ON-LINE MOBILE STAFF DIRECTORY SERVICE: IMPLEMENTATION FOR THE IRBID UNIVERSITY COLLEGE (IUC)

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ABSTRACT

Mobile Directory Services came to exist to help users to find the information they need wherever and whenever they are. With the increasing popularity of mobile communications and mobile computing, the demand for mobile directory services applications grows. This paper leads to develop mobile web based directory service for Irbid University college IUC to provide students with information and services about lecturers or supervisors via their hand phones.

Keywords: information system, mobile communications and computing, mobile directory services.

1 INTRODUCTION

With the rapid development of computer science technology and the popularity of web solutions, the Internet has become a major means for collecting and displaying information. Many computer applications are developed to help users make decisions concerning the management of staff information, and communication through and outside the organization [17].

The explosive growth of mobile devices including phones, personal digital assistants and pagers presents tremendous opportunities for companies to increase sales, improve productivity, and provide better service. But simply making existing applications available over mobile devices doesn’t completely capitalize on the opportunities. Form factor, browsers, input/output limitations and even the type of transactions that are likely to be conducted all have to be considered [23].

Directory services provide a foundation for a modern enterprise information infrastructure. Directory services are not only ‘databases’ but rather a range of processes, applications, systems, and data that allow an organization to provide timely, accurate, and secure information about the organization and its people. Easily accessible directory information supports the work, business practices, and inter/intra organizational communications of educational institutions, staff, students, and affiliates in support of wider goals of the business process [6].

This paper will try to introduce an example directory service using mobile web based application that has the same functionalities of web based directory services, so it would be faster and more effective for students to deal with.

1.1 Problem Statement

Staff information is always important in our daily educational life because it effects in many of our life activities such as choosing classes, arranging meetings, and more. IUC has a fragmented web-based staff directory, which offer limited information about the staff. In ability by students and others to access staff information at the right time and place causes a considerable amount of time wasting activities such as finding and asking other staff about the places of their counter parts, this challenge requires ubiquitous and mobile kind of computing.

Recently the IUC has adapted a new management structure by merging into three main colleges, these new structure posses a new challenge of providing a unified staff directory that is accessible any time and any where. It will be very useful if we can know what is the contact number and address information of any staff in IUC before do any activity that effected by this information. Real-time staff directory service information will be good factor in our educational life starting from choosing the right supervisors to choosing classes. So, mobile staff
directory information system will enhance our educational process by good preparing for everyday university activities.

This study will try answering the following questions:
What are the requirements of implementing a mobile staff directory?
How we design and implement a mobile staff directory?
What will be the impact of implementing a mobile staff directory?

1.2 Objective

The objectives of these study are:
To analyze and define the user requirements for mobile staff directory service.
To design mobile staff directory service system model.
To develop a prototype to prove the new model.
To evaluate prototype.

1.3 Scope

Over 800 different mobile devices are available on the mobile market [20], with many different shapes and brands, however developing to meet the capabilities of all devices are out of the scope of this paper, this research will focus only on Nokia and Sony Ericsson mobile phones.

On the other hand IUC is a large institution; this study will focus only on implementing the mobile staff directory for the information technology department of college of arts and sciences.

2 LITERATURE REVIEW

2.1 Mobile Web Based Application

Web applications are gaining popularity via mobile wireless PDAs, web browsers on these systems can be quite slow and often lack adequate functionality to access many web sites. [16] developed a PDA thin client solution that leverages more powerful servers to run full-function web browsers and other application logic then sends simple screen updates to the PDA for display. The solution uses server-side screen scaling to provide high-fidelity display and seamless mobility across a broad range of different clients and screen sizes including both portrait and landscape. They have implemented this solution over Windows Mobile and evaluated its performance on mobile wireless devices. Their results on multiple mobile wireless devices demonstrate that the suggested solution delivers web browsing performance up to 80 times better than existing thin-client systems, and 8 times better than a native PDA browser. In addition, their solution is the only PDA thin client that transparently provides full-screen, full frame rate video playback, making web sites with multimedia content accessible to mobile web users.

2.2 Mobile Services

Typically wireless devices are used to offer services in a more quickly method rather than using web. A survey using popular brands trial in mobile announcing found that as many as 84 % of the 500 young British adult are likely to recommend the service to their friends, while only 7 % are likely to abandon the service [24]. An earlier study undertook by [8] found that in mobile announcements for example the level of brand recognition was as high as (66%) of people who remember and spontaneously recall the average campaign. The best campaigns exceed 50% spontaneous brand awareness and 80% prompted awareness. SMS is 50% more successful at building brand awareness than TV and 130% more successful than radio.

2.3 Directory Services

[25] defined A directory service is a software application or a set of applications that stores and organizes information about a computer network's users and network resources, and that allows network administrators to manage users' access to the resources. Additionally, directory services act as an abstraction layer between users and shared resources. According to [7] a directory service should not be confused with the directory repository itself; which is the database that holds information about named objects that are managed in the directory service. In agreement with [19] in case of a distributed directory services model, one or more namespaces are used to form the directory service. The directory service provides the access interface to the data that is contained in one or more directory namespaces. The directory service interface acts as a central common authority that can securely authenticate the system resources that manage the directory data.

According to [1] that like a database, a directory service is highly optimized for reads and provides advanced search possibilities on many different attributes that can be associated with objects in a directory. The data that is stored in the directory is defined by an extendible and modifiable schema.

2.4 Mobile Directory Service

With the increasing popularity of mobile communications and mobile computing, the demand for mobile directory services applications grows. According to [10] Mobile directory services exploit knowledge about the information of real-world objects such as persons in order to adapt the functions of a directory service towards the user.
[29] stated that the economic deployment of portable directory services applications will very soon become possible due to the progress in and the resulting cost reduction of locating technologies such as GPS. Furthermore, the next generation wireless multimedia networks will utilize such high radio frequencies or even infrared links that the radio cells will be limited to the size of a room. This will allow retrieving location information from the wireless network mobility management functions without additional costs. To enable the fast and efficient development of mobile directory services, [10] developed a sophisticated directory information server (DIS) based on specific directory data models and services. According to [27], the approach treats directory services not as an isolated class of applications but conceptually integrates them into a generalized framework for mobile multimedia communication services. [2] stated that the directory information service is integrated part of a software platform for mobile multimedia applications and interacts with the other platform support functions and mobility management services. [3] declared that the platform shields the applications from the distribution of the underlying communication networks and locating infrastructures and offers a set of sophisticated support functions and high-level APIs to the application programmers. The APIs communicate with the platform through a suite of mobile application platform access protocols based on the widely accepted directory access protocol DAP [14] and lightweight directory access protocol LDAP [26]. The main property of the DIS is that a new event turns the directory into an active directory, allowing a directory user to be informed about relevant changes to the directory content. The new optimization feature of the “is-nearest-to” matching rules allows to build a sophisticated trader [13] based on the DIS directory implementation since it allows to perform a service selection in the directory. According to [4] the implementation of the DIS server shall be based on available directory servers.

In spite of the increase in the availability of mobile devices in the last few years, Web information is not yet as accessible from WAP phones as it is from the desktop. [5] proposed a solution for supporting one of the most popular information discovery mechanisms, namely Web directory navigation, from mobile devices. The solution consists of caching enough information on the device itself in order to conduct most of the navigation actions locally while intermittently communicating with the server to receive updates and additional data requested by the user. The cached information is captured in a directory capsule. The directory capsule represents only the portion of the directory that is of interest to the user in a given context. At the end of 2002 more users will be capable of Internet access than wired Internet users [12]. Yet, we are still far from the dream of having Web information as conveniently accessible from a hand held device as it is from our desktop. This is due to two main limiting factors: Form factor: Existing information discovery mechanisms for searching and browsing the Web are not well suited to the limited screen real estate and input capabilities of handheld devices. These mechanisms need to be revisited in order to take into consideration the specific device. Communication mode: Mobile devices are typically connected through networks with low bandwidth and high latency. Both the slow response time and the still prohibitive prices of over-the-air connection make users reluctant to stay constantly connected. Many researches have tried to introduce their contribution to mobile directory services. For instance, iCAR introduced by [11] mobile ad-hoc networks into a cellular network to improve the latter’s call blocking rate in hot spots such as sporting venues or on the scene of emergency events. The network structures were a typical feature of 4G mobile networks. In recent years, small portable devices have been increasingly equipped with multiple communication interfaces. Some new multiple-interface servers are also under design and development. These facilities make the integration of different networks feasible and more convenient. Therefore, heterogeneous networks will become the main part of future mobile systems and offer people more flexible network services. [18] proposed a new service discovery methodology for future generation mobile systems: model-based service discovery or MBSD. MBSD takes advantage of the OMG (Object Management Group) and Model-Driven Architecture (MDA,n.d.) techniques. The system architecture of MBSD and its operation were presented and implemented. The proposed methodology was validated via a mobile service scenario. (see Figure1)

![Figure 1. Service Discovery & Delivery Workflow](image-url)
3 METHODOLOGY

3.1 Introduction

The methodology used for this study is an agreeable method, excellently chosen, described and accepted among the experts in Information System which is namely the Design Research Methodology.[28]

3.2 Research Design Methodology

The methodology consists of five main phases as follows:

- Awareness of Problem
- Suggestion
- Development
- Evaluation
- Conclusion

3.2.1 Phase 1: Awareness of Problem

The first stage of this method is the understanding of the objectives and the scope of this study, as well as the problems which are required to be solved. Through discussion and related literature reviews, the awareness of the problem raises because students are not able to retrieve staff information quickly and effectively. Mobile web applications have been needed as a way to solve similar problems.

3.2.2 Phase 2: Suggestion

The study suggested the use of mobile solution to help student to search for the detailed information of a given lecturer or supervisor. The output of this phase is the Tentative Design. The design of the system includes UML diagrams, and formulation of suitable algorithm to achieve the desired result. The UML diagrams involved are use case diagrams and sequence diagrams.

3.2.3 Phase 3: Development

After designing the system, this research proceeds with the development of the system prototype. The completed design is now translated into program code. In this phase, this study will use JSP in coding the cards for the On-line Mobile Staff Directory Service and MySQL as the RDBMS.

3.2.4 Phase 4: Evaluation

In the case of our system, to test the usability of the mobile web based prototype two areas will be evaluated through doing a questionnaire to evaluate the two areas. The first area is the prototype usefulness; the second area is the prototype ease of use both of which are from perspective of TAM (Technology Acceptance Model). Then, attitude toward use predicts the behavioral intention to use. Finally, intention predicts the actual use of that technology [9]. The PUEU (perceived usefulness, ease of use) was adapted from [9]. The questionnaire’s questions for the prototype’s usefulness dimension will be written depending on the requirements that were collected previously from the predicted users of the system.

3.2.5 Phase 5: Conclusion

The final phase of the chosen methodology is the conclusion. Based on the findings and results from the data analysis, a conclusion on the study is made and suggestions from users are proposed for future work enhancement.

4 FINDINGS AND RESULT

4.1 System Characteristics

4.1.1 Purpose and Functionality

The purpose of the OMSDS system is to provide students with an effective portable mechanism to search for academic staff information via their hand phones, a directory for all academic staff members in the Irbid University college IUC will be available for students to access and retrieve estimated information that help them in arranging meetings with their lecturers or supervisors immediately when they wish to do so.

4.1.2 Typical user

The OMSDS is intended to be used by students within IUC community.

4.1.3 The Environment

The OMSDS is a web based mobile system that can be used anytime, anywhere, via hand phones.

4.2 Requirements Specification

This section specifies the requirements of the system. According to the first phase “Awareness of problem” of the adopted research methodology, in order to collect and identify the requirements of the system feasibility study was executed; a survey was conducted with 25 students at IUC.
As a result 80% of the respondents have agreed and 20% have strongly agreed the idea of developing an online staff mobile directory that gives them the information regarding their academic staff. Some of the respondents wrote suggestions for the idea; some of the suggestions given were to provide photos for staff members. Depending on the obtained results the requirements for the OMSDS will be stated as follow:

4.2.1. For the Student Part

i. Functional Requirements:

- In the main WAP page, the OMSDS shall allow the student to search for a certain staff member.
- When the student follows one of the three options The OMSDS shall return a list of the corresponding staff members in a new WAP page.
- When the student selects a certain staff from the returned list the OMSDS shall display the personal photo in a different WAP page.
- When the student press on the staff’s photo a new WAP page will display the information for the selected staff.

ii. Non Functional Requirements

- The execution of OMSDS should be the same on Nokia and Sony Ericsson mobile phones.

4.2.2. For the Administrator Part

i. Functional Requirements:

- The web based part of the system shall allow the administrator to view, add, update, and delete a certain staff from.

ii. Non Functional Requirements

- The web based part shall insure that the administrator provide correct username and password before being able to login as an administrator.

4.3. Use Cases diagrams

According to [15], the cases are a formal way to capture and to express the interaction and dialog between system users (called actors) and the system itself.

A use case expresses what the system should do without concentration how the system should do it.

For the case of our study the three main actors in the OMSDS system are the administrator and the student. Figure 2 shows the abstract view of the use case for the OMSDS.

The typical use case contains a narrative flow of events that constitutes a specific use of the system; each administrator of the OMSDS site has the operations of adding, updating, deleting certain staff record information. Each student has the operations of searching for a certain staff according to his position, department or to his name.

![OMSDS use case diagram](image)

Figure 2. OMSDS use case diagram

4.6.3. Coding and Implementation:

In these steps the design of the system is converted into code to implement it and evaluate it. In our case, the OMSDS is mobile web based application in which WAP pages can be implemented with any scripting language such as ASP, JSP, or PHP.

JSP was chosen because it is one of the most robust server-side scripting languages for creating dynamic interactive pages, when we combine it with WML, this will result in interactive WAP pages.

So, for developing the dynamic WAP pages, a combination of JSP, WML codes is chosen as the server-side scripting language, because it is considered one of it is fast, stable, and secure.
WAP services can be hosted on Web servers using technologies such as Java Server Pages (JSP). Dynamic WML documents for wireless devices can be easily developed using JSP. Java Server Pages lets us embed Java statements within HTML documents. When JSP is invoked, it is compiled into a Java server and executed by the server to create a dynamic HTML document. In the case of WAP, dynamic WML documents will be created, therefore, developing WAP applications using JSP can be done easily once you know the syntax of WML. [23] has strongly recommended the use of JSP to develop WAP applications. For the database implementation MySQL 5.0 is chosen as the relational database management system (RDBMS). MySQL is a multithreaded, multi-user SQL database management system, and that is suitable into the situation in which many users try to access the OMSDS database simultaneously. For the server side, Tomcat 5.5 was used as a Web Application Server.

Other tools used in this study were as follows:

- Open Wave mobile simulator.
- JCreator Pro 4.5 (IDE for JSP).
- PHP Admin 3.4 (MySQL database administration tool)
- Microsoft Visio 2003
- Microsoft Word 2003

Figure 3 show screenshot for the main screen that shows up to any student, in which the student can search for a certain staff according to his position, department, or to his name.

Figure 4 shows screenshot for the search result as a list:

4.7. Usability Testing

In order to test the usability of the mobile web based prototype two areas will be evaluated through doing a questionnaire to evaluate two areas. The first area is the prototype usefulness; the second area is the prototype ease of use both of which are from
perspective of TAM (Technology Acceptance Model). Then, attitude toward use predicts the behavioral intention to use. Finally, intention predicts the actual use of that technology [9]. The PUEU (perceived usefulness, ease of use) was adapted from [9]. The questionnaire's questions for the prototype's usefulness dimension will be written depending on the requirements that were collected previously from the predicted users of the system. (see Figure 6)

The survey's questions for the two areas will be written depending on the functionality related requirements listed in Section 4.2 written under the results of the feasibility study made to collect user requirements at the beginning of this study (refer to Appendix A for the feasibility survey); the usability testing questionnaire was conducted on 24 respondents; the random sample where selected from college of art and science including Postgraduate students and Lecturers. Each of them was given brief demonstration about the prototype. The questionnaire covers two dimensions which are the usefulness and the ease of use of the prototype system (refer to Appendix B to see the complete questionnaire form). The executed questionnaire consisted of two sections: 1) the general information and 2) the user evaluation. The general information section works as a mechanism to collect user's demographics. The user evaluation section works as a mechanism to collect data on user's opinion regarding the usefulness and ease of use usability aspects. The study uses the Statistical Package for Social Sciences (SPSS) version 13 to perform the descriptive statistics analysis for the collected data.

As shown in Table 1, (75.0%) of the respondents were Males (25.0%) were Females. As shown in Table 1, (83.3%) of respondents were students, were (16.7%) were lecturers.

As shown in Table 1, (25.0%) of respondents were local and (75.0%) were international.

Table 2 illustrates the Summary of Statistics for the all user evaluation questions dimensions usefulness and Total percentage for the two dimensions is more than (80%) which indicates that the participants agree that the prototype system is useful and easy to understand.

Table 3 summarizes of Statistics for the two dimensions usefulness and ease of use, since the percentage is above 80% for the two dimensions; this indicates that the prototype system has met the users' satisfaction.

5 CONCLUSION

5.1 Project Summary

This paper has achieved its objectives as illustrated below:

- Research objective 1:
  To analyze and define the user requirements for mobile staff directory service.

- Research objective 2:
  To design mobile staff directory service system model.

- Research objective 3:
  To develop a prototype to prove the new model.

- Research objective 4:
  To evaluate the prototype.

5.2 Problems and limitations

The usability testing was executed on the prototype using OpenWave 6.2.2 mobile simulator only, the real system still needs to be tested.
Table 1. Demographics Data Summary

<table>
<thead>
<tr>
<th>Gender</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18</td>
<td>75.0%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>25.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students</td>
<td>20</td>
<td>83.3%</td>
<td>83.3%</td>
</tr>
<tr>
<td>Lecturers</td>
<td>4</td>
<td>16.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nationality</th>
<th>Frequency</th>
<th>Percent</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local</td>
<td>6</td>
<td>25.0%</td>
<td>25.0%</td>
</tr>
<tr>
<td>International</td>
<td>18</td>
<td>75.0%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 2. Descriptive statistics for all dimensions

<table>
<thead>
<tr>
<th>Prototype USEFULNESS</th>
<th>mean</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Using the Mobile Staff Directory Service will make it easier for me to get staff contact details and other estimated information.</td>
<td>4.33</td>
<td>86.6%</td>
</tr>
<tr>
<td>2 Using the Mobile Staff Directory Service would enhance the way of retrieving staff related information.</td>
<td>4.5</td>
<td>90%</td>
</tr>
<tr>
<td>3 Using the Mobile Staff Directory Service would make it easier to arrange meetings with my academic staff.</td>
<td>4.67</td>
<td>93.4%</td>
</tr>
</tbody>
</table>

Prototype Ease of use

<table>
<thead>
<tr>
<th>Prototype Ease of use</th>
<th>mean</th>
<th>percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 using the Mobile Staff Directory Service would be easy for me</td>
<td>4.5</td>
<td>90%</td>
</tr>
<tr>
<td>5 I would find it easy to search for a certain staff using the Mobile Staff Directory Service according to his name.</td>
<td>4</td>
<td>80%</td>
</tr>
<tr>
<td>6 I would find it easy to search for a certain staff using the Mobile Staff Directory Service according to his position.</td>
<td>3.83</td>
<td>76.6%</td>
</tr>
<tr>
<td>7 I would find it easy to search for a certain staff using the Mobile Staff Directory Service according to his department.</td>
<td>4</td>
<td>80%</td>
</tr>
<tr>
<td>8 I would find it easy to retrieve the information for a certain staff using the Mobile Staff Directory Service.</td>
<td>4.5</td>
<td>90%</td>
</tr>
</tbody>
</table>

Table 3. Summary of Statistics

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Participants</th>
<th>Mean</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prototype Usefulness</td>
<td>24</td>
<td>4.5</td>
<td>90%</td>
</tr>
<tr>
<td>Prototype Ease of Use</td>
<td>24</td>
<td>4.16</td>
<td>83.32%</td>
</tr>
</tbody>
</table>
6 REFERENCES


