8]. The Chat server is based on CentOS Linux [9]. The Chat Server and the SQL Server are both housed in a customized shuttle computer. This shuttle computer acts as miniature computer that was customized and partitioned to function for multiple projects by the senior design project team. The shuttle computer equips an AMD Athlon II processor, and supports a 16 GB memory and 250 GB hard drive. These custom

specifications provide the capability for dealing with high volume processes, including running multiple servers.

2.3.2 Database Server

The database server is SQL based which will be utilized for posting Events or Campus Activities. Once a student posts an event, the other students will then receive an XML document from the SQL server will all the data containing the new posted event.

Most of the communication will be between the Chat Server and the users' mobile device. The functionality will be based on the communication from the mobile device to the Chat Server, which occupies the majority of communication traffic usage. Hence the Chat Server is configured in a specific way to meet the requirements to accommodate the software structure and deal with the traffic needs.

2.4 Software Structure

The software structure is based on the integration of the XMPPFramework [10] into the UMES-Chat application. The XMPPFramework has all the extensions integrated in a pod download. Each extension gives the direct communications requirement to the server to make the application accessible. The XMPPFramework provides an extension for the following functionality:

- Login/Logout Processes

- Registration Processes

- Individual Chat Processes

- Group Chat Processes

- Buddy List or 'Who's Online?' Processes

- Offline Message Storing Processes

MySQL [11] server with a database structure is deployed to GET and POST requests for the Events Page. This continuously updates the user useful information around the campus. The XMPP server is incapable of sending Email Verifications and maintain the Events. Hence the Event server is equipped with minimum configuration. The XMLDictionary Pod [12] is integrated into this app to create the XML documents to send to the server.

2.4.1 Login/Logout Processes

The login and logout process is developed based on the XMPPFramework [10]. The XMPPFramework offers an XMPPStream, which links the communication or connection from the mobile device to the Chat Server. On the iOS platform, the username and password is set within the prewritten framework on the XMPPFramework, and then the connection can be built with the prewritten function. This is processed by sending an XML document which contains the username and password of the current user to the server to verify if the they are from a certified user. Then a verified user will be logged on and forwarded to the initial page.

The logout process will be completed with another prewritten function within the XMPPFramework. The stream connection from the current logged in user is deallocates on the current device. This disconnects the user from the application and returns them to the login page.

2.4.2 Registration Processess

During the registration process the optional inputs will also pass into servers. When a user is

registering, the server but not the local host will process the registration iq documents.

Corresponding functions are developed within the environment to pass the data within the XMPPFramework, process data, and create iq document for registration. The extension accessed is the In-Band Registration extension, in which the user will input his/her university email, first name, last name, major, and desired password. The major, first and last names are the optional data. Once the chat server receives the registration, the SQL server will send an email to the user to verify. The user can log in after the verification is complete.

2.4.3   Individual Chat Processes

An open source framework called JSQMessagesViewController [13] is deployed to display the view controller where the messages will be sent from. This will facilitate the user's ability to send private messages to another user currently online. The proper port will be accessed to verify the correctness of the message sender's and the receiver's username.

2.4.4   Group Chat Processes

The group chat process needs specific data structure to support its operations. Classes and majors information are imported to separate data. The user can find associated class groups by searching the major. The JSQMessagesViewController is used for send and receive in both individual chats and group chats. The group chats and individual chats share the same user interface page.

2.4.5   Buddy List or "Who's Online" Processes

Once logged in, every user is considered as a buddy by server. This enables the utilization of the prewritten functions within XMPPFramework [4] to pull all online buddies. This also provides the user function to check who is online.
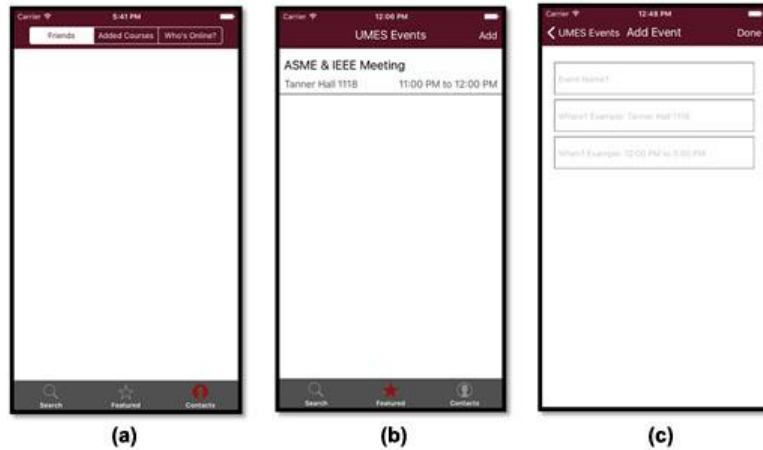
2.4.6   Offline Message Storing

The XMPP server enables the user to receive the offline messages. This server will fetch all offline messages when they login. With this feature users won't miss any message no matter if they are online or not.

User interface of some functions introduced as shown in 0 and 0.
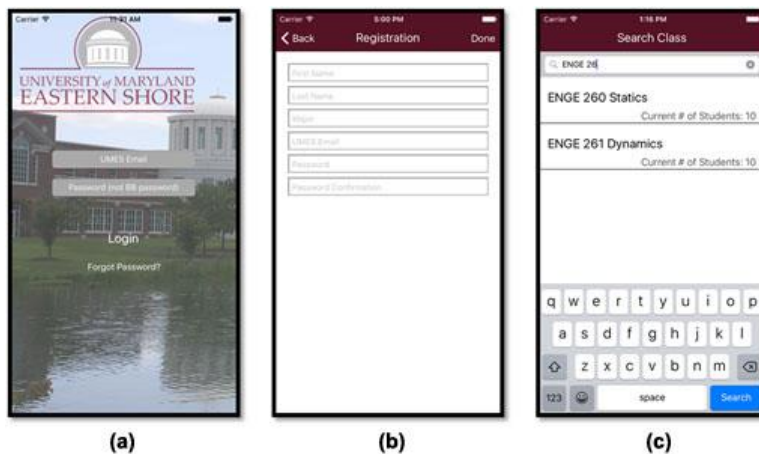
(a) Login page [14]; (b) Registration page; and (c) Class Searching page.

(a) Contacts page; (b) Event page, shows events student have added; and (c) Add Event page.

2.4.7 User Interface Design

The interface builder is an easier and efficient tool to create the user interface of the application. This tool enables the visualization to the developer, and can easily adopt better design ideas and future modifications.

Xcode uses an AutoLayout [15] system, in which constraints are added to the view. It is essential for creating a one storyboard file, as show in 0. The size can be modified to meet different phone sizes. Some constraints are more challenging to configure. Specific properties are needed for certain constraints to set a certain times interval, after which the layout will be reset. NSLayoutConstraint [16] is used to set the constant value of the constraint. After it is set, the layout is called to view again. This automatically updates the constraints.
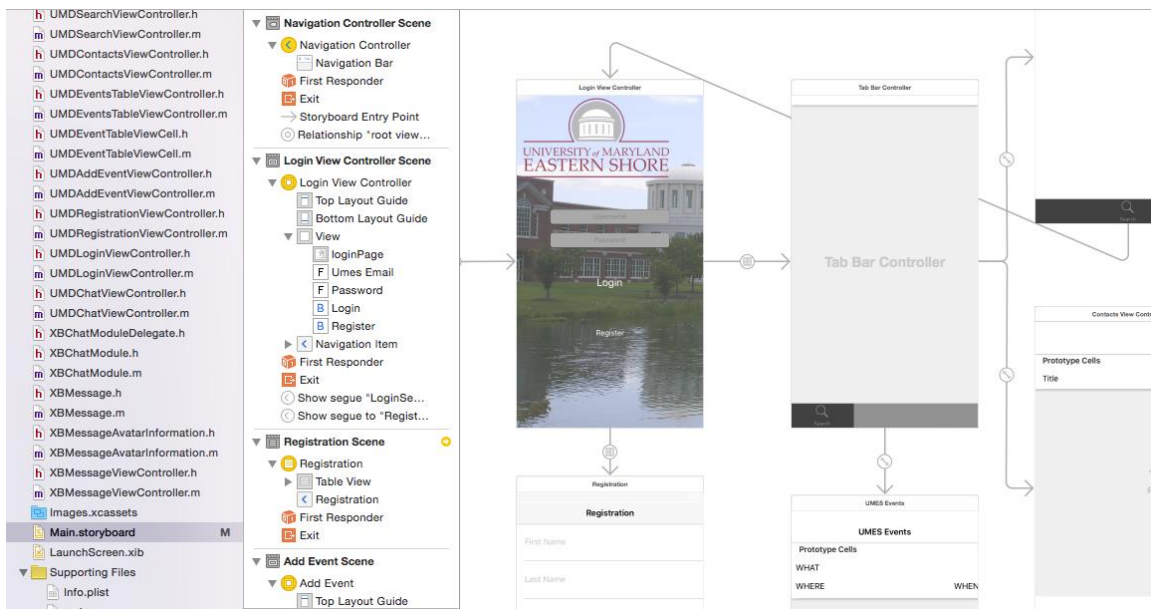
Xcode workspace of Interface Builder.

3.   Student Learning, Training, Engagement, and Profession Development

3.1 Student Engagement and Profession Development

The UMES-Chat is a senior design project conducted by undergraduate engineering student. In

engineering department, students can choose any topic for their senior design project based on personal interest upon instructor's evaluation and approval. Students are strongly encouraged to identify and define specific problems from daily life as well as to address contemporary issue, analyze and model them quantitatively, and propose practical solutions. By this way their motivation can be greatly inspired.

Moreover, mobile devices especially smart phone have become a basic equipment for people nowadays. Millions of applications meet users' needs on every aspect from social networking, problem-solving, entertaining, to providing all kinds of information. Mobile application developing becomes a high-demand job on the market now and maybe an essential skill in the future.

As the basic requirement of the senior design course, in every week each senior design student team needs to publicize a weekly report, and give a presentation to the whole class and anyone who is interested. Many students who have attended such presentations communicate with developers and show their interests to similar projects.

On the other hand, during the development of the UMES-Chat app, student team members have contacted, consulted and acquired assistance from commercial application developers. They have received professional training, to follow industry development process and meet related standards and requirements, and the development process is greatly expedited as well.

3.2 Potential for Teaching Improvement

Multiple educational tools are also created during the development process of the mobile application.

3.2.1   Course Module

Many atomic modules in the UMES-Chat application can be reused as learning modules for different electrical engineering and computer engineering courses such as Programming Language and Embedded System. There are two kinds of learning modules to be developed. First is the application developing models, such as object oriented modeling, and database modeling, construction and analysis. Secondly, typical code segments can be extracted and redesigned as practical examples for students to exercise on how to create functional modules. Thirdly, there are quite a few industry software, tools, and add-ons involved and deployed during the development of the UMES-Chat. They will also be extracted and enriched to different learning modules for student training and practice.

3.2.2   Mobile Application Development Template

A complete packet of mobile application development template is created based on the UMES-Chat development documents. Documentation is one of the most important trainings aspect in senior design process to all students. During the development of UMES-Chat, various files, such as log, report, code, etc. are requested and collected periodically. These documents clearly recorded all details of each step in the development process. By the use of the template other students in the future could go through the process again, to either develop similar applications or create new projects for mobile devices.

3.2.3   Pi Cluster

In parallel, the UMES-Chat developing team is collaborating with another student group in constructing a Pi-Cluster [17], which will later host both servers of the UMES-Chat app. The Pi-Cluster is composed of 32 single board computer Raspberry Pi 2 nodes, each of which contains a 900MHz quad-core ARM Cortex-A7 CPU with 1 GB RAM. Such configuration enables the Pi-

Cluster as an inexpensive parallel computing platform for educational activities.

The Pi-Cluster is a course project of computer engineering students. It is developed to support students' learning and research activities on computer engineering topics, such as parallel programming, high performance computing and interconnected networks.

4.   Conclusion

In this paper, we presented an undergraduate senior design project that develops a mobile social networking application, UMES-Chat. The application takes advantage from the smart phone to penetrate user's daily life, can effectively improve student's communication experience and learning process, as well as provide up-to-date academic information of all kinds of activities. On the other hand, the development process of the mobile application provides great opportunity and experience for student engagement, learning and profession training. Moreover, various student learning modules and tools and also created based on the project. It has also expanded the intercultural dependency of the students learning process as they perceive the benefits and the culture of learning groups will eventually produce.

5.   Future Work

The UMES-Chat is an ongoing project with more and more features and functions to be integrated in future. For example, academic calendar functions can be added to the UMES-Chat application to remind students of important due dates. Also subscription or follow request to certain topics can be added which would help students receive up-to-date on information. On the other side, related mobile app development template and teaching modules will be updated to add more design varieties and functionalities, to furtherly improve students engagement and learning effectiveness.

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