

Development of an e-Diary Service for Deployment on the UFH network

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Abstract: *Diaries play a critical role in the management of work schedules in societies and working environments. The result of their use is proper decision-making and time-management. This research project focused on the development of an e-Diary Service system for employees and students at the University of Fort Hare (UFH). This university is situated in a town called Alice in the Eastern Cape province of South Africa. The development of the e-diary was aimed at addressing the problems encountered in the use of hard copy diaries for the management of work schedules at UFH. It has always been a problem using a hard-copy diary for managing work schedules because of the irregularities and inconsistencies associated with its use. These include among others the misplacement or loss of recorded information and failure to meet set targets and attend to some important scheduled events due to lack of a reminder-alert in a hard copy diary. The system was thus developed to provide a suitable solution to these irregularities and help its users to manage their work schedules in an easy, fast, safe and cost-effective manner. Its functions include among many others the ability to allow users to record, update, view and delete their work schedules while also facilitating for the important functionality of sending reminders to users with regards to their work schedules via electronic mail or Short Message Service (SMS).*

Keywords: Development, Deployment, e-Diary Service, UFH network.

1. Introduction

Currently, few administrative services offered really lack utilization of computerized systems. These systems have the potential to give direct access to users and allow them to utilise all services available. Amongst the services that can be offered by computerised systems are e-Services. These are becoming increasingly popular in the management of public organizations including institutions of tertiary learning and their stimulus on these organizations cannot be ignored.

We note that e-Services in public organizations have a potential of competing with e-Services in the private sector in a great way [1]. However, there are many barriers that block the increase of e-Service provisioning in the public sector. The main premeditated barriers include lack of ICT skills and knowledge, low-standard training and insufficient support, lack of reliability of "Government-to-Government" interaction via the Internet, resistance to e-Service development projects and lack of top management support [2]. Consequently, there is a primary focus on the study of e-Services especially the services of a diary in order to penetrate through these barriers and avail these very important services to the public sector.

The other major concern with a hard copy diary is the amount of effort required from the owner in order to maintain it. A diary entails a lot of paperwork, therefore its owner should understand the important and diligent effort needed to maintain it. Diaries become useless if their owners do not consistently

open them and update their schedules almost on daily basis. The e-Diary Service however allows for the automation of

administrative processes, cuts down the use of paper documents, optimizes work time and implies an overall turning point in terms of efficiency in managing and adhering to tasks. The e-Diary Service includes a different set of tools each implying a different level of integration of the stakeholders' interests [3].

ICTs are effective and efficient tools for information access, processing, storage and retrieval, management and dissemination in many working and social environments. However, there exists a widespread disparity in access to ICTs in both, among and within universities. The goal of this project was thus to narrow the notion of digital divide to information dissemination and access to knowledge in order to prioritize the promotion of sustainable educational development. We noted that the UFH employees utilized hard copy diaries to maintain their work schedule records i.e. meetings, workshops, appointments, tasks, etc.

However, this can only work well if-and-only-if the diaries are used on a regular and daily basis, which is not always the case at UFH due to problems encountered in the workplace. These include misplacement or loss of data and the vital aspect of information recorded and forgotten due to the absence of a dynamic reminder in the physical diary. Therefore, the e-Diary Service web application addressed these problems by providing reminders via e-mail or mobile SMS. It was deployed on the university network for use by all employees and students with access to the UFH network.

In the preceding years, organizations kept an ordinary printed paper diary or a wall chat. This would prove handy for employees to organize their work schedules and they would

thus sometimes recommend that the papers be managed by secretaries. This undermined the diary rule of privacy because diaries can contain personal and confidential information. The feasibility study, requirements analysis and specification, design, development, integration, implementation and maintenance of a simple, cost-effective, robust and integrated e-Diary software system is the key plan and objective of this research project. This will result in system which helps employees to be in control of their daily work schedules.

The primary objective of the e-Diary Service is to allow access to all parties to input their work-related data and specify some differentiating attributes in order to make records for all schedules which share that attribute. Furthermore, the e-Diary Service will ensure word and data-processing, electronic filing, e-mailing, prepare graphics, scheduling and calendaring in a fast and confidential manner.

This research focused on developing a usable e-Diary Service web application for staff and students at the UFH. The developed application system is meant for utilization by the UFH staff and students to aid them in executing their daily tasks in a timely manner. Some of the key features of this application is the ability of its users to use it individually without assistance. It is highly anticipated that, since the UFH staff members and students use computers on a daily basis, and because of that they are regarded as computer literate, there should be no problem with them using the e-Diary Service.

2. Physical Diary vs. e-Diary

A physical diary makes writing easy and provides a quicker way to manage schedules. Additionally, it also makes it easier to add calendar entries. Furthermore, e-diaries are not limited to one year like physical diaries because they can be used continuously [4]. Physical diaries are changed annually as compared to e-diaries which can be used every year because of their storage capacity and dynamism [5]. Their calendars can also be easily backed up since they can either be stored in the system or downloaded to personal computers for later utilization. Additionally, e-diaries can be accessed from all ICT-enabled areas via the Internet [4, 5]. In addition, they allow users to set reminders for important dates or events, electronically and dynamically.

However, even though e-diaries have many advantages over physical diaries, they sometimes lack privacy and security, such as providing access to unauthorized users on online diaries. This is possible if unintended users know your credentials or take a guess or use simple keyloggers to hack passwords.

Additionally, some e-diary platforms are not compatible with others. Therefore, if users lose subscription to a certain e-diary service or the e-diary company closes, they might find it difficult to access their back-up files from the previous e-diary service using another e-diary service platform [6].

The implementation of this e-Diary Service came after a sequential process of development until the final working web application was produced. It will involve an exhaustive analysis and assessment of the associated constraints to come up with the best results possible.

3. UFH e-Diary Service Architecture

The e-Diary Service developed in this research aims to be available to UFH employees and students via the Internet in order to be accessible to its users, ubiquitously. The e-Diary Service sends e-mail messages to its users' e-mail accounts upon registration in order to maintain privacy, retention and security. The UFH e-Diary Service system architecture is illustrated in the figure below:

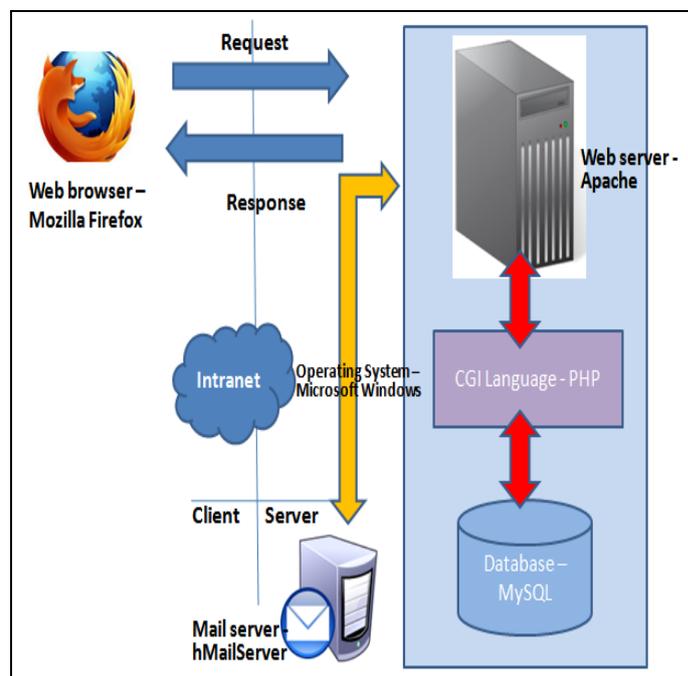


Figure 1: UFH e-Diary Service System Architecture

The above diagram illustrates that a web browser is used by the UFH e-Diary Service to access the system, retrieve or view information and navigate around the system. This begins by specifying the system's Uniform Resource Locator (URL) in the browser's URL field. The web browser allows the UFH e-Diary Service users to access information by converting the Hypertext Preprocessor (PHP) code. It achieves this by accessing the web server (i.e. Apache) and requesting for information [7]. Then, the web server responds to the request by displaying the information on the computer screen via the web browser.

As mentioned above, the web browser interacts with the UFH e-Diary Service via the Apache web server [8]. The primary function of the web server is to convert the URL entered by the user in the web browser URL field into a program name [9]. It then sends the program name back to the web browser by transmitting it via the Intranet. Subsequently, it then runs the program and sends back its output to the web browser. It was also mentioned above that the web browser converts PHP code. PHP is a Common Gateway Interface (CGI) language which means that in the UFH e-Diary Service, it is used by the Apache web server to facilitate the users request and response to and from the system, respectively. In the UFH e-Diary Service, the (Hypertext Markup Language) HTML code is embedded in PHP source documents which means that there is no need to call an external file in order to process data [10]. The code is then interpreted by the Apache web server which contains a PHP processor module resulting in the generation of a webpage.

Additionally, as illustrated in the above diagram, there is

also My Structured Query Language (MySQL), which is a database system which utilizes a client-server architecture that orientates around the MySQL server [11, 12]. The MySQL server is the program which manipulates the databases. In the UFH e-Diary Service, the clients communicate with the MySQL server in order to manipulate the database i.e. record data, view data, update data and delete data. The clients run on the same machine as the MySQL server because the UFH e-Diary Service uses Windows, Apache, MySQL, and PHP (WAMP). Lastly, the UFH e-Diary Service also enables users to send and/or receive e-mails and by using the mail server, called hMailServer.

4. Implementation of the e-Diary

The implementation of the e-Diary Service came after a sequential process of development until the final working web application was produced. The methods utilized in the implementation included literature review and action research. The following sub-sections will explain the research methods that were used to design and implement the system. In order to capture the importance of designing and implementing an e-Diary Service at UFH, a literature review was done in an academic way. To achieve the goal of implementing the system, the literature review was done in a way that informed what other workplaces have done with relation to a workplace diary system. It was also done in the context of development through ICTs. There was also a look at the different services that can be catered through ICTs. In order to fully understand and motivate the use of an e-Diary Service over a physical diary, their importance was equally evaluated. This aided in finding the different designs and models that could be used to make the research project successful.

4.1 Action Research

The Action research is a process that is led by researchers working with other teams in order to solve problems that are encountered in the process of conducting research [13]. In this research project, the action research was amongst the application developer and the supervisor in order to find channels that can be utilized to advance the execution of UFH employees' daily tasks. The action research also included literature review which included the acquisition of new information from reliable sources (such as information technology websites and books) for the development of an updated and modern system.

4.2 System Requirements

In order to fully understand the system requirements, it was important to understand the existing UFH ICT infrastructure in which the system would be deployed. This helped in making sure that similar software platforms were used or not. The technology, WAMP was utilized, which is a free integrated software bundle suitable for the Windows operating system and includes the Apache Web server, PHP and MySQL database. The advantage of using WAMP is that the various components installed and configured with each other, display no delays and give minimal problems in configuration. This is because open source software is freely available. Additionally, it allows for reuse, diffusion, it has open standards and helps gain independence from vendors

4.3 User Roles and Responsibilities

The e-Diary Service is capable of providing services to only two different users i.e. the UFH employees and the System Administrator. In order for both these entities to access the system, they have to be authenticated and authorized according to their individual functionalities. Upon accessing the system, they are then directed to their different interfaces. The following diagram illustrates the different roles performed by the two users in the e-Diary Service:

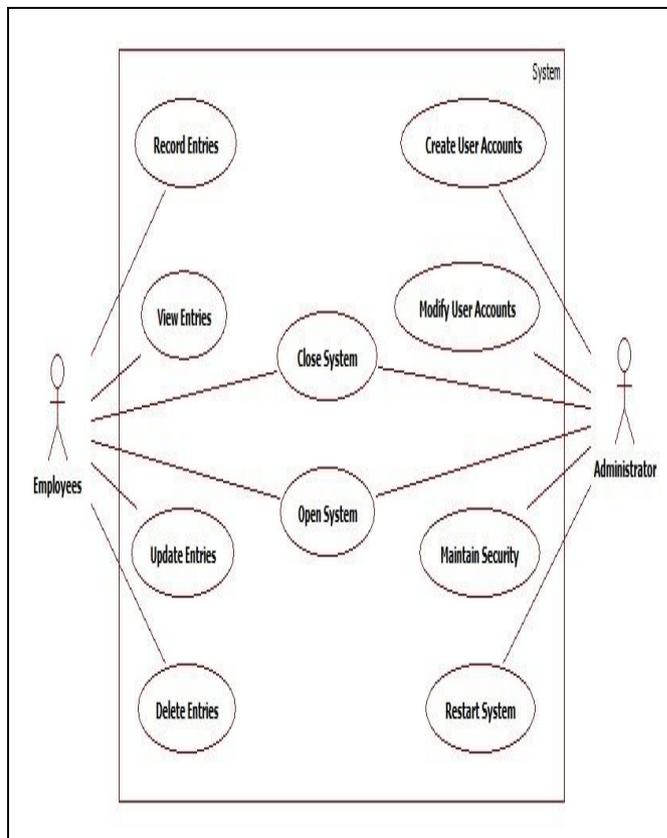


Figure 2: UFH e-Diary Service User Case Architecture

4.3.1 The Administrator

The administrator is responsible for setting up and maintaining the e-Diary Service. The administrator is also responsible for administering user accounts, verify proper working of peripherals and also monitor system performance. Additionally, the administrator is responsible for creating file systems, creating backup and recovery policy and monitor the system communication within the network i.e. the UFH Intranet. In the e-Diary Service, the administrator will also create new users, reset user passwords, activate/deactivate user accounts, monitor server security and other special services. The following diagram illustrates the different tasks that can be performed on the administrator's interface:

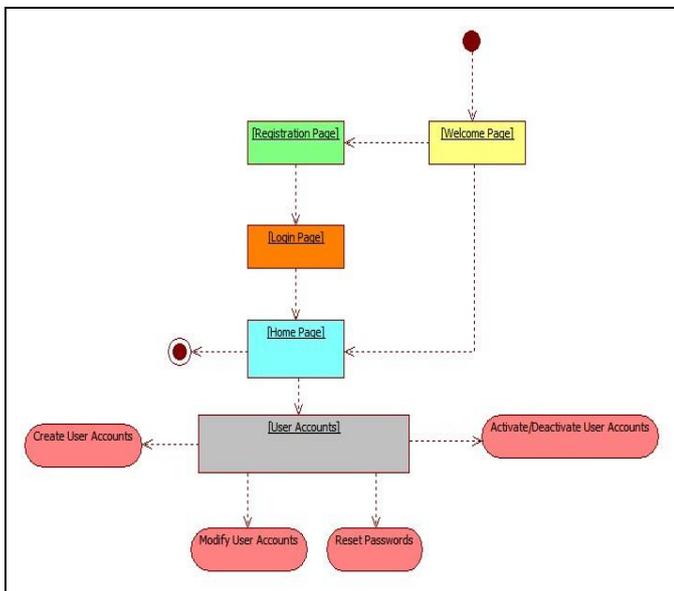


Figure 3: Administrator Interface

4.3.2 The Employees

The employees in this system's context are the people who acquire services from the e-Diary Service. They utilize their computers to interact with the system through giving input to the system and obtaining output from the system. The e-Diary Service also allows employees to manage their meetings, birthdays, conferences, reminders and to do's through recording, viewing, updating and deleting. The figure below illustrates the different tasks that can be performed on the employees interface:

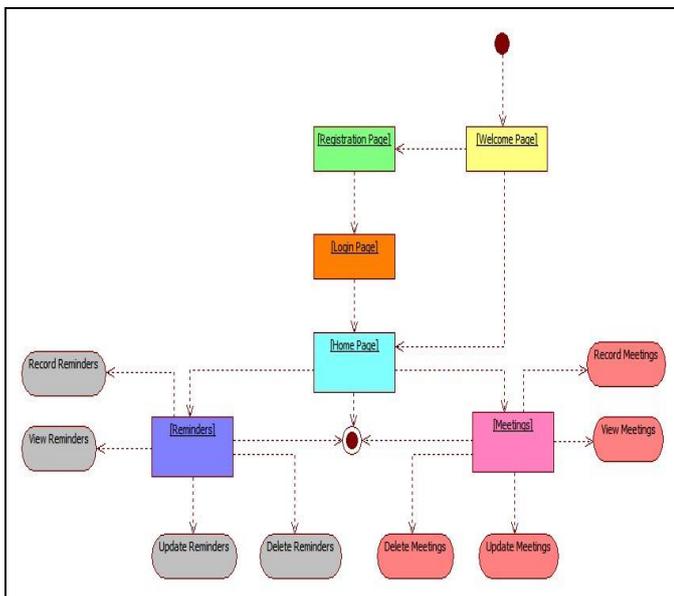


Figure 4: Employees Interface

5. Database Design

One of the components of the UFH e-Diary Service is the MySQL database. The name of the database is *ufh_employees*. This database is used to store data, such as login credentials and meetings' data. The data stored is then manipulated using SQL queries embedded in PHP code [12]. For example, the meetings' data stored in the database can be viewed, updated and deleted using those queries. This section of the paper will focus on the design of the database .i.e. particularly the tables

which make up the database. The tables contained in the database are namely, *employees* and *meetings*. As mentioned above, the database is a MySQL database which is an open source relational database management system (RDBMS). It operates as a server which allows multiple users to access databases. In addition to the use of PHP code embedded SQL queries to manipulate the database, an interface called HeidiSQL is used for the UFH e-Diary Service. This allows the developer to browse and edit the database and its' tables from a Windows® interface (<http://code.google.com/p/heidisql/>) [13]. Below is an explanation of the two tables contained in the database.

5.1 The Employees table

The employees table contains the UFH e-Diary Service users' login credentials and other users' data, such as the e-mail address and mobile phone number. The Welcome Page gives registered users an option to login and gives unregistered users an option to register by clicking the login or register buttons (redirecting them to the Registration Page), respectively. If the user chooses to register and is redirected to the Registration Page in order to enter their registration details in textfields and click on the register button, subsequently then the details are sent to the employees table. Also, an e-mail message is sent to the users' e-mail address notifying them about the status of their registration. On the other hand, if the users' login on the Welcome Page, the login credentials that they enter in the textfields are matched with those in the employees table. If they match, the user is granted access to the UFH e-Diary Service. However, if they don't match, the user is denied access. The structure of the employees table is depicted by the table below:

Field	Type	Null	Key	Default	Extra
username	varchar(50)	NO	PRI		
password	varchar(50)	NO		(NULL)	
email	varchar(50)	NO		(NULL)	
phone	int(11)	NO		(NULL)	

Table 1: Employees Table in the Database

5.2 The Meetings Table

The meetings table is used in the UFH e-Diary Service to store meeting details. In order to store meeting details, users enter meeting details in the text fields of the Record Meetings Page and click on the invite button. Subsequently, the details are stored in the meetings table. After that an e-mail message is sent to the chairperson and invitee(s) e-mail addresses notifying them about the meeting. Users can also view the meeting details stored in the meetings table from the View Meetings Page by entering the relevant chairperson's e-mail address in a textfield and clicking on the search button. This action initiates a search for that chairperson in the meetings table and if it is contained in the table, its corresponding details are retrieved and sent to the other textfield for users to view. Additionally, users can also update meeting details from the Update Meetings Page by entering the update details in textfields and clicking on the update button. This updates a record containing the details corresponding to the chairperson e-mail address entered in one of the textfields. After that an e-mail message is sent to the chairperson's and invite(es) e-mail addresses notifying them about the update status. Furthermore, users can

also delete meeting details from the Delete Meetings Page by entering the relevant chairperson e-mail address in a textfield and clicking on the delete button. Subsequently, the meeting details corresponding to that chairperson are deleted [14]. After that an e-mail message is sent to the chairperson and invitees(s) e-mail addresses notifying them about the deletion. The structure of the meetings table is depicted by the table below:

Field	Type	Null	Key	Default	Extra
Chairperson	varchar(255)	NO	PRI		
Invitees	varchar(255)	YES		(NULL)	
Venue	varchar(255)	YES		(NULL)	
Agenda	varchar(255)	YES		(NULL)	
StartTime	time	YES		(NULL)	
EndTime	time	YES		(NULL)	
Details	varchar(255)	YES		(NULL)	
Date	date	YES		(NULL)	

Table 2: Meetings Table in the Database

5.3 Scripting Languages

In the UFH e-Diary Service, client-side and server-side scripting were utilized during system development. These are extensively explained below:

5.3.1 Client Side Scripting

The technique of client-side scripting involves the self-containment of a client-side scripting language in an HTML page. This is independent of a database or an external script in order to execute. In this technique, the client refers to the system on which the web browser (i.e. Mozilla Firefox) is running. The web browser interprets the client-side scripting language. The client-side scripting language used in the UFH e-Diary Service is JavaScript. JavaScript is utilized to articulate the behaviour of web pages. JavaScript is used in the UFH e-Diary Service mostly because of its' dynamic feature which is used for dynamic clocks and reminders [15]. In addition to this feature, JavaScript is also comprehensive and an untyped interpreted scripting language. The process involved in the technique of client-side scripting is that the user requests a web page from the Apache web server then the web server responds by sending the web page to the user [16]. Lastly, the web page is displayed on the web browser with the client-side script that was running during or after the display of the page.

5.2.1 Server-Side Scripting

The technique of server-side scripting involves the embedding of a scripting language within HTML code [17]. As mentioned above in the UFH e-Diary System Architecture, the consequence of this technique is that a users' request to the web server (i.e. Apache) is handled by a scripting language running on the server before returning a response to the user. Therefore, this restricts the access of unauthorized users to the database and other sources of data. In the UFH e-Diary Service, the scripting language used on the server-side is PHP. The advantages of using server-side scripting is that users can only see the HTML output when viewing the page source and not the scripts, page loading is fast and it also allows developers to create an individual template of a web

application which can be automatically used by other created dynamic pages [18]. These advantages are all present in the UFH e-Diary Service.

6. UFH e-Diary Service

One of the components of the e-Diary Service system architecture is the MySQL relational database management system (RDBMS). It is a very fast and robust RDBMS which is utilized in the system to store, update, search, delete, view and retrieve data. In addition to the afore-mentioned advantages, MySQL is also an open source system, easy to configure and when complimented with a user friendly interface, it is also easy to interact with the client and make enhance data addition and retrieval processes. It is also portable, meaning that it can be utilized on different platforms. Hence, the MySQL database was used in the e-Diary Service. Below is an illustration of the interfaces used and an in-depth explanation of the MySQL database used in the e-Diary Service.

6.1 UFH e-Diary Service Website Interfaces

The UFH e-Diary Service is a system that is used by UFH employees to substitute their physical diaries. Hence, the UFH e-Diary Service is designed to make it easy for UFH employees to record, view, update and delete their diary entries. Therefore, this section of the paper will explain the different interfaces which the employees use to interact with the system when performing the above-mentioned actions.

6.1.1 Welcome Page

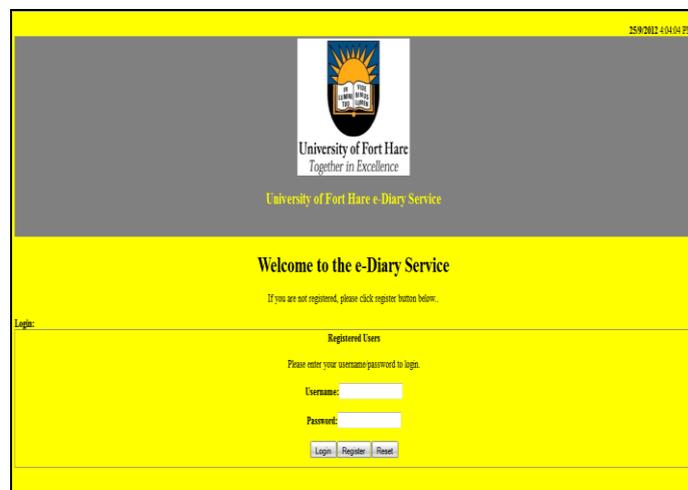


Figure 5: Welcome Page Interface

The above figure illustrates the UFH e-Diary Service welcome page which is the initial page of the employees' interface. This page allows registered users to login by entering their login credentials in the relevant textfields and clicking on the login button. In order to allow users access to the system, the system checks if the login credentials match with those stored in the *employees* table of the *ufh_employees* database. Subsequently, the users are redirected to the home page. However, for unregistered users, they have to register on the registration page. In order to enter the registration page, the user has to click on the register button. In addition to these options, the users can reset the welcome page if they wish to do

so (i.e. if they've entered erroneous credentials) by clicking on the reset button.

6.1.2 Registration Page



Figure 6: Registration Page Interface

The above figure illustrates the registration page which is used by users to register in the UFH e-Diary Service. The user enters the registration details in the textfields and clicks on the register button. The details are then sent to the *employees* table in the *ufh_employees* database for storage. Also, an e-mail message is sent to the registered users' e-mail address to notify him/her about the registration status. Then the system redirects the user to the login page for logging in. Additionally, the registration page also allows users to reset the page by clicking on the reset button. Also, if the user has entered the page accidentally, he/she can return to the welcome page by clicking on the return to welcome page button.

6.1.3 Login Page

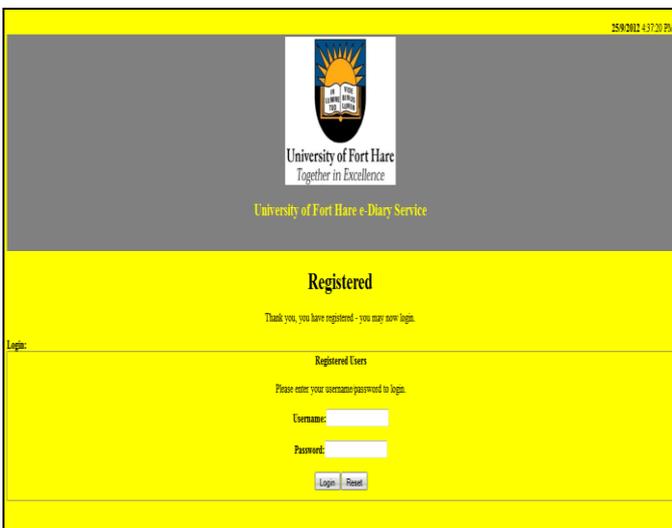


Figure 7: Login Page Interface

The above figure illustrates the login page which is utilized by UFH e-Diary Service users to login to the system. Users are redirected to this page after registering on the registration page. In order to login, users have to enter their registered login credentials in the textfields and click on the login button. In order for the users to be granted access to the system, their login credentials are matched with those stored in the *employees* table of the *ufh_employees* database. Subsequently, they are redirected to the home page. The users also have an

option of resetting the page by clicking on the reset button.

6.1.4 Home Page

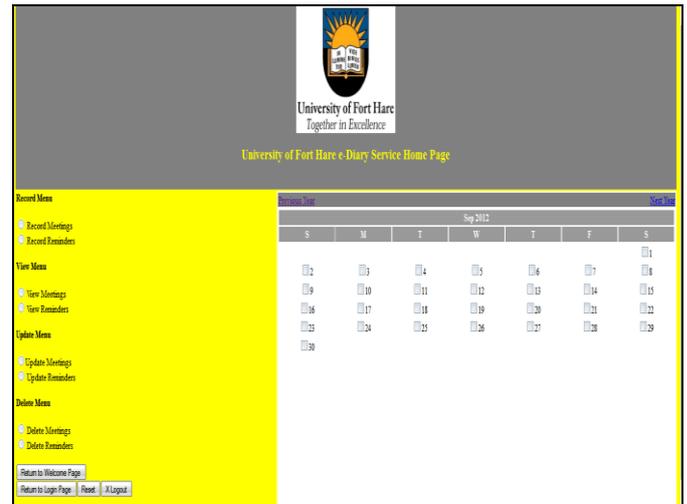


Figure 9: Home Page Interface

The above figure illustrates the home page of the UFH e-Diary Service. This page gives users an option to access the record meetings, view meetings, update meetings and delete meetings pages by clicking on the relevant radio button. This page also gives users options whether to either return to the welcome or login page by clicking on the return to welcome page or return to login page buttons, respectively. The users can also reset the home page by clicking on the reset button. Also, if the users wish to logout of the system they can click on the logout button.

6.1.5 Record Meetings Page



Figure 8: Record Meetings Page Interface

The above figure illustrates the record meetings page of the UFH e-Diary Service which is used by users to record meetings. The users record meetings by entering the meeting details in the textfields and clicking on the invite button. Then the message details are sent to the *meetings* table of the *ufh_employees* database for storage. Also, e-mail messages are sent to the chairperson and invite(e)s e-mail addresses to notify them about the meeting. Users are also given an option to logout, return to the home page and reset the record meetings page by clicking on the logout button, return to home page and

reset buttons, respectively.

6.1.6 View Meetings Page

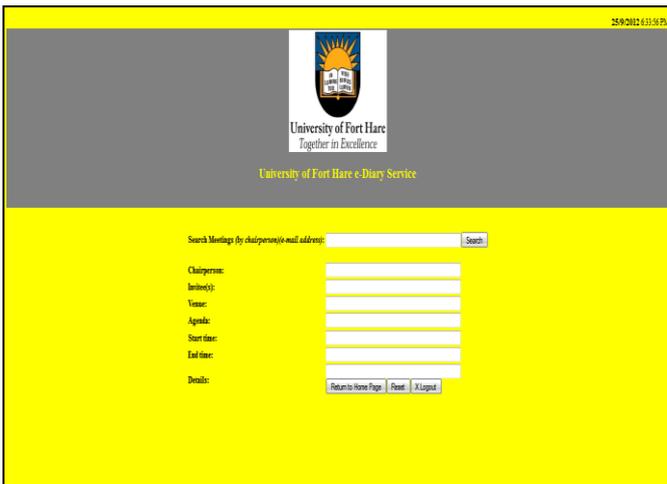


Figure 10: View Meetings

The above diagram illustrates the UFH e-Diary Service view meetings page that is used by users to view meetings. Users view meetings by searching for the meeting details stored in the *meetings* table of the *ufh_employees* database. The meeting details are those that correspond to the chairperson's e-mail address entered by the user in the view meetings page textfield before clicking on the search button. The meeting details are then sent from the database to the other textfields for the users to view. Users are also given an option to logout, return to the home page and reset the view meetings page by clicking on the logout, return to home page and reset buttons, respectively.

6.1.7 Update Meetings Page



Figure 11: Update Meetings

The above diagram illustrates the update meetings page of the UFH e-Diary Service which is used by users to update meetings. The users update meeting details by entering the update meeting details and clicking on the update button. This updates the meeting details corresponding to the chairperson's e-mail address entered in the update meetings page that are stored in the *meetings* table of the *ufh_employees* database. Then e-mail messages are sent to the chairperson and invitee(s) e-mail addresses notifying them about the update. Users are also given an option to logout, return to the home page and reset the update meetings page by clicking on the logout, return to home page and reset buttons, respectively.

6.1.8 Delete Meetings Page

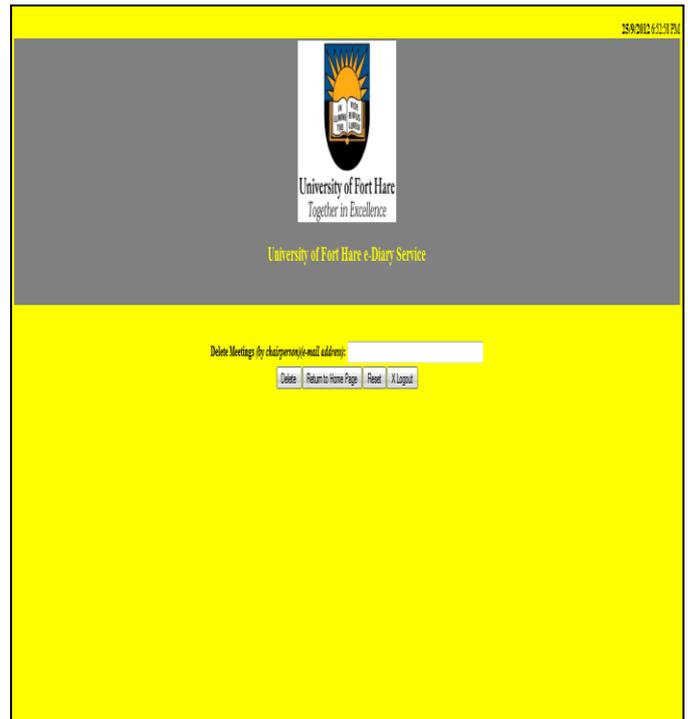


Figure 12: Delete Meetings

The above figure illustrates the delete meetings page of the UFH e-Diary Service that is used by users to delete meetings. The users delete the meetings by entering the chairperson's e-mail address in the delete meetings page textfield and clicking on the delete button. Then the meetings details corresponding to that chairperson's e-mail address are deleted from the *meetings* table of the *ufh_employees* database. Then e-mail messages are sent to the chairperson and invitee(s) e-mail addresses to notify them about the deletion. Users are also given an option to logout, return to the home page and reset the delete meetings page by clicking on the logout, return to home page and reset buttons, respectively.

6.2 Establishing and opening the UFH e-Diary Service database connection

In order for the e-Diary Service users to interact with the MySQL database, they have to do it via the system. This means that the system has to establish a connection with the database and open it. The code snippet below illustrates how the connection is established and opened.

```
/*Connects to the Database*/  
mysql_connect("127.0.0.1", "root", "") or die(mysql_error());  
mysql_select_db("ufh_employees") or die(mysql_error());
```

Figure 13: Establishing and opening the Database Connection

The above code snippet appears at the top of each PHP file in which a database connection is required. The `mysql_connect()` function is used in PHP to open a MySQL database connection. This function either allows a connection to the database (i.e. on success) or returns an error on failure (using the `mysql_error()` function). The Internet Protocol (IP) address, 127.0.0.1 is the hostname of the MySQL server, root is the username and the null value is the password used for logging into the database server. The password is null because these parameters are all optional and therefore, a null value is acceptable. Additionally, the `ufh_employees` parameter of the `mysql_select_db()` function is the name of the database server to which a connection is currently established.

6.3 Additional MYSQL functions used in the System

Some of the MySQL functions used in the development of the e-Diary Service have been explained in the above section. However, there are additional MySQL functions that were also used during the systems' development. This section will explain those additional functions [19]. Firstly, it is worth mentioning that these functions are used to access the MySQL database server. These additional functions are as follows:

1. **MySQL_query() Function** : This function is used to send SQL statements to the MySQL database.
2. **MySQL_fetch_array() Function** : This function returns a result row as either, an associative or numeric array (The PHP Group, 2001 - 2012). However, it is possible for it to return both types of arrays
3. **MySQL_num_rows() Function** : This function is used to calculate the number of rows in a MySQL database table

7. UFH e-Diary Security

This section will provide an explanation of the security aspects that are implemented in the e-Diary Service. Security is important in the e-Diary Service because it controls access to the system by ensuring that users identify and authenticate themselves upon accessing the system. Below is an explanation of the security aspects found in the e-Diary Service.

7.1 User Authentication

In the e-Diary Service, user authentication is performed to identify the user and verify whether they are allowed to access the system [19]. The method used for the authentication of users in the system is a combination of a username and password. Firstly, users register their username and password on the registration page (*registration_page.php*). The user enters two passwords. Then the system checks if the passwords match for confirmation. If the passwords don't match, the system gives an error message. Subsequently, if they match, the username/password combination is sent to the MySQL database. When the users have registered on the system, they can then login to the system using the username/password combination on the login or welcome page (*login_page.php* or *welcome_page.php*). However, if the username/password combination entered doesn't match that of an existing user (i.e. a user stored in the database), then the system gives an error message and denies access to the system.

7.2 E-mail notification

The e-Diary Service also implements another aspect of security by sending e-mails to users after they have registered. This helps in making sure that the users' information is secure.

Additionally, it also ensures confidentiality because only the relevant user can read his/her details.

8. UFH Employees System User Utilization

As mentioned, the e-Diary Service is used by UFH employees to record, view, update and delete meetings and reminders as a substitute to hard copy diaries. However, they can only perform these actions on the system if they are authorized users. Therefore, this section will provide an explanation of how authorized users interact with the e-Diary Service to manage their meetings with relevance to code.

The code *rmeetings.php* of the e-Diary Service generates a page that allows users to record meetings by entering the meetings' chairperson, invitee(s), venue, agenda, details, start and end times. If the users wish to send an invite to the invitee(s), they can click on the invite button and an e-mail notification will be sent to the invitee(s) and the meeting will be recorded. However, if the users entered the page by mistake or want to reset the page, they can click on the return to home page or the reset buttons, respectively. The page also allows users to logout by clicking on the logout button.

The code *vmeetings.php* of the e-Diary Service is used by users to view recorded meetings. This page allows users to search meetings by chairperson after clicking on the search button and view the meeting details corresponding to that chairperson. Additionally, this page enables users to return to the home page, reset the page or logout by clicking the return to home page, reset or logout buttons, respectively.

The update meetings (*ummeetings.php*) code allows users to update recorded meeting details by entering details in the same way as in the record meetings page. Then the user can click on the update button. In the same way as with the above-mentioned pages, the user can return to the home page, reset the page or logout by clicking on the return to home page, reset or logout buttons, respectively.

The final operation that the e-Diary Service users can perform with meetings is the deletion of meetings from the delete meetings page (*dmeetings.php*). The page allows users to delete a meeting by entering the meetings' chairperson and clicking on the delete button. Additionally, they can return to the home page, reset the page or logout by clicking on the return to home page, reset or logout buttons, respectively.

9. System Testing and evaluation

System testing is useful in helping developers assess the quality of the system during the development of a system. This is because system tests display the performance of the system before releasing the system [20]. Testing was also performed in this project to verify the systems functionalities before deployment. The testing was based on the usability principles of Nielsen in order to identify how easy it is to learn to use the system based on the user interface. The testing that was done is categorized as dynamic analysis, which is to identify system failures using an executed program rather than documentation and browsing through code i.e. static analysis [21].

The Nielsen's principles are system status visibility, comparison of the system and the real world, level of user control and freedom, consistency, error prevention, recognition, flexibility, minimalist design, error recovery [20,

21]. Therefore, even though it can be concluded that the system provides efficient informative feedback to users, some features can also still be addressed. Additionally, the system testing was advantageous to the development of the e-Diary Service because it provided the researcher with information on what has been addressed and what still needs to be addressed in terms of usability in the system. Finally and most importantly, it also helped in training the intended users on how to use the system and easily navigate around it.

10. Conclusions

This research project has resulted in the development of an e-Diary Service system that is meant for use by UFH employees and students. This is after it was identified that they make use of hard copy diaries to manage their day-to-day work schedules which is unreliable due to some irregularities which may include misplacement or loss of data. Also, physically diarized information may be forgotten due to the absence of a reminder. This system was developed using the WAMP technology and client-side scripting i.e. JavaScript. Furthermore, in terms of security, this system provides an interface to authenticate users before providing access to them. It also ensures extra authentication by sending notification e-mail messages to users upon registration. In order to successfully develop the system, tools such as hMailServer, Macromedia Dreamweaver r8 and HeidiSQL were utilized in addition to WAMP. The goals of this research project were to develop a system that is easy to learn to use and also allows users to manage their work schedules in a timely manner. This means that the system was expected to remind users about their work schedules via e-mail or SMS. In addressing these research objectives, the research project developed a system that allows users to record, view, update and delete their work schedules. Additionally, it reminds users about their work schedules via e-mail messages. During the process of developing the e-Diary Service, some problems were encountered. This research project has managed to address most of the research objectives and overcame most of the challenges encountered in the development process of the e-Diary Service. However, due to time constraints given that this research project was conducted in only a single annum, some functions could not be performed or incorporated into the system. Future work to this project would be directed towards enhancing the SMS reminder service and the migration of the e-Diary Service into a mobile platform.

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