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Fast and Reliable System for Managing Customer Information of a Local Electric Power Generator

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ABSTRACT

Web applications have become a vital requirement for organizations in managing information, because running any organization through the classic way makes the management process tough. The purpose of this paper is to propose a fast and reliable way to solve the problems that supervisors of an electric power generator face in managing customer information. This will be done through a web-based system. The system will be developed with ASP.NET web framework and MySQL database management system. Ajax and jQuery library will be utilised for smart searching facility and printing dynamic receipts. It will be easy to use and supports all smart devices because of the help of bootstrap framework. IIS web server and Microsoft Azure cloud virtual machine are used for hosting and running the system. To investigate the workability and efficiency of the system a questionnaire and an interview have been conducted and analysed. The results confirmed that, by using the system, the supervisors can manage customers' information in an efficient way and it will save a lot of time and money and they will be able to back-up data easily. The findings of the paper can be applied for managing big-data by public or private sectors in Kurdistan.

Keywords: Web-Based System; Information Management System; Azure Cloud Virtual Machine; ASP.NET Web Application; MySQL DBMS.

1. INTRODUCTION

Recently, companies, organizations and governments compete one another in creating efficient and high-performance systems to run and mange big data. In other words, web-based systems play a vital role in organizing, storing and managing information which is sometimes impossible to do with classic paperwork. According to [1], information management is "the management of the processes and systems that create, acquire, organize, store, distribute, and use information". It helps people to use information in adequate ways.

Information management is best done with web-based systems. Web-based systems are the applications that run in a web browser [2]. [3] and [4] mentioned advantages of managing customer information such as increasing business performance, customer satisfaction, loyalty and profitability. Web-based systems have been used for managing student, examination, medical, transportation, weather and organization information [5], [6], [7], [8], [9], [10], [11] and [12]. For example, PHP, ASPNET, MYSQL database and

Google Map have been used for creating a web application for guiding visitors in the work of [13] and [14]. With regard to healthcare systems, [15] and [16] have designed web based systems for managing receptionist, doctor, nurse, laboratory and accountant parts of the hospitals and companies drug information.

In this paper, a web-based system will be proposed for solving the problems that the supervisors of a local electricity generator face in managing customer information in Kurdistan of Iraq. They use paper bills each month to write information of nearly one thousand customers which include the number of amperes, price of the amperes, customer name and date. So, the process is really both time and money consuming. They get nearly one thousand bills from a photocopy shop. Despite the mistakes they do in writing of customer name, number of amperes and price per ampere, it takes almost a week to fill in the bills by handwriting (manual method). Moreover, each month price of ampere, some customer information and numbers of amperes are changed, which makes the management process even more hindering. The web system is hosted in the cloud so it can be accessed anywhere around the globe. Since, it used bootstrap framework, it is responsive to every smart device. The most up to date web technologies services have been used to enhance efficiency, accuracy and performance of the system and it is designed in such a way that, in case of having big data, it can be updated with newer web technologies for example it can work with the approaches proposed by [17] and [18] about how to process and organize large amount of data in the cloud.

The rest of this paper is structured as follows: Methodology is explained in Section 2. Results and discussion are presented in Section 3, and Section 4 summarizes major conclusions and plans for future work.

2. METHODOLOGY

2.1 System Overview

2.1.1 System Architecture

The architecture of the system, as illustrated in figure 1, consists of three layers; the client layer, the server layer and the database layer. The client layer is the entry of the system for the user. The user can access the system through Internet by using a web browser with a smart device. It is connected to the server layer through HTTP protocol. The application layer is asp.net web application which is hosted in IIS web server and it is run in Microsoft Azure virtual machine. It gets client's request; after processing it, it sends response back to the client in HTML format. In the database layer, MySQL database management system is running. This layer gets server requests in SQL format and processes it, then it sends results back to the server.

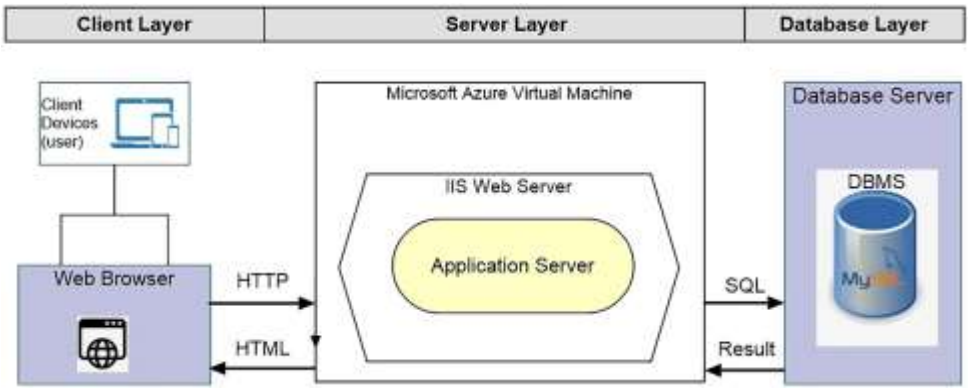

Figure 1. Architecture of the System

2.1.2 Database Design

MySQL has been used for managing customer information of the system which is an open source database management system. The Database Design of the System is shown in figure 2. It consists of three entities: user, customer and note. User is for storing user's information, note for holding the user's notes such as monthly expenses and the customers' information that need to be updated for the next month and customer for storing customer information including name, number of amperes, date, money per ampere and board. Boards are numbered for sorting purposes. A board is a group of customers sorted according to the quarters in which they live.

Figure 2. Database Design

2.1.3 Front-End Design

For designing the website of the system, many web technologies have been used including: ASP.NET, JavaScript, JQUERY, AJAX and Bootstrap framework. ASP.NET is "an open source web framework, created by Microsoft, for building modern web apps and services with .NET."[19]. The front-end of the system has been designed with ASP.NET and HTML and the back-end has been coded with C# programming language. JavaScript and its library jQuery are used for interactions of the pages and printing dynamic receipt of customers. Ajax library with Web Service have been utilized for smart searching purposes. Bootstrap

means "Build responsive, mobile-first projects on the web with the world's most popular front-end component library"[20], which is used in the website to make it responsive to all smart devices as well as for the website styles.

2.1.4 Security

Microsoft IIS with Microsoft Azure Virtual machine have been used to host the system website. To login into the system, Captcha code is required, which is demonstrated in figure 4. The Captcha code is created by two methods, one for random code and the other for an image as a background of the code. After each failed attempt the code should be reentered again. This makes login into the system website more secure. Session Object has been used to stay logged in in the system and pass data between pages of the system [21] . The session object is stored in the web server which makes the system safe. In terms of database security, we have used SQL Parameter in MySQL Query to secure our database against being destroyed.

2.1.5 System Functions

The system/website functions are described as follows:

1. For opening the website, the user should type http://www.sumar.xyz in the Internet browser address bar, then he can login into the system by entering Captcha Code, username and password. The welcome and login page can be seen in figure 3 and 4.
2. The user can open the user management page by clicking on menu/nav bar and click on user management icon. The system menu/nav bar and user management page are shown in figure 5 and 6 respectively.
3. In management page, the user can update his password.
4. The user can open the customer management page by clicking on menu/nav bar and click on customer icon. This page is displayed in figure 7. In customer page, current information of customers can be updated and new customers can be added to the system. Also, the user can search for customers by using smart search function.
5. The print and note pages can be seen in figure 8 and 9. The print page can be used for printing customers information in receipt form. The note page can be used for saving monthly expenses and special customers information.
6. The user can backup and restore the database of the system in backup page. This page can be seen in figure10 and it can be opened by clicking on menu/nav bar backup icon

These functions allow the supervisor of the electric power generator to manage the machine and its customers information in an appropriate way.

Figure 3. The Home Page of the System (Mobile View)

Figure 4. The Login Page of the System (Mobile View)

Figure 5. The NavBar of the System (Mobile View)

Figure 6. The User Management Page of the System (Mobile View)

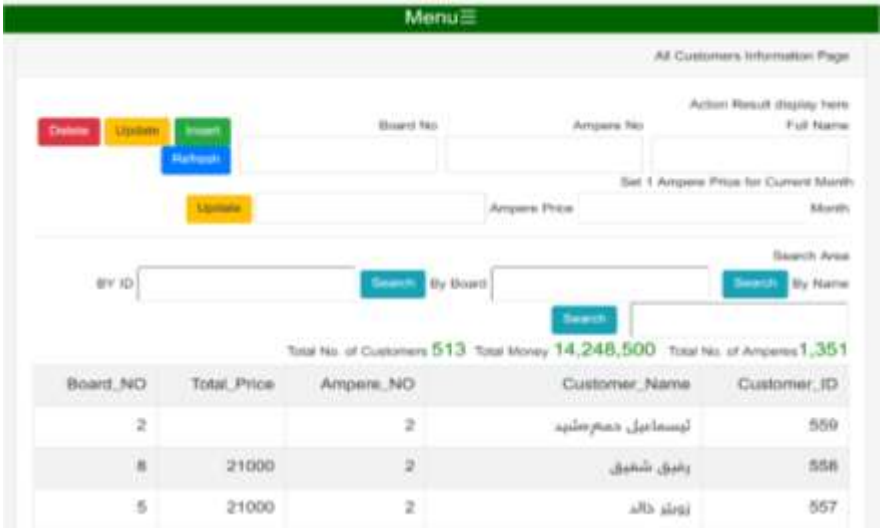

Figure 7. The Customer Page of the System (Tablet View)

Figure 8. The Print (Receipt) Page of the System (Tablet View)

Figure 9. The Note Page of the System (Mobile View)

Figure 10. The Backup Page of the System (Mobile View)

2.2 Data Collection

The system has been working since May 2019. Twenty-five people are working on the system (5 supervisors and 20 assistants). To get feedback from the users on the workability and accuracy of the system, a questionnaire and an interview have been conducted. These have been broadly explained in results and discussion section.

3. RESULTS AND DISCUSSION

The questionnaire consists of ten questions as listed in table 1. It was filled out by the users. For each question they chose one of (Strongly Disagree, Disagree, Neutral, Agree and Strongly Agree) which scored from 1 to 5 respectively.

Table 1. The Questionnaire for Evaluation of the System

Questions	Result (1-5)	Percentage
1. Do you agree with the language used in the system?	4.6	92%
2. Is the system easy to use?	5	100%
3. Is it possible to use the system with different devices?	5	100%
4. Would you like to use the system in the future?	4.6	92%
5. Do you like the interface of the system?	3.6	72%
6. Is it easy to navigate between website pages?	4.6	92%
7. Would you recommend the system to other supervisors of electric power generators?	5	100%
8. Is it possible to access the system everywhere?	4.6	92%
9. Do you think the system increases efficiency and accuracy of the management process?	4.6	92%
10. Is it easy to backup data with the system?	4.6	92%
Average	4.62	92.4%

As the results show, for questions 2, 3 and 7, 100% of the participants chose strongly to agree i.e. they confirm that the system is easy to use. They also strongly agree that the system could easily be used with different devices and they recommend it to other supervisors of electric power generators.

92% is the result for question 1, 4, 6, 8, 9 and 10. This indicates that the users agree with the language used in the system. It worth mentioning that Kurdish language is used in the system and it makes it easier for them since it is their native language. The participants are

willing to use the system in the future as it increases efficiency and accuracy in the management process.

Concerning the interface of the system, question 6, the results show that the preference rate is 72%. Result of this question compared to other questions is the least. But the interface can be improved more in the future with the users' demand when updating the system.

For the interview part, five questions were answered by the supervisors of the electric power generator. The questions focus on the time and money spent in preparing receipts as well as updating information with and without the system and how it facilitates the process.

The first question was "how much time does it take for preparing the receipts with and without the system?". The supervisors said that they needed 15 to 20 hours each month in preparing the receipts. But now it takes only 25 minutes to half an hour to prepare them and this is a very big difference as depicted in figure 11.

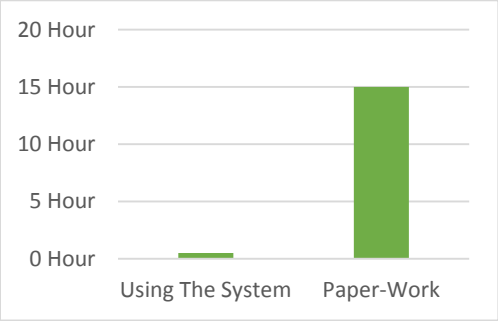

Figure 11. Time Spend with and without Using the System

Concerning the second question which was about the cost, the supervisors stated that before using the system they spent 18,000 to 20,000 Iraqi dinars per month with the system they need only 1,500 Iraqi dinars. So, it saves around 85% of the cost. Differences of the cost are illustrated in figure 12.

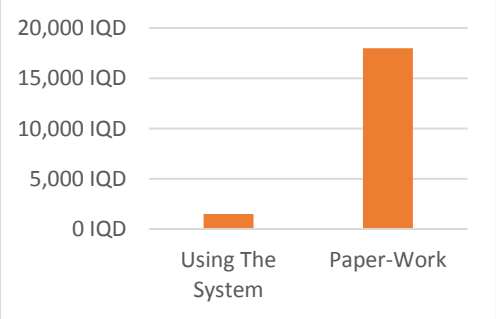

Figure 11. Money Spend with and without Using the System

The third question was about updating information of the customers in the boards with and without the system. It was confirmed that before the system they had to do a lot of paper-work daily to update information for example; they were using notebooks, after updating less than ten customers' information they had to change the notebook and rewrite

the entire information, which was tedious as they mentioned. On the opposite, with the system they need only a few minutes to update information.
In answering the fourth question, about the help they get from the system in calculating total amperes, price, expense and profit, they replied that the system makes the work significantly easy. Previously, they needed a calculator, pen and paper and a lot of time to do the calculations.

The last question was left to them to comment about the system in general. Most of them said that the system makes a lot of simplification, accuracy, faultlessness in the management process. On the contrary, lots of mistakes were happening in calculation of total price, profit, expenses, total number of customers and amperes.

4. CONCLUSIONS AND FURURE WORK

In this paper, a fast and reliable system for managing customer information of a local electric power generator has been described. Through this system, the supervisor of the electric power generator can manage their customer information in an efficient and precise way. The system is highly easy to use, saves a lot of time and money for the supervisors. It supports all smart devices and it can be accessed everywhere on the globe. It prevents losing data because it has automatic backup feature. The workability of the system has been confirmed by its users and they recommend it to other supervisors of electric power generators.

Future work includes more working in the system interface, enabling customers to view their information using username and password, using extra security layers/functions in the system for login purpose such as fingerprint and face-ID and extending the system to be used by other electric power generator s to manage their customers' information.

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