# ABSTRACT

This project includes the design and implementation of the Wireless Computer Help Desk System for the Systems Department at the Mary and Jeff Bell Library at Texas A&M University – Corpus Christi. This project facilitates the management and monitoring of work-orders and inventory using any device that is connected to the Internet and has a browser installed on it (Desktops, Laptops, Personal Digital Assistant (PDA) and Cellular phones). The system maintains a database for both inventory and work-orders. When the work-orders are submitted online they are stored in the database and the systems support staff is notified by an appropriate email generated automatically by the scripts. This system also generates reports from the work-orders to determine the areas of technology in which the library staff needs training. The system also helps to maintain a history of the inventory. The use of wireless PDAs and cellular phones makes it easy to update the inventory and the work-order database and also helps in getting high priority work-order email alerts instantaneously through cellular phones or pagers. The Systems Department can also post announcements, virus alerts, regular workstation maintenance instructions, etc. so this project can be used a single resource for communication and management.

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# 1. INTRODUCTION AND BACKGROUND

## 1.1 Introduction

Wireless Computer Help Desk System (WCHDS) is a work-order and inventory management tool developed for the Systems Department, Mary and Jeff Bell Library, TAMUCC, to help them provide on-time and efficient services to the rest of the staff in the library that they support.

## 1.2 Current Help Desk System

Currently, the  Mary and Jeff Bell Library has a computer help desk system which includes a Microsoft Access database. The staff either call or email the work-orders to the Systems staff and the Systems staff store these work-orders in a work-order database developed in Microsoft Access and eventually work on it. The database helps the Systems staff to monitor work-orders. All the Systems staff have access to the work-order database.  This system is not efficient due to the following reasons:

- There is no means of letting the Systems staff know about a high priority work-order if they cannot be reached by phone at that time unless the email is checked.

- During busy periods, although the work-orders are completed, they are not updated in the database. This can cause confusion for the rest of the Systems staff.

- There is no quick means of searching the work-order database for a particular computer related problem that was previously fixed.

- The work-order database is not connected to the inventory database so history of problems related to the inventory cannot be tracked.

- There is no particular email format to submit work-orders and so the staff may not send all the required information that is needed to complete the work-order, which will delay services.

- There is no single resource for the library staff through which the Systems staff can provide required knowledge, information, training, alerts etc.

## 1.3    Wireless Computer Help Desk System (WCHDS)

The Wireless Computer Help Desk System (WCHDS) developed by this project solves the inefficiencies of the existing system and provides more facilities to improve the services provided by the Systems department with the following features:

- Centralized database to store inventory and work-orders

- An online interface for the library staff which includes a form to submit a work-order, links to check the status of work-orders, FAQs, instructions for regular workstation maintenance, announcements and virus alerts

- Interface for the Systems department to monitor work-orders and inventory

- Wireless access to this system, which enables Systems staff to

    o Get high priority work-order alerts instantaneously through cell phones, PDAs or pagers

    o Update the work-order on the spot

    o Query the database (This can be done from anywhere in the library where there is access to the Internet.)

    o Check the history of the inventory

- Administration interface, which can be accessed only by the supervisor of Systems department. This page includes database maintenance and report generation, which can be used to plan required computer skills training sessions.

## 1.4    Importance of Wireless Computer Help Desk System ( WCHDS)

Every organization aims to grow. As the organizations grow the workload increases. To meet this workload, organizations start using more and higher level technology. With increased use of technology, the need for supporting and securing the technology increases. A system, like Wireless Computer Help Desk System (WCHDS) will help the Systems department to provide services efficiently and on-time. Wireless Computer Help Desk System (WCHDS) developed by this project meets the requirements of the Systems department, Mary & Jeff Bell Library. Commercial help desk software like FrontRange Solutions HEAT (company: FrontRange Solutions Inc) [HEAT 2002] are in use but there are no commercial products yet that have wireless access or features to generate reports from work-order statistics.

## 1.5    Similar Works

Several organizations and universities are coming up with similar kinds of Computer Help Desk Systems. The University of Victoria [CVU 2002] and the University of Minnesota, Crookston [CUM 2002] have computer help desk systems on their Web sites. Wireless Computer Help Desk System (WCHDS) developed by this project includes additional features, such as wireless access, report generation (which can be used to plan training sessions), FAQs, etc. compared to the above-mentioned universities.

# 2. WIRELESS COMPUTER HELP DESK SYSTEM

Wireless Computer Help Desk System (WCHDS) is a software project developed for the Systems department in the Mary & Jeff Bell Library, TAMUCC. The Systems Department is responsible for the maintenance of computers and peripherals in the library. Wireless Computer Help Desk System (WCHDS) developed by this project helps the Systems department to manage the work-orders and inventory and provides on-time services to the library staff. Reports generated from the work-orders help in planning required computer skills training sessions for the library staff. The project can also be used to post the information that the Systems department wants to provide to the library staff, such as, virus alerts, announcements, instructions for regular workstation maintenance, etc. Wireless access to this system enhances its availability from anywhere and anytime through all possible devices that can connect to the Internet. The Wireless Computer Help Desk System (WCHDS) developed by this project primarily includes the following modules:

- Desktop Interface Module

- Mobile Friendly Interface Module

- Wireless Application Protocol (WAP) Interface Module for WAP enabled wireless devices as shown in Figure 2.1

Each of these modules further includes:

- User Interface

- Systems Staff Interface

- Administration Interface
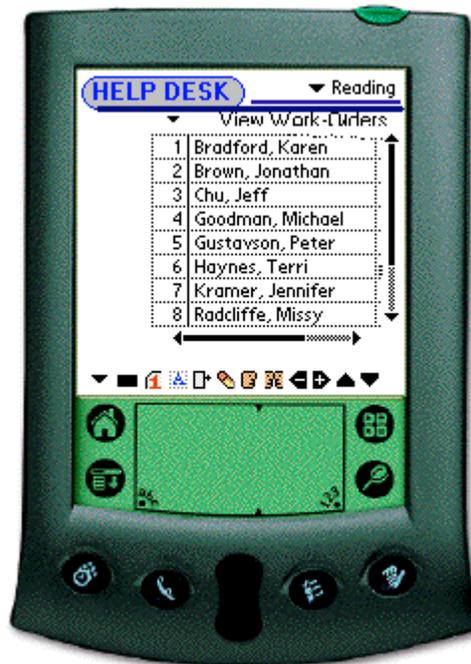
**Figure 2.1:    Interface on WAP enabled wireless PDA**

Mobile friendly interface and interface for WAP enabled device are designed to be accessible on a wireless PDA or cellular phone. These interfaces are designed to work efficiently in a *microbrowser*. A microbrowser is a browser designed to fit into a small wireless terminal that makes minimal demands on the hardware, memory, and the CPU. Mobile friendly interface and interface for WAP enabled device do not have access to generate reports because it is difficult to fit the reports into the microbrowser and also there is no necessity to view the reports on PDA or cellular phones. Reports can be viewed from any regular desktop or laptop.

## 2.1    User Interface Module

The User Interface as shown in Figure 2.2 is for library staff. All the library staff have access to this interface. This interface includes:

- A form to submit work-orders

- A link to view status of work-orders

- A link to FAQs

- A link to virus alerts

- A link to instructions for regular workstation maintenance such as virus check, disk defragmentation, scan disk, etc.

- A link to announcements for staff, such as  upcoming events, training, etc.

When a work-order is submitted, PHP scripts store it in the work-order database. The work-order is then categorized based on the problem type and is assigned to the Systems department staff member who deals with that problem category. An email as shown in Figure 2.3 is generated and sent automatically to the Systems staff.
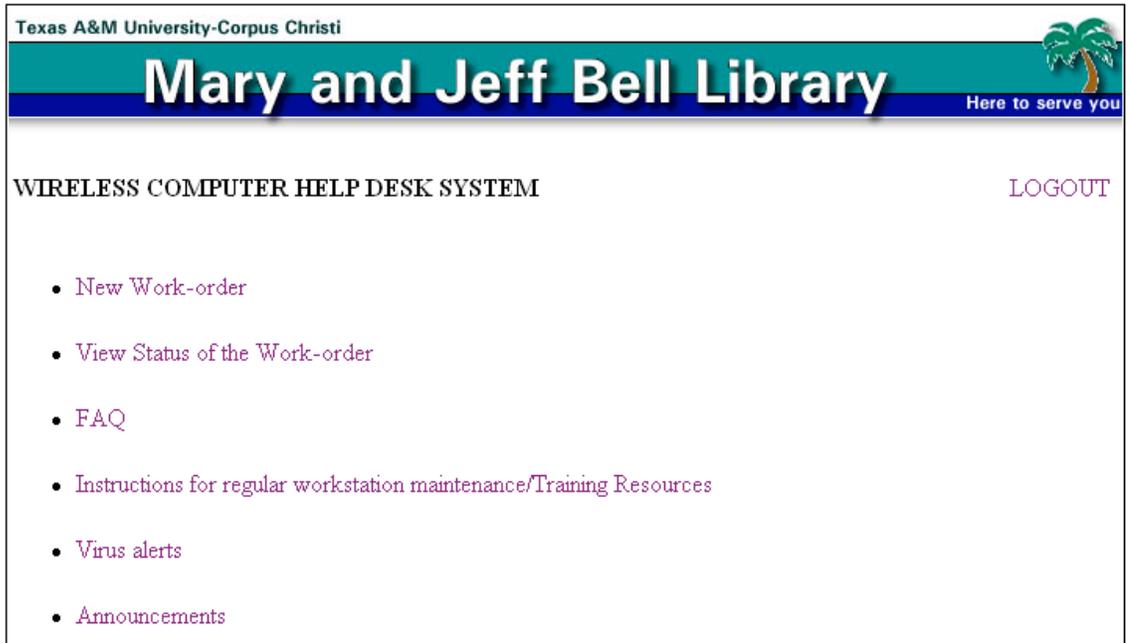
**Figure 2.2     Desktop User Interface**
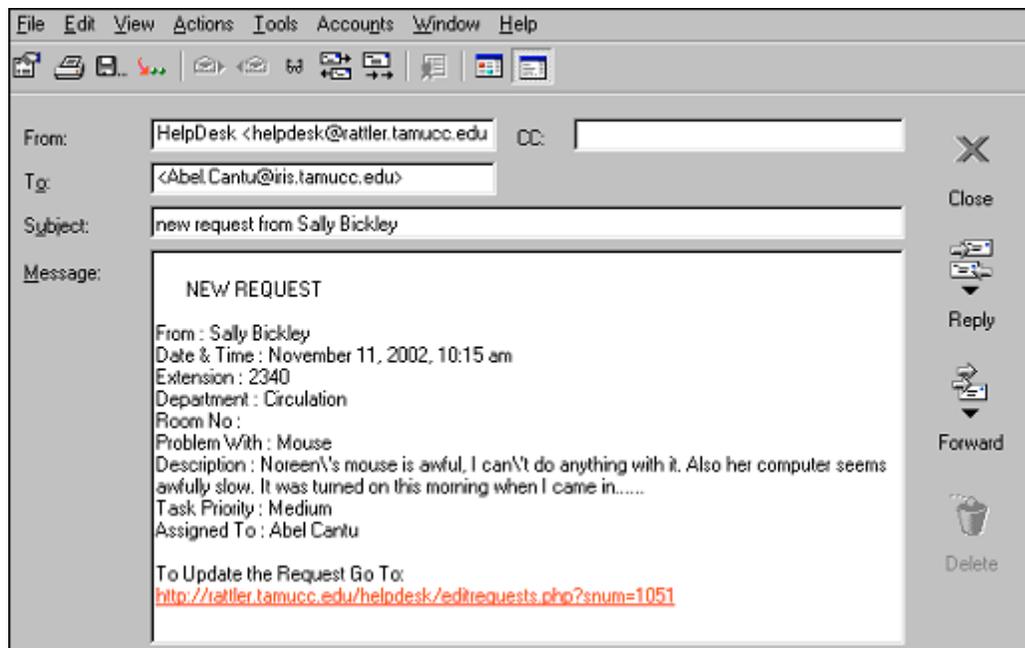


**Figure 2.3 Automatic email sent to the Systems staff**

## 2.2    Systems Staff Interface Module

The Systems Staff Interface, as shown in Figure 2.4, is designed for Systems staff.
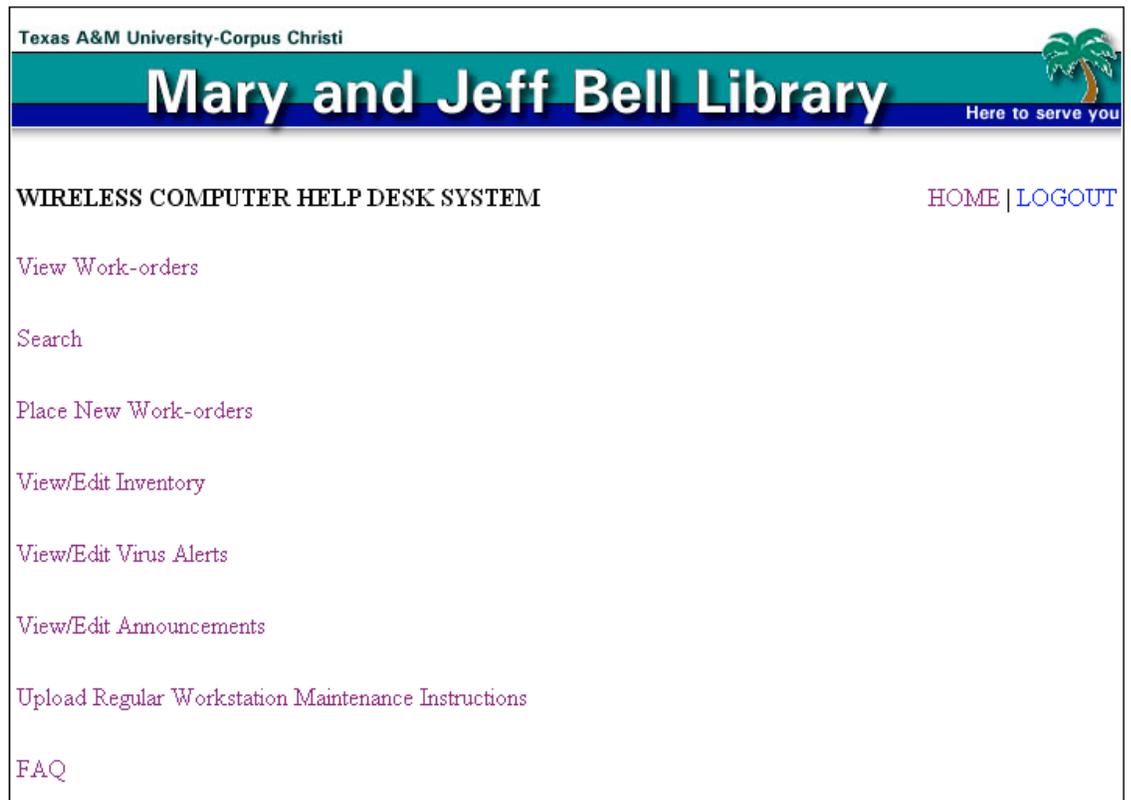


**Figure 2.4:    Desktop Systems Staff Interface**

Only Systems staff have access to this interface which includes:

▪ A Link to incomplete work-orders page which displays a list of work-orders to be completed as shown in Figure 2.5. When the work-order is submitted it is stored in the database with the status "Received". The status can be changed to either "Forward" or "Accept" by Systems staff in the work-order update form as shown in Figure 2.6. Once the work-order is completed System staff has to enter the solution and change the status to "Completed". When the work-order status is changed to "Completed" a link pops up which, if

accepted, will add that particular work-order's description and the solution to the list of FAQs.

| Track num | Status | Date | Name | ProblemWith | Description | Assigned To | Task Priority | Forward To |
|---|---|---|---|---|---|---|---|---|
| 1624 | received | 11/29/04 10:07AM | Virginia Buckley | GroupWise | have rec'd two rejections from other email addresses on mail I did not send. | Systems Staff | Low | Systems Staff |
| 1623 | received | 11/28/04 6:40PM | Ramadevi Jaini | Media Statistics Database | | Ramadevi Jaini | Low | Ramadevi Jaini |
| 1622 | accepted | 11/20/04 2:45PM | Ramadevi Jaini | Media Statistics Database | | Ramadevi Jaini | | |
| 1621 | received | 11/17/04 6:13PM | Kavita Durbha | Media Statistics Database | | Ramadevi Jaini | | Ramadevi Jaini |
| 1620 | received | 11/06/04 0:25PM | Ramadevi Jaini | Media Statistics Database | | Ramadevi Jaini | | Ramadevi Jaini |
| 1619 | received | 10/28/04 2:22PM | Ramadevi Jaini | Media Statistics Database | | Ramadevi Jaini | | Ramadevi Jaini |

**Figure 2.5:     List of incomplete work-orders**

| Date | 11/11/02 - 4:51PM |
|---|---|
| Name | Deanna Solomon |
| Department | Systems |
| Extension | 5972 |
| User Id | |
| Problem with | CPU |
| Description | The daylight savings time need to be changed and a screen saver needs to be |
| Assigned To | Abel Cantu |
| Task Priority | Medium |
| Forward To | Abel Cantu |
| Status | received |
| TAMU ID | 15-00-0-0036253 |
| Solution | |

RESET    SAVE

**Figure 2.6:     Work-order update form**

- A form to submit work-order. In some cases when the library staff member has to submit a work-order but does not have access to the Internet then they can call the Systems department and the Systems staff can add that work-order to the work-order database through form on Systems Staff Interface.

- A form to access inventory as shown in Figure 2.7, can be used to add, edit or delete inventory.



| | | TAMUID | Equipment | Model | SerialNum | Name | Location | Grants | Note |
|---|---|---|---|---|---|---|---|---|---|
| EDIT | DELETE | 36670 | | VHS Cleaner/Inspector/Rewinder | 4011 | Media | | | |
| EDIT | DELETE | 24763 | CD Rom | Virtual CDWorks Tower | CDW176 | Systems Spare | | | |
| EDIT | DELETE | 24764 | CD Rom | Virtual CDWorks Tower | CDW177 | Systems Spare | | | |
| EDIT | DELETE | 24766 | CPU | Digital DEC 3000 CPU | AB4300031B | Systems Work Room | | | |
| EDIT | DELETE | 27536 | CPU | Alpha Dec 433 | NI93407643 | Portal | | | |
| EDIT | DELETE | 30783 | CPU | MicroStop | 116533 | ELC workstation 11 | | | local printer use |

**Figure 2.7:     Inventory**

- A search engine as shown in Figure 2.8 can be used to search previous work-orders by a search word, problem type, name or department.



**Figure 2.8:    Work-order Search**

- A form to add information to the FAQs.

- A form to add/edit instructions for regular workstation maintenance

- A form to add/edit Virus Alerts

- Forms to add/edit Announcements

Some of these features such as Add/Edit FAQs, virus alerts, announcements, etc. are not available on interfaces for PDA and cell phone.

## 2.3 Administration Interface Module

Administration Interface as shown in Figure 2.9, can be accessed only by the head of the Systems department. This interface includes the following features:

- View/Edit all incomplete work-orders

- View/Edit individual incomplete work-orders

- Edit completed work-orders

- Edit individual completed work-orders

- View/Edit Inventory

- Individual (Systems Staff) monthly reports

- Monthly statistics report of work-orders

- History of Inventory

- Delete work-orders from the database

- View/Edit work-orders routing table

- View/Edit Systems Staff table

- Add/Edit/Delete login accounts to access Wireless Computer Help Desk System

Some of the above features such as reports, delete work-orders, edit work-order table, edit system staff table, and login accounts are not available on interfaces for PDA and cellular phones.

There are three types of login accounts in Wireless Computer Help Desk System (WCHDS). The login account type is specified when the account is created. The three types of login accounts are:

- Administrator login account, which has access to Administration Interface.

- Systems Staff login account, which has access to the Systems Staff Interface.

- User login account which has access to the User Interface.



**Figure 2.9:    Desktop Administration Interface**

# 3. SYSTEM DESIGN

## 3.1 Overview of the System

The major components of the Wireless Computer Help Desk System (WCHDS)

developed by this project are:

- Hardware: Linux Server, PDA, regular workstation such as Pentium II/III with WIN 9x operating system and wireless network.

- Languages: PHP, HTML, JavaScript, and WML

- Database: MySQL

### 3.1.1 PHP

The Wireless Computer Help Desk System (WCHDS) developed by this project uses PHP [PHP 2002] to generate dynamic Web pages. PHP stands for Hypertext Preprocessor. Scripts written in PHP access the MySQL [MySQL 2002] database on the database server. PHP scripts use Structured Query Language (SQL) [SQL 2002] statements to query MySQL database.

PHP is a scripting language that is embedded in HTML and interpreted by the server. It is used to manage dynamic content, work with databases, handle session tracking, and even build entire e-commerce sites. It works well with a number of popular databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server.

The most common PHP installation is probably the PHP module running with Apache on Linux or a UNIX-variant. PHP works on Windows NT and 9x, as well as with a number of other Web servers. Because PHP scripts run on the Web server, they avoid most of the incompatibility and maintenance costs associated with client-side (browser-

based) approaches to interactivity, e.g. JavaScript. On the other hand, PHP scripts can be more efficient and portable than some other server-side approaches (including traditional CGI programs). PHP scripts developed for MS Windows 2000, SQL Server and the IIS Web server, can be deployed easily and profitably on robust enterprise class Unix systems running the Apache Web server and Oracle. In short, PHP enables cross-platform, vendor-neutral solutions, which can be built and deployed on any popular Web architecture.

PHP provides a wealth of tools for interacting with, transferring and transforming data stored in any number of ways, e.g. it can handle plain text, HTML, XML, WML, XSLT, PostScript, PDF, ODBC, SQL, most RDBMs, encrypted authentication, secure sockets (SSL), and many other secure transaction procedures.

### 3.1.2  WAP

The wireless industry came up with the idea of Wireless Application Protocol (WAP) [WAP 2004]. The point of this standard was to show Internet contents on wireless clients, like mobile phones.  The Wireless Application Protocol Forum (WAP Forum) is a consortium of telephone manufacturers who have joined forces to promulgate and promote data standards for wireless devices. Chief among the WAP Forum's efforts is WAP, which specifies a set of protocols for the exchange and markup of data between wireless devices.

The WAP client relies on two other standards promoted by the WAP Forum: WML and WMLScript. WML specifies a markup language for representing content format, whereas WMLScript specifies a simple client-side programming language much like JavaScript.

WAP network as shown in Figure 3.1, [Rischpater 2001] is a classic client-server network using a gateway. The WAP stack as shown in Figure 3.2, uses a gateway server called the WAP Gateway to bridge between the wireless network and the Internet. On the wireless network, clients and servers use the WAP protocols to exchange data. Over the Internet, hosts use Web protocols such as TCP/IP. Figure 3.3 shows the sequence of events that occurs when a smart phone requests a page, say *index.xml*, from a remote Web server *wap.apress.com*.
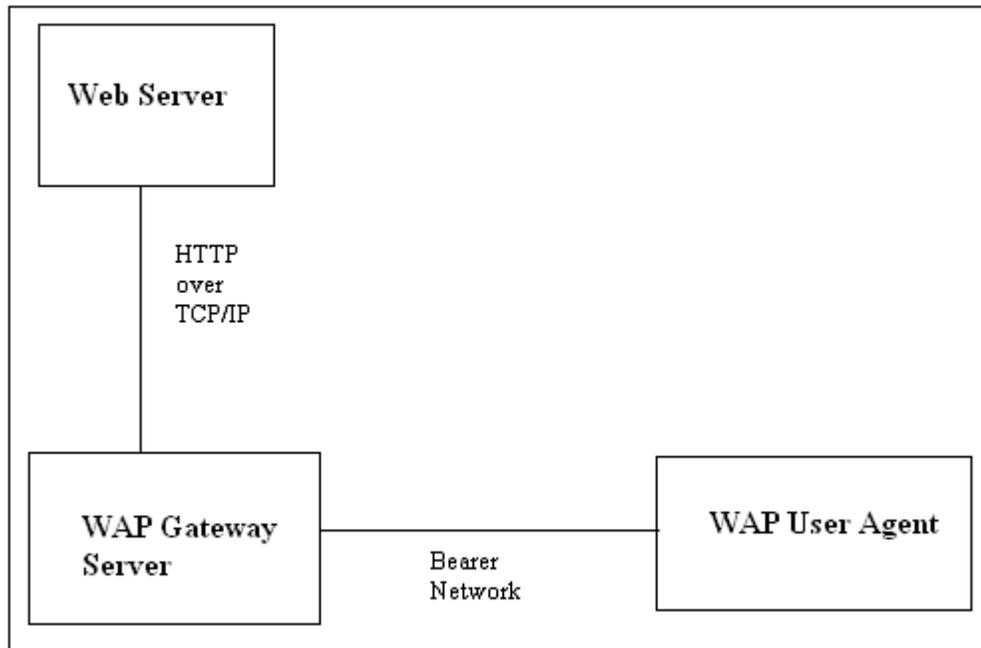


**Figure 3.1:     The WAP network**

| |
|---|
| Wireless Application Environment (WAE) |
| Wireless Session Protocol (WSP) |
| Wireless Transaction Protocol (WTP) |
| Wireless Transport Layer Security (WTLS) |
| Wireless Datagram Protocol (WDP) |
| Wireless Bearer Network (GPRS, CDPD, SMS, USSD, &c) |

**Figure 3.2:     The WAP stack**
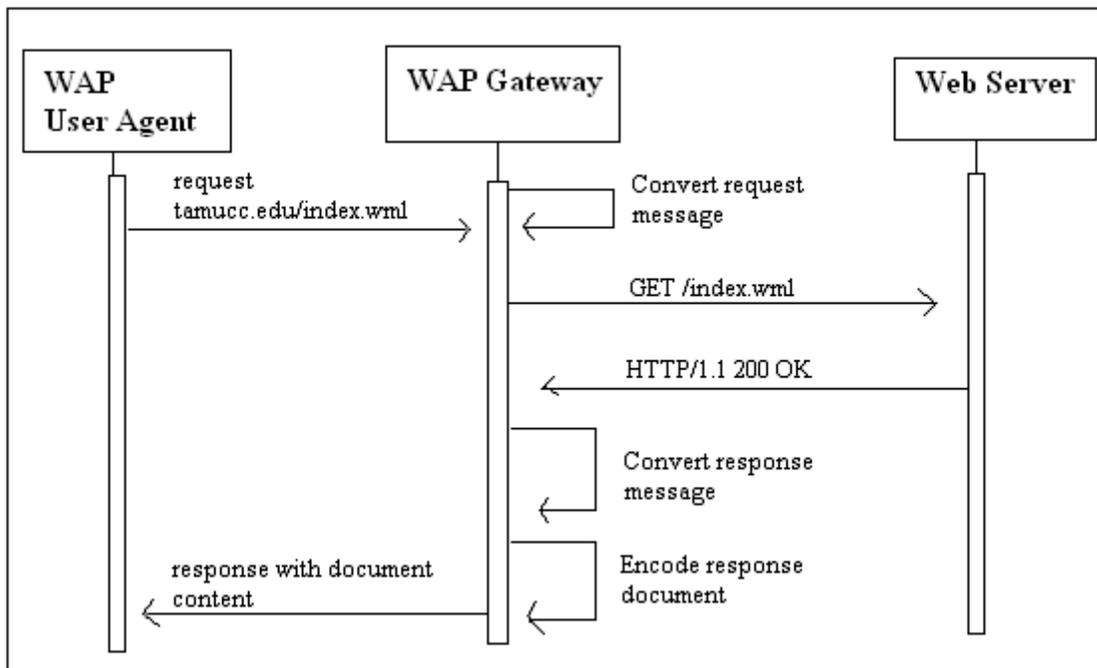


**Figure 3.3:     WAP client request and server response**

The client called the WAP User Agent on the phone uses the Wireless Session Protocol (WSP) to make a request of the WAP Gateway for the desired document. In turn, the WAP Gateway converts this request to an "HTTP GET request". The WAP Gateway then uses the "HTTP GET request" to request the desired document from the Web server. The Web server processes the HTTP request, and returns the *index.wml* file to the WAP Gateway. Then, the WAP Gateway translates both the document and the HTTP response, and sends the results back to the client.

### 3.1.3 WML

WML stands for Wireless Markup Language. It is a mark-up language inherited from HTML, but WML is based on XML, so it is much stricter than HTML. WML is used to create pages that can be displayed in a WAP browser. Pages in WML are called DECKS. A deck contains a set of cards. A card element can contain text, markup, links, input-fields, tasks, images and more. Cards can be related to each other with links.

### 3.1.4 WMLScript

WML uses WMLScript to run simple code on the client. WMLScript is a simple JavaScript language. However, WMLScripts are not embedded in WML pages. WML pages only contain references to script URLs. WMLScripts need to be compiled into byte code on a server before they can be run in a WAP browser.

### 3.1.5 MySQL

The Wireless Computer Help Desk System (WCHDS) developed by this project includes a MySQL [Welling 2003] database. MySQL is the world's most popular Open Source Database. It is designed for speed, power, and precision in mission critical, heavy load use. MySQL [MySQL 2002] handles large databases, in the area of 50,000,000+ records. It is tested with a commercial memory leakage detector, a privilege and password system, which is very flexible and secure and which allows host-based verification. Passwords are secure since all password traffic when connecting to a server is encrypted.

## 3.2　System requirement for normal usage

Any PC/Mac machine, PDA, or Cellular Phone with a browser and Internet connection can be used to access Wireless Computer Help Desk System (WCHDS) developed by this project irrespective of the operating system running on that machine. This system does not require a very high speed Internet connection since it does not involve transfer of large volumes of data such as images or sound.

## 3.3　Database Tables

The database for Wireless Computer Help Desk System developed by this project is a MySQL database, named as HelpDesk which contains tables that store information about the Inventory, WorkOrders, FAQs, Inventory History, User Authentication, Staff Listing, etc. This subsection gives a brief description of the tables and fields in the database and their relationships. All the tables are normalized to avoid redundancy. The following is the list of tables in the database.

- Announcements

- Authentication

- department_id

- FAQ

- helpdeskstaff

- Inventory

- REQUEST

- staff_id

- TASK

- VirusAlerts

Following is a brief description of the above tables and the prominent fields in them. For complete description of the fields, see Appendix A.

*Announcements:*

This table stores the announcements for the library staff posted by the Systems department. This table includes the fields **SNUM, Title, Description, N**o**te and link**.

*Authentication:*

This table stores usernames and passwords for login authentication. This table includes the fields **id, userid, password and type.**

*department_id:*

This table includes a list of department names in the library. The fields are **dep_id** and **dep_name.**

*FAQ:*

This table includes a list of FAQs. The fields are N**um, Type, Problem,** and S**olution.**

*helpdeskstaff:*

This table includes list of Systems department staff. The fields are N**um, Name,** and **Email.**

*Inventory:*

This table includes information about the inventory in the library. The fields are **Snum, Tamuid, Equipment, Model, SerialNum, Name, Location, Grants,** and **Note.**

*REQUEST:*

This table includes information about the work-orders. The fields are **SNUM, BroadCastToDept, Date, DateCompleted, Name, UserID, Extension, Department, RoomNumber, ProblemWith, Description, TAMUID, TaskPriority, AssignedTo, Status, ForwardTo,** and **Solution.**

*staff_id:*

This table includes list of library staff. The fields are **id, Name, email, home_phone, ext,** and **ADULB_Num.**

*Task:*

This table includes information about how to route the work-orders to the Systems department staff. The fields are **snum, Task, Name, EmailTo** and **HighPriority.**

*VirusAlerts:*

This table includes information about virus alerts. The fields are **SNUM, Title, Description, Note** and **link.**

### 3.3.1 Entity Relationship Diagram

The Entity Relationship Diagram (ERD) for Wireless Computer Help Desk

System (WCHDS) developed by this project is shown in Figure 3.4.
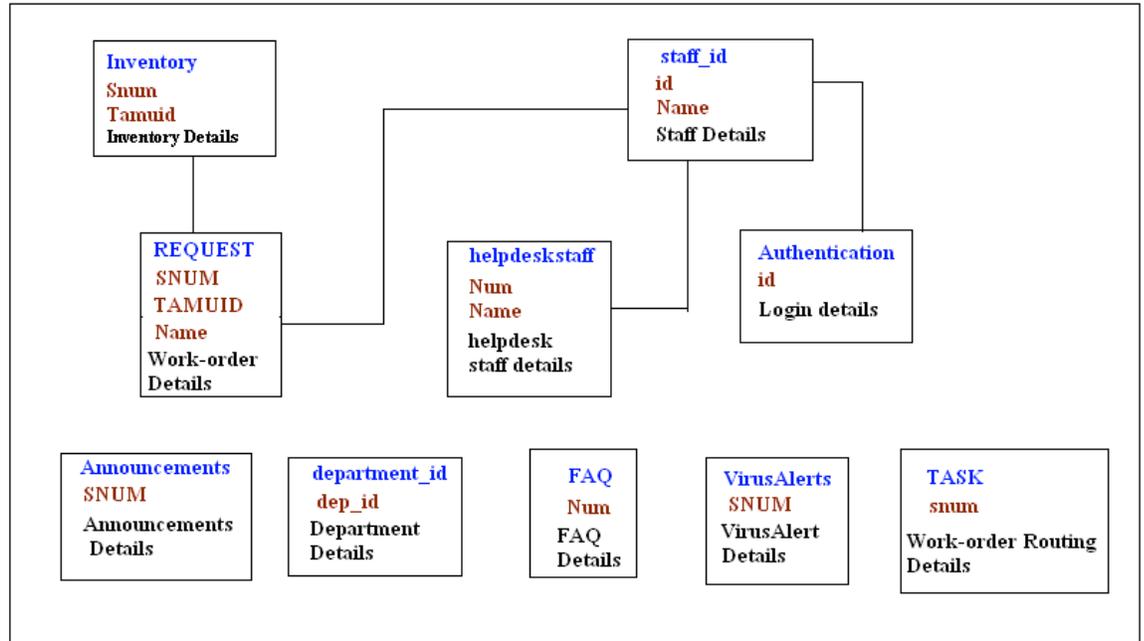


**Figure 3.4:    ER Diagram of Wireless Computer Help Desk System**

## 3.4    File formats

The different file formats used are as follows:

- '.sql': to run queries on MySQL database.

- '.php': to convert database query results and display them on the Web pages.

- '.html': to write the Web pages

- '.wml': to write the Web pages for WAP enabled devices

- '.jpeg': for images

## 3.5    Configuring Apache server to serve PHP and WAP content

In order for the Apache server to serve PHP and WAP, changes have to be made to the httpd.conf file by adding following mime types specific to PHP and WAP.

```
AddType application/x-httpd-php3 .php3 .php .phtml

AddType application/x-httpd-php3-source .phps

AddType text/vnd.wap.wml wml

AddType text/vnd.wap.wmlscript wmls

AddType application/vnd.wap.wmlc wmlc

AddType application/vnd.wap.wmlscriptc wmlscAddType

image/vnd.wap.wbmp wbmp
```

## 3.6    Login and Authentication

All the three interfaces, User Interface, Systems Staff Interface, and Administration Interface have access to different features and privileges. So, users are forced to login before they can access the interface. The username and password entered into the login form are verified with those stored in the table called Authorization on the HelpDesk database. Session control mechanism is used to keep track of the user as they navigate through the interface.

## 3.7    Automatic Redirection to WAP Site

The Wireless Computer Help Desk System (WCHDS) developed by this project includes three sets of Web pages one for the desktop browser, the second for a microbrowser on a PDA with WAP not enabled, and the third for the microbrowser on a PDA with WAP enabled. The index page runs a PHP script as shown in Figure 3.5, which checks to see if the device opening the page is a WAP enabled device or not. If it is a WAP enabled device then it redirects to WAP site, else it gives option to either go to a mobile friendly site or a regular Internet site.

```php
<?php
        //automatic redirection
        if(ereg("wap", $_SERVER['HTTP_ACCEPT']) ||
            ereg("wml", $_SERVER['HTTP_ACCEPT'])) {

                //redirects to WAP site
                include("../wap/index.php");
        }
        else {
                include("helpdesk.php");
        }
?>
```

**Figure 3.5          Automatic redirection script (*index.php)*

## 3.8    Designing Interface for Wireless Applications

Developing wireless applications for mobile devices presents software engineers, quality assurance engineers, and human factors engineers with a unique set of challenges [Reza 2004]. Unique problems faced by user interface designers are:

- Limited bandwidth: A wireless device typically has much less bandwidth available for transmitting and receiving data than a wired device.

- Intermittent connection: The connection to a wireless device is typically unreliable. A persistent point-to-point connection is difficult.

- Limited battery life: A wireless device is typically (also) a mobile device. Since mobility dictates compactness in size, and since there is no wired power connection, batteries are the only means of power supply. Even the longest lasting batteries offer a very limited amount of power.

- Limited memory on client device: The mobile nature of wireless devices and their requirements to remain a small size, room for memory is limited. Memory is also limited by the available power source (batteries).

- Limited CPU: Because of the size of the devices and the battery life, processing information on the device is very expensive. Very few operations should be performed on the device.

- Limited user interface: A keyboard and/or a mouse are not available for a wireless or a mobile device. Also, the display very small. This makes viewing and data entry more difficult.

# 4. TESTING AND EVALUATION

## 4.1 Testing

Wireless Computer Help Desk System developed by this project was successfully completed and both system testing and usability testing were done.

### 4.1.1 System Testing

System testing was performed to test functionality, performance and accuracy. Tests were also performed on the interfaces to make sure forms, links and reports work accurately. The system was tested and re-tested at several stages while it was being developed and the errors that were found at each stage were corrected. Different factors that were tested in those tests are:

- Script accuracy – Are the scripts that query and update the database accurate?

- Database redundancy – is the database designed without redundancy?

- Security – are all the interfaces properly authenticated to ensure security?

- Access to the system – is the system accessible from environments below?

  o Workstations with different operation systems such as Windows 9x, Windows XP, Redhat Linux, Macintosh, PDA, and cellular phones.

  o Different browsers such as Netscape, Internet Explorer, and Mozilla.

The system is divided into modules. Independent and integrated testing was performed at every stage of development. Each unit is developed and tested simultaneously. Once the units of a module are tested independently, the units are combined to form the module. Each module is tested independently for data integrity, data consistency, consistency of data input and output formats and to check if it has achieved the requirements. Standard coding guidelines were adopted along with proper documentation to facilitate easy inspection and maintenance.

### 4.1.2 Usability Testing

Usability testing was performed because it is a Web-based project. The interfaces were tested and evaluated for usability at every stage of development. After the application was completely done a heuristic evaluation was performed, against the general guidelines [Rosson 2000] listed below:

- Use simple and natural dialog

- Speak the user's language

- Minimize the memory load

- Be consistent

- Provide feedback

- Provide clearly marked exits

- Provide short cuts

- Provide good error messages

- Prevent errors

- Include good help and documentation

## 4.2 Evaluation

The Wireless Computer Help Desk System (WCHDS) developed by this project has the following three different levels of interfaces:

- Systems Staff Interface: One of the Systems staff has evaluated the Systems Staff Interface.

- User Interface: One of the library staff who is working for a department other than Systems has evaluated the User Interface.

- Administration Interface: Head of the Systems department has evaluated the Administration Interface.

  The above evaluations included testing for the following usability factors:

- Ease of finding information

- Legibility or ease of reading the content.

- Completeness with which the site's subject is treated

- Appearance of the site

- Consistency in Layout, Menus, and Visual Cues

- Help on how to use the site

Dr. Fernandez after evaluating all the interfaces suggested the following changes:

- Back buttons on all pages for easy navigation throughout the interfaces.

- Add a drop down menu for the input field 'Name' in the Add Task form.

- Cursor to blink in the first field of all the forms.

- Change 'Delete previous months Work-orders' to 'Delete Work-orders'.

- Users when login into the interface should be able to see only their own work-orders and not others.

- Change the order of links on the index Web page to Desktop/Laptop and then PDA because Desktop/Laptop is the most frequently visited link compared to PDA.

- In the View/Edit complete work-orders list the field 'Traking Number' should be linked to the complete details of the work-order.

Changes suggested by Dr. Fernandez were made. Ms. Deanna Solomon after evaluating the Administration Interface suggested that the property identification number called TAMUID should be six digits. She also suggested adding the two latest announcements about software auditing and Google's desktop search tool. Ms. Virginia Buckley after evaluating the User Interface suggested that the users should be able to see both incomplete and completed work-orders. Mr. Abel Cantu after evaluating Systems Staff Interface suggested adding 'RELOAD' button on the page that shows list of the inventory. The Usability evaluation forms that were used to evaluate this project are listed in Appendix B.

## 4.3    Usability on Mobile Devices

Mobile and Wireless devices face demand volatility [Szuc 2004]. Usability issues faced by mobile devices are:

- Stability – Increased need for real time information on the move will demand systems that can provide 100% stability.

- Simplicity – The ability to access applications and data within literally a few strokes. This is especially important when the user is on move.

- Screen size and color – With more dependence  on applications and improved data input, people will demand clearer and larger screens for their mobile devices.

- Dropouts - Devices will have to look at ways to save data or auto save in the case of dropouts.

- Switching applications – Easy methods for switching between applications and mobile platforms that can cope with more than one application being active at the same time are needed.

- Input methods – better methods of input are needed.

- Mobility – Real ability work on the move. This needs to be tested by the users who are on the move and in different situations to find out the real possible problems.

- Voice recognition – ability to input data using voice.

- Expected experience and consistency – Test the learning in learning to use the interface on mobile devices.

- Navigation – Can users navigate through the interface with maximum 2 steps?

- Multitasking – The need to move seamlessly between applications is important. Answer the phone, respond to the email, and answering the urgent 3 way chat.

- Tough and resilent – The devices should be unbreakable as they will be used while on move.

# 5. RESULTS AND CONCLUSION

## 5.1    Results

The primary objective of developing a work-order and inventory management system that can be accessed from anywhere and anytime was achieved. It was tested and found satisfactory by the Systems department, Mary & Jeff Bell Library, TAMUCC. Centralized database, wireless access and email alerts provided by this system make it an effective tool for the Systems department to provide their services efficiently and on-time.

## 5.2    Conclusion

A system to manage work-orders and inventory is developed. This system is very useful for the Systems department as they provide their services. The system provides a centralized database to store work-orders and inventory. Web based and WAP access to this system makes it easy to access from anywhere and anytime. Information stored in the database about the work-orders serves as a knowledge base for future work-orders. Reports generated by this system, assist in indentifying areas of technology in which the staff need training. FAQs help staff members who are attempting to solve before requesting support. So the system also serves as a self help tool or tutorial. High priority email alerts help to provide on-time service to the staff. On the whole, the system has a centralized place to store information. It helps manage work-orders and provide services on-time which make it an efficient tool.

# 6.   FUTURE WORK

The Wireless Computer Help Desk System (WCHDS) developed by this project can be upgraded by adding the following features:

- A feature that allows accessing the system over a telephone in addition to the Internet.

- A feature that allows Systems staff to receive high priority work-order alerts over a telephone in addition to the email.

Access to the System over a telephone will make it a more advanced tool which can be accessed virtually from anywhere and anytime. These features can be developed in Voice XML.

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# APPENDIX A – DATA DICTIONARY

Tables used in the database for Wireless Computer Help Desk System (WCHDS) developed by this project are as follows:

## *Announcements*

This table stores the information about the announcements that the Systems department sends out to the rest of the Library staff. It includes the following fields:

- snum: serial number is a unique identifier of an announcement

- title: title of the announcement

- description: description of the announcement such as time and location

- note: additional notes for the announcement

## *Authentication*

This table stores usernames and passwords for login authentication. This table includes the following fields:

- snum: serial number is a unique identifier of a login account
- username: user name for the login account
- password: password for the login account
- type: user type such as users, Systems staff, and Administrator

## *department_id*

This table includes a list of department names in the library. The fields are:

- dep_id: department identifier is a unique identifier of a department
- dep_name: department name

## *FAQ*

This table includes a list of FAQs. The fileds are:

- snum:  serial number is a unique identifier of a FAQ
- type: category of FAQ such as problem with printer, scanner, monitor, etc.
- problem: FAQ description
- solution: solution for the problem described in the FAQ

*helpdeskstaff*

This table includes list of Systems Department staff. The fields are:

- Num: number is a unique identifier of the Systems Department staff

- Name: name of the Systems Department staff

- Email: email address of the Systems Department staff

*Inventory*

This table includes information about the inventory in the Library. The fields are:

- snum: serial number is a unique identifier of the inventory item

- tamuid: tamuid stands for Texas A&M University inventory identification number. It is a unique identifier.

- equipment: type of inventory such as CPU, printer, scanner, monitor, etc.

- model: model name of the equipment

- serialnum: serial number on the equipment marked by the manufacturer

- name: name of the person or department to which the equipment belongs

- location: name of the location where the equipment is located

- grants: name of the grants with which this equipment was bought

- note: additional notes regarding the equipment

*REQUEST*

This table includes information about the work-orders. The fields are:

- snum: serial number a unique identifier of work-order

- date: date the work-order was submitted

- datecompleted: date the work-order was completed

- name: name of the person submitting the work-order

- adulb_num: staff's workstation login account user name

- extension: telephone number extension

- department: department in which the person submitting the work-order works

- roomnumber: room number of the office in which the person works

- problemwith: problem with such as printer, scanner, login, etc

- description: description of the problem

- tamuid: tamuid stands for Texas A&M University inventory identification number. It is a unique identifier of the inventory item

- taskpriority: priority of work-order

- assignedto: name of the Systems staff to whom the work-order is assigned

- status: status of the work-order

- forwardto: name of the Systems staff to whom the work-order is forwarded

- solution: solution to the work-order

### *staff_id*

This table includes list of library staff. The fields are:

- id: staff's unique identification number

- Name: full name

- email: email address

- home_phone: home telephone number

- ext: extension at work

- ADULB_Num: staff's workstation login account user name

### *TASK*

This table includes information about how to distribute work-orders among the Systems department staff. The fields are:

- snum: serial number a unique identifier

- task: category to which the work-order belongs such as login problems, configuring workstations, problem with printers, network problems, etc

- name: name of the Systems staff to whom the work-order of a particular category has to be assigned

- emailto: email address to which the work-order has to be sent

### *VirusAlerts*

This table includes information about virus alerts. The fields are:

- snum: serial number a unique identifier of virus alert

- title: title of the virus alert

- description: description of the virus alert

- note: additional notes for the virus alert such as links