

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

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Abstract

Web applications have become a backbone for organizations especially in managing information, because running any organization through the classic way makes the process hard. This paper tries to develop a web-based system that helps the supervisors of an electric power generator in handling the problems they face in managing customer information. Through the manual process, the supervisors spend a lot of time and money and despite inefficiency and inaccuracy of paper-work, it is tiresome. The system will be developed with ASP.NET web framework and MySQL open source database management system. Ajax and jQuery library will be utilized 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. As a result of this system, the supervisors of electric power generator can manage customers' information in a reliable, fast and efficient way and it will save a lot of time and money and they would be able to back-up data easily.

1. INTRODUCTION

Recently, companies, organizations and governments compete one another in creating efficient and high-performance systems to run and manage 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].

In this paper, a web-based system will be proposed for solving the problems that the supervisor of a local electricity generator faces 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 rest of this paper is structured as follows: Related work is reviewed in Section 2. Methodology is explained in Section 3. Results and discussion are presented in Section 4, and Section 5 summarizes major conclusions and plans for future work.

2. Related Work

Web based systems have been presented by many researchers for managing information in different areas such as non-government organizations, guiding visitors, health care and education. Reducing organization's paperwork and managing customer information have been presented by [11] and [12] who created web applications to manage partner customer interactions.

PHP, SQL and Google Map have been used for creating a web application for guiding visitors and students to find University of AKRON Buildings. The app can be used in different devices including mobile, tablet and computers. They used MYSQL database for keeping app information [13]. Also, [14] created a web and mobile application named GuideMe for guiding visitors who want to visit the country of Sri Lanka. In the app, MSSQL database and ASPNET have been used for managing visitor's and App's information.

With regard to healthcare systems, some researches have been reviewed. Firstly, [15] used HTML, CSS, ASP.NET for designing a healthcare system. They used SignalR in the system for real-time functionality. However, as they mentioned, their system lacks a high level of accuracy, privacy and security. Secondly, [16] developed a hospital database management system to store doctors', staffs' and patients' information in a hospital in Nigeria. Apache Server, PHP and MYSQL were installed in a server computer. And the clients only needed a standard computer with Mozilla browser and a Local Area Network in order to connect to the server. The system consisted of administrative, receptionist, doctor, pharmacy, nurse, laboratory and accountant parts. Information of the mentioned parts was stored in the MYSQL database. Whereas, a drawback of the system to be stated is that it worked only inside the hospital. The system information could not be accessed outside of the hospital. Lastly, a database management system for company's drug information has been developed by [17]. In the system, Microsoft Azure cloud services, Microsoft SQL server database, ASP.NET and Visual Basic have been used.

The last two papers are related to education. Hou developed a web application for examination purposes. The application was designed with C# for programming, ASP.NET for designing and MS SQL for the Database of the system. It was designed only for computer screens, no other devices [18]. [19] proposed a system for dynamic English listening question bank. In the system, random exam papers with audio files were generated automatically. The system was designed through ASP.NET, IIS web server, windows server 2008, Internet Explorer browser and Microsoft SQL server 2005.

Despite of the advantages and outcomes of the reviewed works, they have drawbacks and we try to avoid in our work. For example, some of the systems could not support different devices; some others could not be accessed everywhere because they were not hosted in the cloud; while in others new web technologies services have not been used. Therefore, we have developed a web system that 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. Furthermore, the system 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 [20] and [21] about how to process and organize large amount of data in the cloud.

3. METHODOLOGY

3.1 System Overview

3.1.1 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.

3.1.2 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.

3.1.3 Website 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." [22]. 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" [23], which is used in the website to make it responsive to all smart devices as well as for the website styles.

3.1.4 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 [24]. 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.

3.1.5 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.

3.2 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.

4. 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.

As the results show, for questions 2, 3 and 7, 100% of the participants chose strongly 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.

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.

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 really 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.

5. CONCLUSIONS AND FUTURE 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 generators to manage their customers' information.

Table 1. The questionnaire for evaluation of the system

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

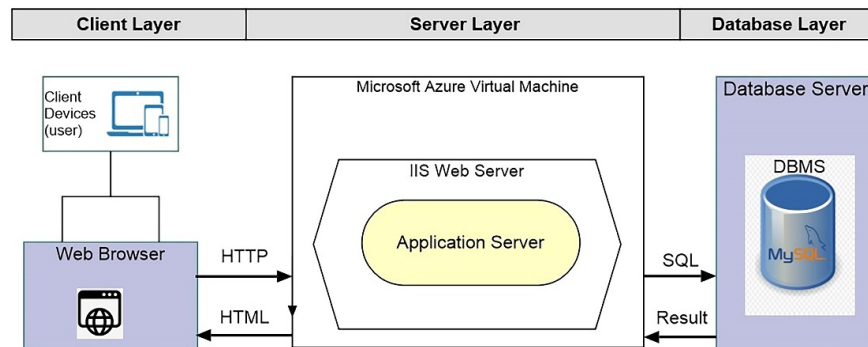


Figure 1. Architecture of the System

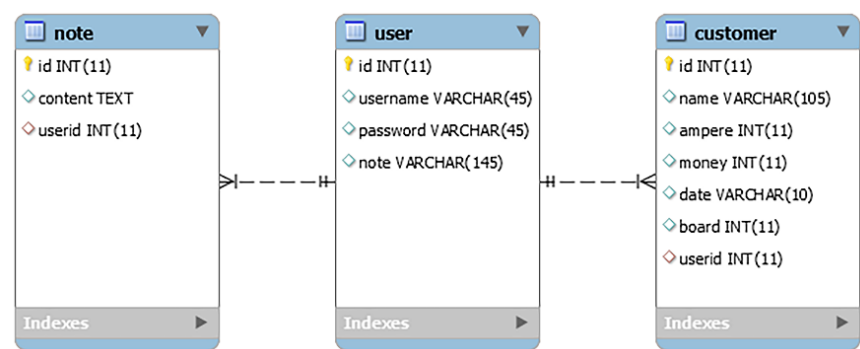
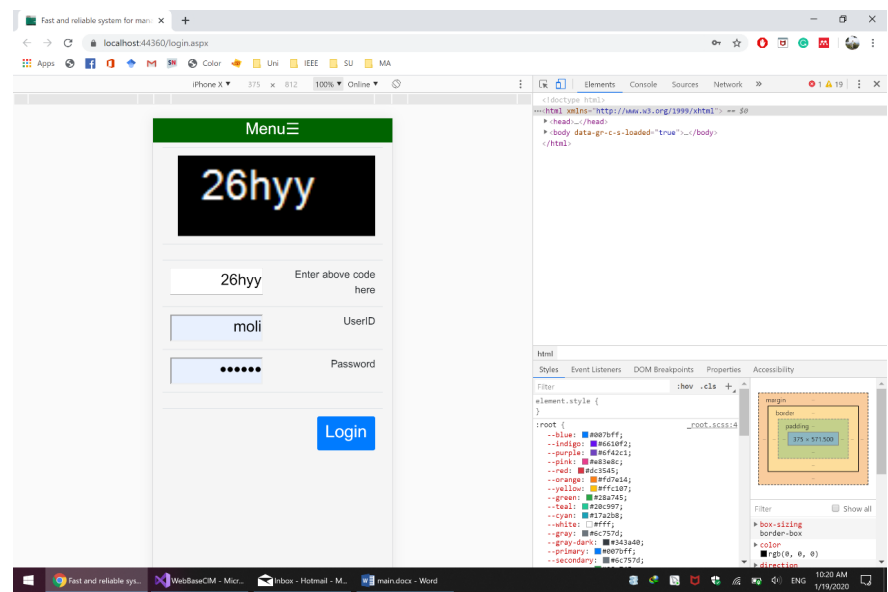
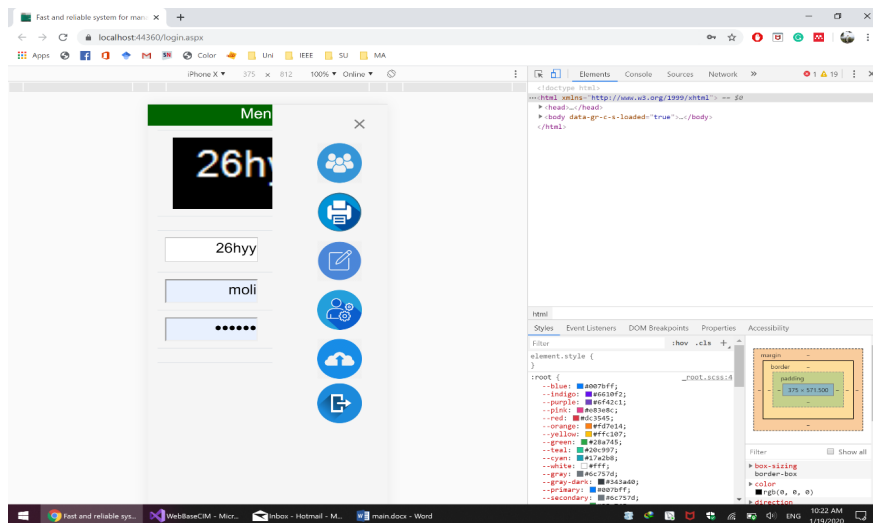


Figure 2. Database Design



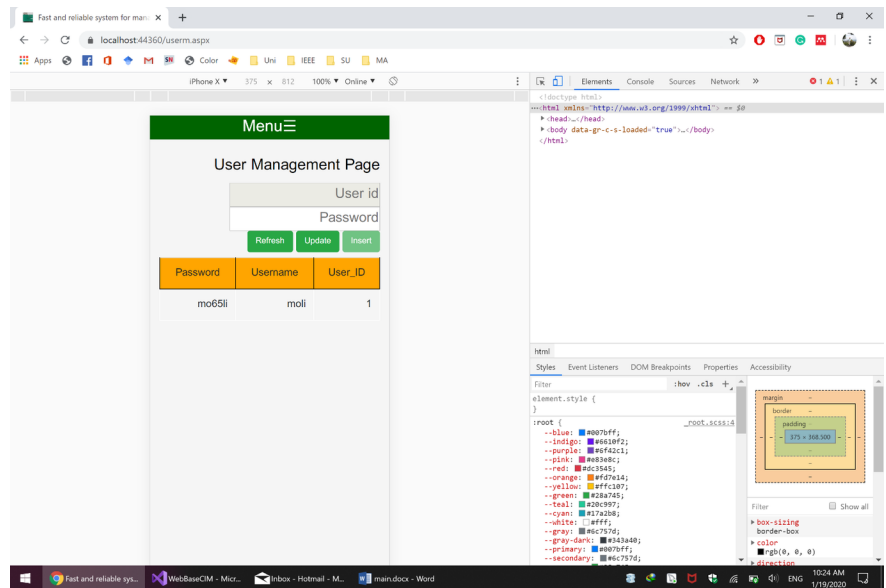
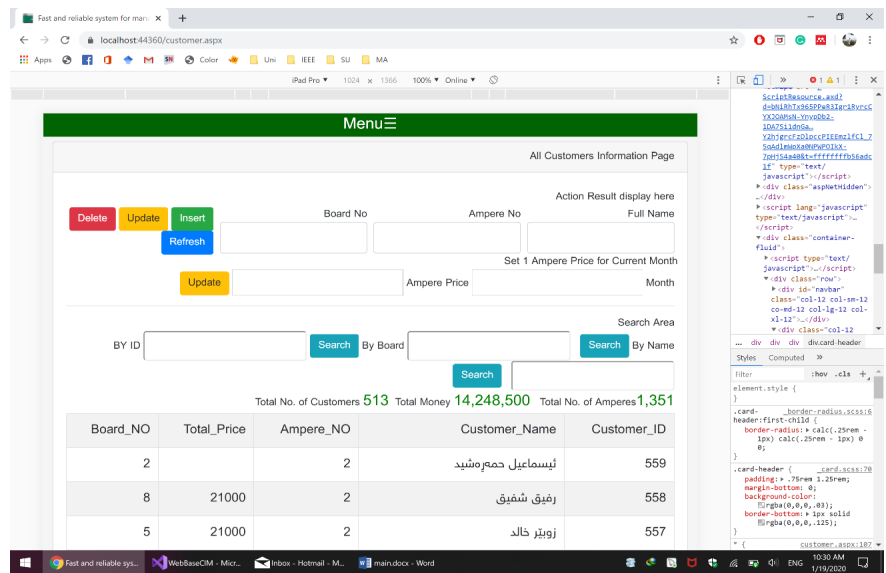


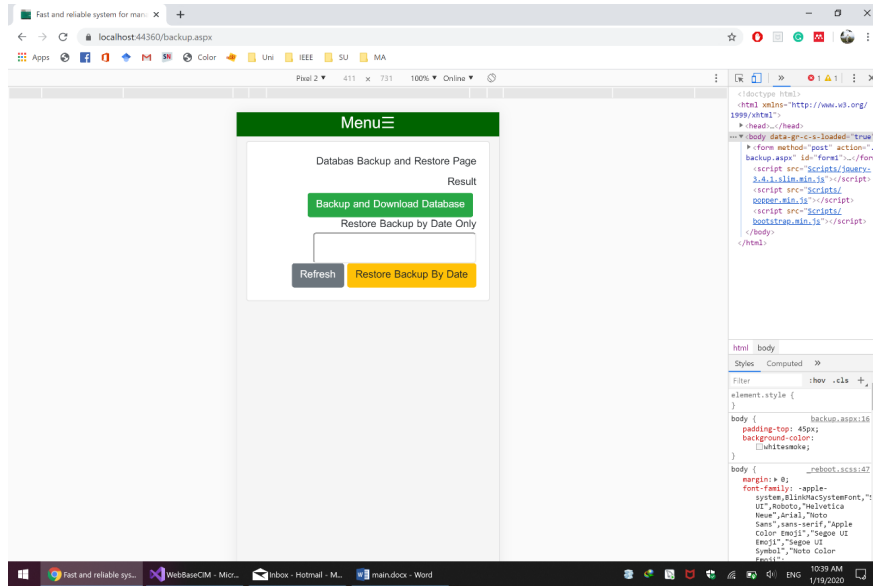
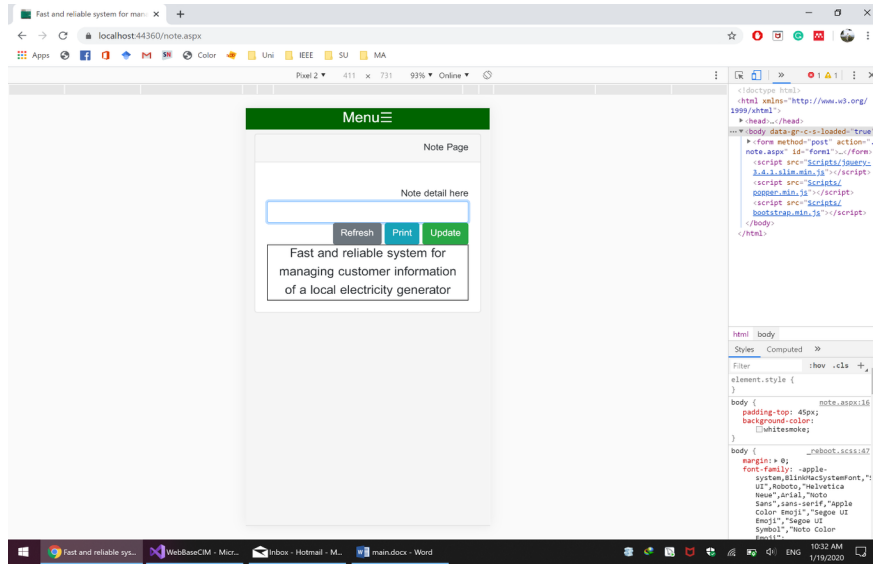
Menu☰

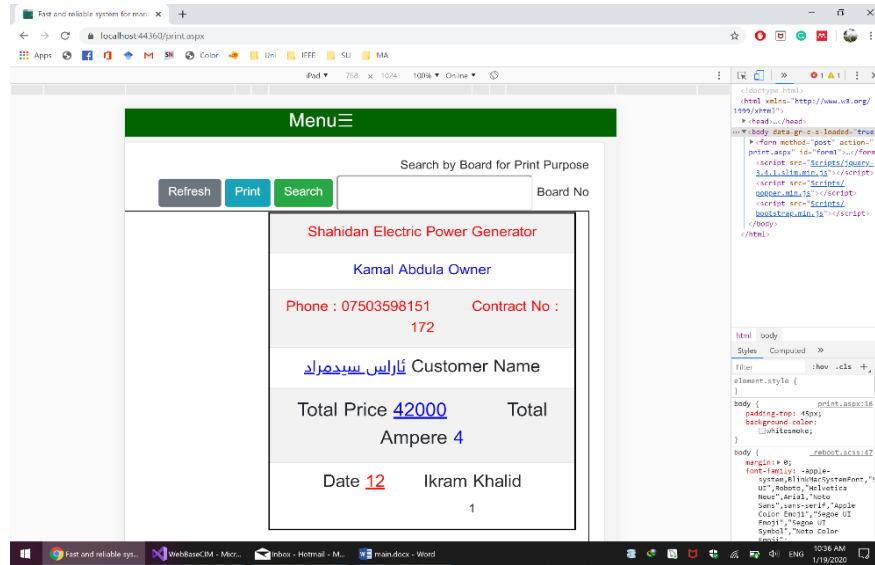
Welcome to
" Fast and reliable system for
managing customer
information of a local electric
power generator "



[to enter the system click here](#)







[CHART]

Figure 11. Time spend with and without using the system

[CHART]

Figure 12. Money spend with and without using the system

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Compliance with ethical standard

Conflict of interest the authors declare that they have no conflict of Interest.

REFERENCES

- [1] B. Detlor, "Viewpoint - Information management," *Int. J. Inf. Manage.*, vol. 30, no. 2, pp. 103–108, Apr. 2010.
- [2] V. Bruno, A. Tam, and J. Thom, "Characteristics of web applications that affect usability: a review," *Proc. OZCHI 2005*, 2005.
- [3] R. Rahimi, "Customer relationship management (people, process and technology) and organisational culture in hotels," *Int. J. Contemp. Hosp. Manag.*, vol. 29, no. 5, pp. 1380–1402, May 2017.
- [4] F. B. Maklan and Stan, *Customer Relationship Management Concepts and Technologies*. 2013.
- [5] F. Al-Hawari, M. Alshawabkeh, H. Althawbih, and O. Abu Nawas, "Integrated and secure web-based examination management system," *Comput. Appl. Eng. Educ.*, vol. 27, no. 4, pp. 994–1014, Jul. 2019.
- [6] J. Xu, J. Wang, X. Wang, and P. Lv, "iTest: A novel online testing system based on the WeChat platform," *Comput. Appl. Eng. Educ.*, vol. 27, no. 4, pp. 885–893, Jul. 2019.
- [7] L. Ramírez-Donoso, M. Pérez-Sanagustín, and A. Neyem, "MyMOOCspace: Mobile cloud-based system tool to improve collaboration and preparation of group assessments in traditional engineering courses in higher education," *Comput. Appl. Eng. Educ.*, 2018.

- [8] S. Patel *et al.* , “Home monitoring of patients with Parkinson’s disease via wearable technology and a web-based application,” in *2010 Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBC’10* , 2010, pp. 4411–4414.
- [9] N. Xu, S. Peng, and Z. Wang, “Designing Geodata Service Composition Web Application Based on Service-Oriented Architecture,” *IEEE Access* , vol. 4, pp. 4136–4147, 2016.
- [10] X. Zhang, L. Dai, L. Ren, and S. Tang, “Occupation exposure declaration and monitoring information system design and application for medical staff,” in *2017 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* , 2017, vol. 2017-Janua, pp. 1409–1412.
- [11] S. Rajkumar, S. E. Abraham, and V. Santhi, “Web based portal using a biometrie interface and Android application to assist non-government organizations,” in *2017 International Conference on Intelligent Computing, Instrumentation and Control Technologies (ICICT)* , 2017, pp. 898–902.
- [12] A. N. Purbowo, Yulia, and A. I. Suryadi, “Web Based Application Customer Relationship Management for Helping Sales Analysis on Bike Manufacturer,” in *2017 International Conference on Soft Computing, Intelligent System and Information Technology (ICSIT)* , 2017, pp. 347–352.
- [13] H. Nguyen, H. Zhao, S. Jamonnak, J. Kilgallin, and E. Cheng, “RooWay: A Web-Based Application for UA Campus Directions,” in *2015 International Conference on Computational Science and Computational Intelligence (CSCI)* , 2015, pp. 362–367.
- [14] R. K. O. Kaushalya, J. M. G. . Jayabahu, W. M. P. . Weerasinghe, A. M. C. . Herath, K. A. D. T. Kulawansa, and M. F. M. Firdhous, “GuideMe: An innovative mobile application for guiding tourists,” in *2017 2nd International Conference on Computing and Communications Technologies (ICCT)* , 2017, pp. 15–20.
- [15] S. Mohammed Zeki and A. M. Saleh Rahma, “Healthcare System Technology using Smart Phones and Web Apps (Case Study Iraqi Environment),” *Int. J. Eng. Manuf.* , vol. 7, no. 3, pp. 1–7, May 2017.
- [16] A. J. C., A. V. C., and N. S. E., “Design and Implementation of a Hospital Database Management System (HDMS) for Medical Doctors,” *Int. J. Comput. Theory Eng.* , vol. 10, no. 1, pp. 1–6, 2018.
- [17] K. Lacy-Jones *et al.* , “Biopharmaceutics data management system for anonymised data sharing and curation: First application with orbito IMI project,” *Comput. Methods Programs Biomed.* , 2017.
- [18] Y. Hou, “Design and Implementation of Online Examination System based on ASP.NET,” in *Proceedings of the 2018 International Conference on Advances in Social Sciences and Sustainable Development (ASSSD 2018)* , 2018.
- [19] D. Shi, J. Lopez-Vargas, and M. D. C. C. Loayza, “The Design and Implementation of English Listening Question Bank and Dynamic Examination System Based on Internet,” in *Anais dos Workshops do IV Congresso Brasileiro de Informática na Educação (CBIE 2015)* , 2015, p. 483.
- [20] M. Zhang, P. Martin, W. Powley, and J. Chen, “Workload Management in Database Management Systems: A Taxonomy,” *IEEE Trans. Knowl. Data Eng.* , vol. 30, no. 7, pp. 1386–1402, Jul. 2018.
- [21] T. Samizadeh, A. Rahmani, and H. Tabarsaied, “Data Management in Fog Computing: Principles and Paradigms,” in *Fog and Edge Computing: Principles and Paradigms* , R. B. S. N. Srirama, Ed. 2019, pp. 171–190.
- [22] Microsoft, “What is ASP.NET?,” 2019. [Online]. Available: <https://dotnet.microsoft.com/learn/aspnet/what-is-aspnet>. [Accessed: 20-Sep-2019].
- [23] Bootstrap, “Bootstrap,” 2019. [Online]. Available: <https://getbootstrap.com/>. [Accessed: 20-Sep-2019].
- [24] Microsoft, “Session Object (IIS),” 2017. [Online]. Available: [https://docs.microsoft.com/en-us/previous-versions/iis/6.0-sdk/ms524319\(v%3Dvs.90\)](https://docs.microsoft.com/en-us/previous-versions/iis/6.0-sdk/ms524319(v%3Dvs.90)).