

A Context-Aware Mobile Organizer for University Students

Seyed Hadi Mirisaei and Abdullah Mohd Zin
Programming and Software Technology Research Group,
Faculty of Information Science and Technology,
University Kebangsaan Malaysia, 43600 Bangi, Selangor Malaysia

Abstract: Problem statement: With the expansion of mobile devices, the usage of context-aware mobile applications is becoming very popular. **Approach:** One of mobile applications that are useful for university students is the university mobile organizer. University Mobile Organizer is a software that acts like an assistant for students in their universities' activities. **Results:** However, this application was not used widely by the students. In this research, we explored students' problems and requirements in their university activities and then proposed a context-aware university mobile organizer that will be useful for them. **Conclusion/Recommendations:** Based on these requirements, a proper framework for implementing a university mobile organizer is developed. Lastly, the software is implemented based on the framework that has been developed.

Key words: Spring.net, E-education, survey

INTRODUCTION

With the emergence of mobile devices such as cell phones, PDAs and laptops, context-aware applications are becoming more prevalent. Context-aware systems provide relevant information and services based on information from the user, depending on the users' situation^[1]. Forecasting software or location-aware mobile applications are some commonly used context-aware applications. Expansions of these systems are also seen in university environments such as university mobile organizers. University Mobile Organizer is a software which acts like an assistant for students in their universities' activities. Its purpose is to help students in their indoor and outdoor activities within the university environment. Current context-aware mobile organizers focus only on indoor or outdoor activities. Furthermore, these applications are not well utilized by students, which indicate that current mobile organizers do not meet students' requirements.

Since it is important for the system to satisfy students' requirements, the first step in developing a university mobile organizer is to find out students' requirements. Based on these requirements, a proper framework for implementing a university mobile organizer is developed. Lastly, the software is developed based on the framework that has been developed. This software is developed by using

spring.net technology^[2] as a proper technology because of the novel features that spring.net presents and possibility to integrate with other .net based technologies such as ADO.Net.

Related works: Capture system for biology education^[3] is designed in University of North Carolina at Chapel Hill and it is responsible for detecting that a student has entered a classroom for a specific class and load necessary software or content for the designated class session. This framework records context information such as location or schedule. Software agents resolve the context and provide services in this context-aware framework. These intelligent agents gather data from location agents as context and provide the services for user. Evaluation advantage is that users will address whether students can effectively learn to use the system and whether it supports their educational needs.

Active campus^[4] is a context-aware organizer which supports some class activities. These activities include asking the lecturer an anonymous question online for those who are shying or taking online quizzes in class made by the lecturer. The rating part draws three options for students to evaluate their lecturers speed: 'Too slow', 'just about right' and 'too fast'. The infrastructure of the system stands on IEEE 802.11 b standard. There are five concerns for this research. The

Corresponding Author: Seyed Hadi Mirisaei, Programming and Software Technology Research Group,
Faculty of Information Science and Technology, University Kebangsaan Malaysia, 43600 Bangi,
Selangor Malaysia Tel: 03 - 8921 6177 Fax: 03-8925 6177

first is that technological designs must be adaptable to the variability of institutional arrangements. The second one is considering the differences between laboratory environment and the real world. The third is finding the best infrastructures, while the fourth is an alternative way to assess adoption of technology. Finally, technologies of all sorts are a means to make relationships between social groups. Results show the successful adoption to the real world but the main problem is that some students do not like to use it and their reason is that they do not have any questions to ask the lecturer.

A context-aware mobile and collaborative learning scenario^[5] is a university context-aware application which supports many campus requirements. In the beginning of each session, lecture materials load in a student hand-held device. The attendance list will be filled in automatically during sessions and students' absences will be informed via SMS. The system provides a study space for students to consult their courses or accumulate their absences. Through the shared space, mobile learners can work and collaborate. The framework aims to manage, store, reason and adapt contextual elements to the learning activities.

POODLE^[6] is a redesigning of MOODLE^[7], for being compatible with wireless networks and suitable for hand-held devices. Features for this course manager are online and offline text assignment, advanced uploading of multiple files synchronously, chats and Forums, online question in class, designing quizzes, library, course files and survey tools.

Mobile butterfly watching system^[8] is designed for outdoor learning. The software method is very simple. Students take pictures from a butterfly with their PDAs and send pictures to the server. Server finds the butterfly information and sends it back to students. After that, system takes some quizzes from students based on what they learned to obtain learning progress and provide a complete report for lecturers. This system is a self-learner system, which means there is no need to direct lecturer supervision.

Several principles are mentioned for designing context-aware applications and familiarizes with students' requirement in their outdoor and indoor activities particularly in current university mobile applications.

MATERIALS AND METHODS

The first part of the research is to determine students' requirements of a university mobile organizer. In order to obtain the requirements, we used a questionnaire research method. The next part of the research is to design the framework. This framework is

designed to cover university students' requirements and it is designed based on general context-aware application principles, such as location-awareness or real-time responses. The third part of the research is the implementation process, which include studying and selecting the proper technology, software development and finally software deployment.

RESULTS

The first step in developing a context-aware university mobile organizer is verifying students' requirements. In order to obtain the requirements, a questionnaire survey research was carried out. There three research questions that have been identified for this survey research. The first one is to study students' perceptions regarding university mobile organizer. The next research question is to find student requirements. Different ways to specify potential problems in the university environment were used, such as studying similar systems, interviewing several IT students and personal experiences in the IT faculty. The last research question is regarding which features students prefer to use in a university mobile organizer.

Twenty-nine females and twenty-one male students participated in this survey. The number of respondents from among undergraduate students is three times more than the number of respondents from among postgraduate students. This is approximately the same as their distribution rate in the campus. Thirty-eight students have hand-held devices such as notebooks and PDAs. Eighty-two percent of students are able to connect to the university wireless network; therefore, one of the infrastructures for the university mobile organizer has been used widely within the university. A high percentage of students can access the university network via cable connection. Most of the students do not have any problem connecting to campus wireless network among respondents and should there be any mobile organizers, many students will be able to use the application easily.

Two important concerns for developing mobile applications are security and privacy. Three questions have been asked regarding these issues:

- The problem of disclosing personal information in a university network
- The problem to access online information because of security concerns
- The problem of trusting the wireless network provided by UKM

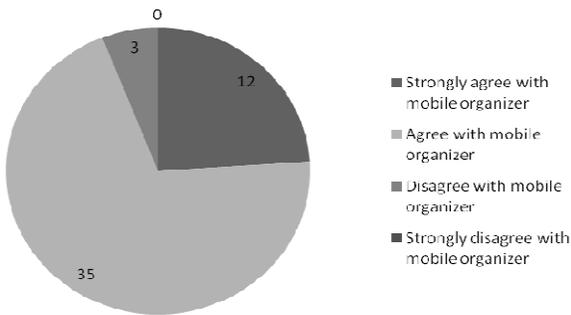


Fig. 1: Summary of respondents' opinions about wireless organizer

The result of the survey shows that the current security in university applications satisfies students. Students, however, would like to have more control over their private information. Suggested features are stated below:

- Use secure applications rather than easy access application
- Decide to publish personal information for friends
- To render personal information anonymous by using tools

Respondents prefer to have secured applications rather than applications that easy to be used. In addition to that, they prefer to have control over their private data. For example, they prefer to be able to control access to their personal information or to be able to use tools like Privacy Enhancing Technologies (PETs) to make personal information anonymous.

There are four major problems faced by the students. The first major problem is that students cannot access their online information easily usually because of server disconnection. The next problem is that students have problems in informing when their class time and location is changed and the reason is a shortage of a real-time application. Waiting in the university bus station is the next problem, which happens a lot because students do not know the exact bus timetable. Finding important events such as registration dates is the last problem for students.

The next research question is regarding how much students use the university mobile organizer. Here, a brief description about the university mobile organizer and its usefulness are given to students. It then continues to ask respondents to answer several questions. The first question asked to measure the respondents' knowledge about the university mobile organizer. Forty-two percent of respondents have heard

about the university wireless organizer, which is a reasonable rate as it was expected that many students knew nothing about the mobile organizer. The next question is measuring how the respondents' favor the university mobile organizer. Twenty-four percent of respondents strongly agree that a university mobile organizer can help them access their required online information more easily within the university. Seventy percent of respondents agree with having a mobile organizer while only six percent of respondents disagree in using a university mobile organizer. Results show that students believe the university mobile organizer can help them in their university activities. Fig. 1 is a summary of respondents' opinion about the mobile organizer.

An analysis of the results shows that students currently have several problems in their university activities and four problems are recognized as major problems for university students. Consequently, students admit that the university mobile organizer is suitable software for solving their problems. Ninety-four percent of respondents prefer to use the application to assist them in their university activities.

The next part of the survey focuses on the features of the university mobile organizer that had been assumed as part of the students' requirements. Fourteen features are offered as stated below:

- Information about class schedule
- Information about changes for class schedule
- Ability to send and receive messages to/from their lecturers
- Method of informing about new events
- Information about faculty news
- Announcement about university's or faculty's activities
- Online submission of assignments
- Downloading course material
- Online multimedia
- Lecturer evaluation system
- Information about bus schedule
- Information about shops close to them
- Online discussion forum
- Online system evaluation

Fig. 2 shows the results of responses to other features from number 2-14 which are mentioned above.

Framework development: This framework contains two main applications, which are Hand-held device application (client application) and server application. Framework architecture is shown in Fig. 3.

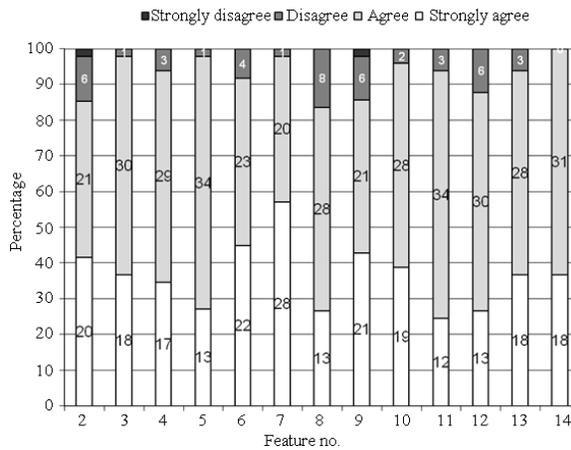


Fig. 2: Summary of responses for university mobile organizer features

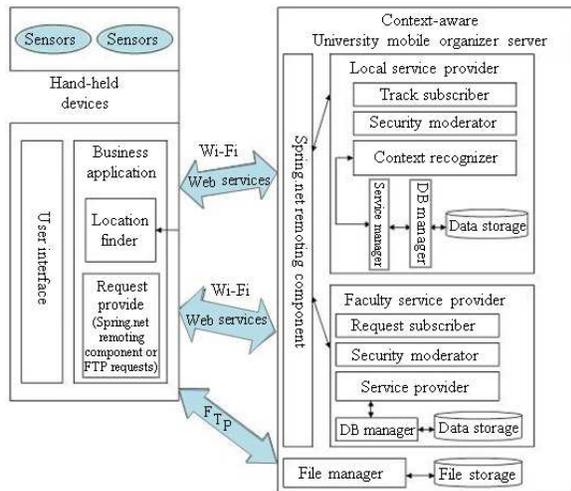


Fig. 3: Framework of context-aware university mobile organizer^[10]

Client Application includes two main layers which are business application and user interface. At a glance, user application is responsible to show the user services such as timetables, course messages, bus schedules and other requests. It is also responsible for requesting a service and sends it to the local or host server based on the type of request.

Local service provider brings local features to users like bus schedule or local events. Local service provider receives local requests, via .net remoting component. After storing the request in a server, a security moderator checks the authorization and authentication of the user. Afterwards, a context recognizer processes the request that includes receiving local information

from the user device, recognizes the context and produces suitable information for service provider. The service provider receives data from the context recognizer and produces the suitable services as an object. The service provider determines the privacy level of response and set privacy level of objects using Client Activated Object (CAO) and Server Activated Object (SAO)^[9]. Remoting components automatically change the plain object to a web service and sends to the client application.

Faculty Service responds to demands related to faculty activities such as timetables, course messages and forums. The server, after checking security issues, sends the request to a service provider in order to create the right response. The response, which is an object, is sent to a client via spring.net remoting component. The file manager responds to requests that relate to files. For file demands, an FTP connection is established between client application and host-server and the file is transferred from server to client.

Implementation: Implementation of the university mobile organizer is done using spring.net technology in a visual studio integrated development area. Programming language is C# and database is SQL server 2005. This application runs on Microsoft operating systems. Windows server 2003 and its facilities provide a secure environment for server applications and present some abilities for managing files and permissions easily. Spring.net technology is used for developing and implementing context-aware aspects like transferring services or context reasoning. SQL server 2005 offers facilities for securing data storing and transferring such as using stored procedures. Because students use their notebooks more than PDAs the user application is designed in two versions for notebooks and smart phones. A sample of an interface for client application in both versions is shown in below.

Software authenticates users by using socket programming. If user is authenticated in the faculty server, the messages are sent to client. Login page includes a brief description of university mobile organizer and the presented services by the software. Figure 4 displays the screenshot of login page in both mobile and notebook version.

The message page includes personal and public information about the user. Timetable part displays the class schedule and urgent messages is a place to see the urgent information which usually inserted by lecturers. Private messages show the messages from your friends within campus area. The screenshots is shown in Fig. 5. Moreover, if students click on messages menu they can access to faculty and university events and they can leave messages for their friends. Message part is going to satisfy proposed features of 1-6.

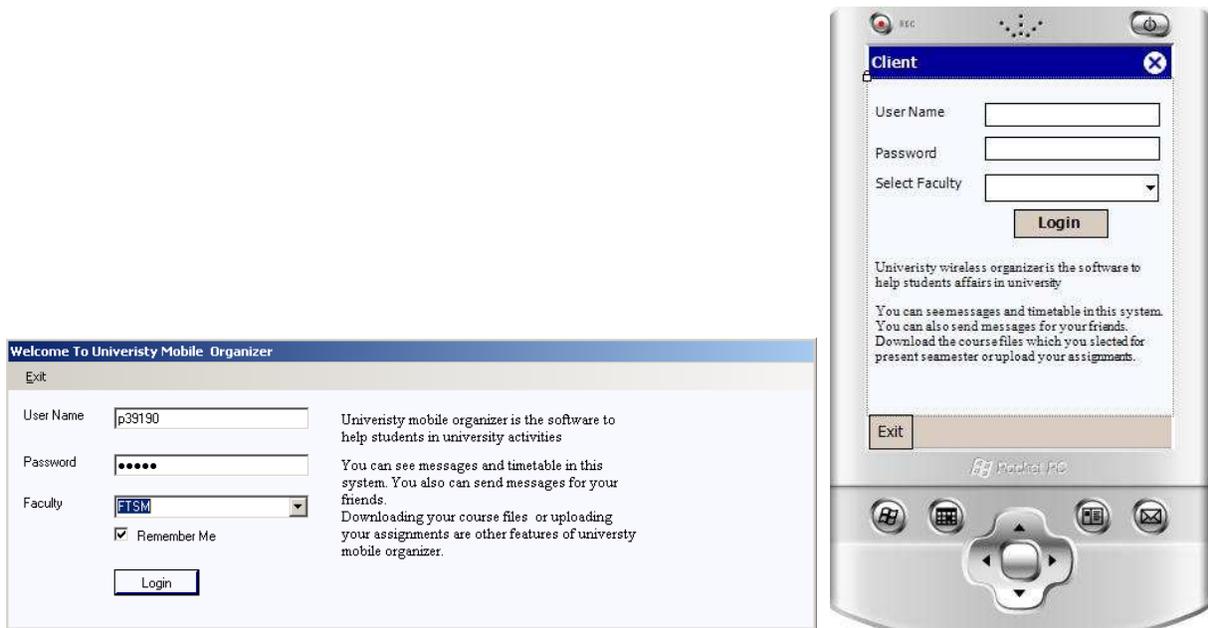


Fig. 4: Login page for client application in notebook and PDA versions

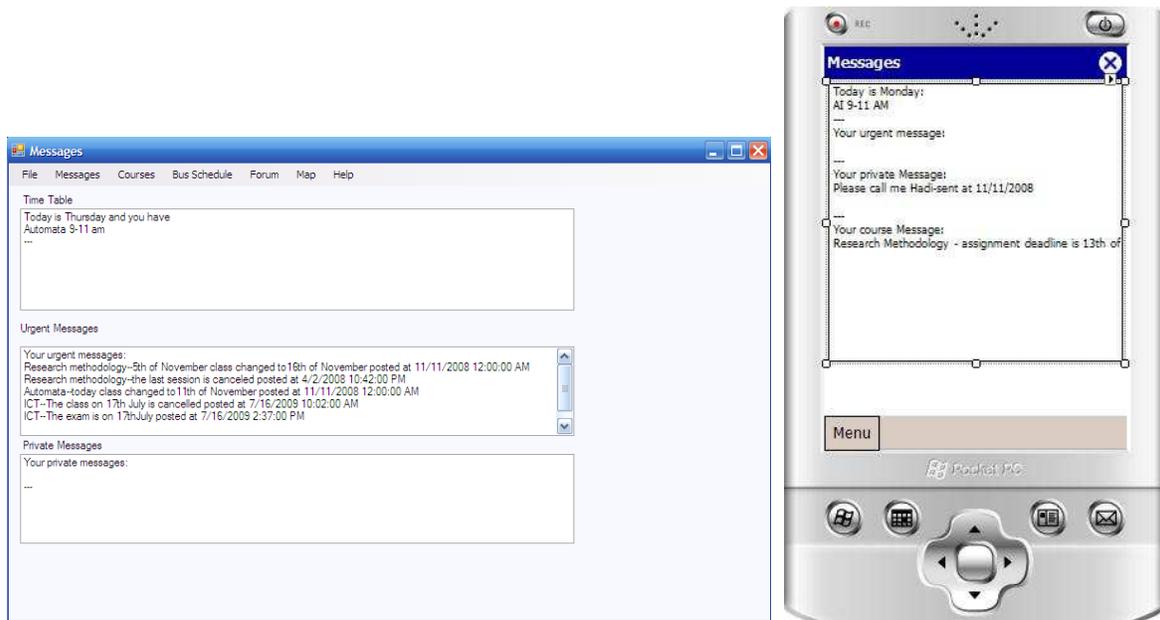


Fig. 5: Message page in notebook and PDA version

Courses page includes all information about student-registered courses. By clicking a course name, students can see the related messages, assignment files and lecture files of the selected course. In upload, students can upload their assignment or project files. Figure 6 shows the course page screenshot. Additionally, in course menu

there is an option to see media files of the registered courses and evaluate a course lecturer. Therefore, this part of software satisfies features 7-10. Bus schedule is one of the features, which have not seen in any other similar systems. This feature helps students to manage their times. This service works by spring remoting

component and when user request for bus schedule, the local server retrieves data from database and sends this data table to client application. Figure 7 shows the screenshot of bus schedule.

The forum is a place that students can create a subject about a course or write their ideas in a discussion thread. This part is supposed to cover some communication shortages between classmates and lecturers. In map form, students can use Google map or use some uploaded campus maps. When students select the map page, system automatically shows the current place of students in mobile Google map. If the system

includes any map images for that location, user can see the local map images or select some predefined routes to find how they can reach to a determined place.

System related features like user profile or system evaluation is designed under file menu option. Students can submit their ideas or system errors online via system evaluation. In the profile form, students can edit their personal information such as password or email. Help form includes complete information about each part of the software. These forms are implemented to satisfy the admitted proposed features in the survey.

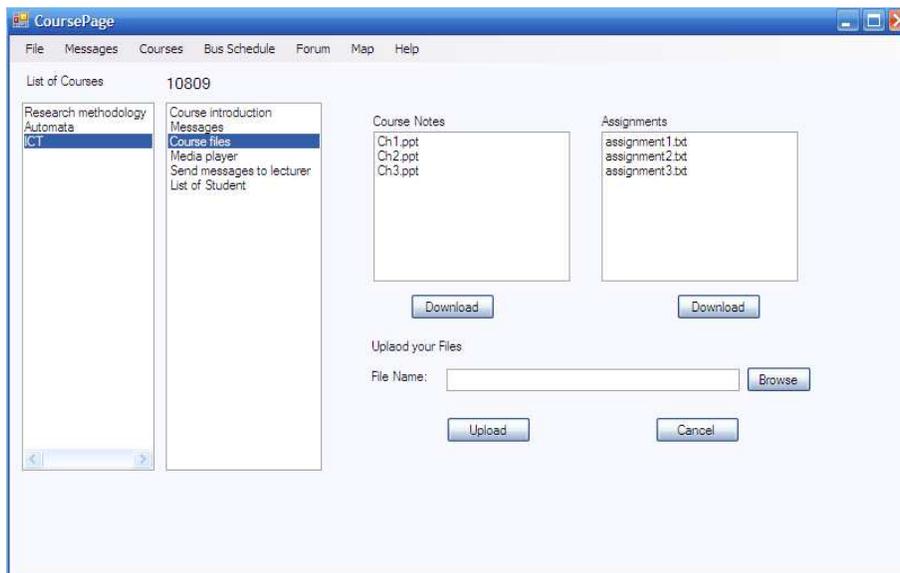


Fig. 6: Student course manager

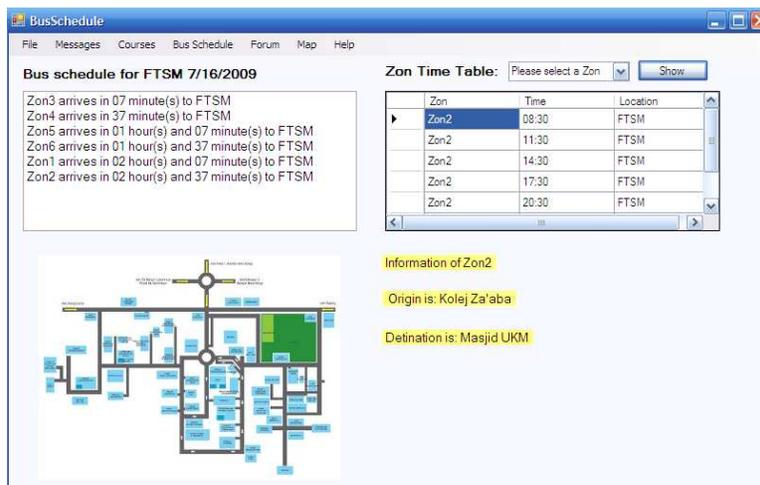


Fig. 7: Bus schedule page

DISCUSSION

This study proposed a context-aware university mobile organizer to solve students' problems in the university environment. From the survey that was carried out, there are four problems that have been identified by students as major problems that they are facing in their daily activities: Immediate easy access to personal information, informing changes in their class schedule on the spot, accessing updated bus schedules and being informed on the university's important dates. The university mobile organizer that has been developed provided features that can help students to solve these problems.

The proposed framework is based on based on the assumption that there are several servers will be used at one particular time. These servers can be divided into two categories: local servers and faculty servers. The use of multiple servers can help to improve the quality of service since some of the information can be provided locally.

The implementation of the software is done by using spring.net technology because this technology has some components that reduces programming complexity of context-aware application. This technology is also compatible with other .net technologies. The client application is designed in two versions to be usable with notebooks and smart phones.

CONCLUSION

This study describes the implementation of a university mobile organizer. From the study that we have carried out, it is important that the process of implementing this type of software must be based on the right user requirements, a proper framework and use of a suitable technology. The result of the study shows that software that was developed manage to satisfy students requirements and hence solve their problems. Using the right technology also helps in reducing software complexity.

We would like to continue this research in order to evaluate the application to see if it satisfies all of the context-aware criteria. For future extensions of the current work, we would like to develop some components to enhance the compatibility of the client application with different operating systems.

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