

RESEARCH ARTICLE

WEB-BASED DENTAL PATIENT EDUCATION AND MANAGEMENT APPLICATION

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ABSTRACT

It is difficult for hospitals and clinics to manage their documents related to their patients and routine works without having management software. The purpose of this paper is to design and develop a web-based dental clinic application for educating and managing patients. Recent web technologies such as ASP.NET, JavaScript, Bootstrap, and Web Service have been used for developing the application; it is hosted in the Cloud and it is powered by Microsoft Azure Cloud computing Service. A clinic has been selected to use and evaluate the application. The evaluation results of the application show that the application meets its objectives of educating and managing patients. It can be updated and extended to use in various private and public hospitals and clinics for educating and managing patients.

KEYWORDS

Dental education, Dental management system, Patient education, Medical informatics, eHealth systems, Clinical information systems.

1. INTRODUCTION

Digital health records play a crucial role in replacing paperwork in hospitals and clinics, and it has many advantages, for example, patients' information will be easily available, identifying patients' diagnoses and providing treatments quickly, as well as it will be an important tool for researchers (Dieterich *et al.*, 2016; Barsley, Sharp and Smith, 2017; Cresswell and Sheikh, 2017; Quintana and Safran, 2017; Gordon *et al.*, 2018). Improving the relationship between patients and medical staff also ensuring medical services are provided properly and accurately a hospital customer relationship management system has been proposed by (Li, 2020). (Triakha *et al.*, 2020) developed a hospital management information system for public health in Haryana India. The system supports real-time reporting, data analytics, and managing patients' information. All mentioned researches above are about the management of the hospital and patients' information. Despite these, (Salajan and Mount, 2012; Javaid *et al.*, 2016) proposed an interactive application and wiki-platform for multimedia teaching. However, none of them combined both management and education purposes. In this paper, a web-based application will be proposed for managing patients' information and educating the patients of a dental clinic through the application. With the application, medical records of patients can be prepared quickly and accurately (Blesi and Ferrari, 2018, p. 6) and it makes the management process easier (Mandzuka *et al.*, 2015; Wang *et al.*, 2018).

The application has two main functions: the first function is specified to educate patients; because educating patients through multimedia documents have significant impacts as stated by (Mitov *et al.*, 2010; Salajan and Mount, 2012; Javaid *et al.*, 2016). The second function is to manage and record patients' information; the success of managing patients' information through the use of applications has been examined by different studies such as (Codreanu and Florea, 2016; Estai *et al.*, 2016; Serrato-Lopez, Pacheco-Rojas, and Armas-Aguirre, 2018; Watson, 2019).

Moreover, this application enhances the interaction between the dentist and patients and helps in providing treatments for the patients (Canbazoglu *et al.*, 2016). The contribution of the paper is to merge both education and management processes in a web-based application. Besides, this application is managing patient's information in:

- Recording the patient's dental and medical history;
- Documenting patient visits, including patient treatment and treatment plans;
- Notifying each patient by an automated email that is sent by the application for the other appointments of the unfinished treatments.

Also, it educates patients through:

- Multimedia documents including text, image, and video according to the patient's special needs.
- Each patient gets instructions from the dentist based on the treatment(s) required.

Evaluation results of the application confirm that the app successfully gains its goals as is shown in table 1. All participants strongly agree and agree that the application is easy to access and it saves lots of time in arrainging appointments. Most of the participants highly rate that the application supports different devices. Finally, they all agree with the overall rating of the application. This application can be used in different clinics and hospitals for educating and managing patients. The rest of this paper is structured as follows: materials and methods are explained in section 2. Results and discussion are presented in section 3 and section 4. Section 5 summarizes major conclusions and plans for future work.

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2. MATERIAL AND METHOD

The Web-based dental application is divided into two parts; one is for managing patients' data and the other for educating patients through multimedia documents. For the first part, the admin of the application can add all patients' information like patient medical and dental histories to the application and the dentist can add treatment and treatment plans for the patients. In the second part, patients can see their visits, educational videos, and texts related to their treatment and treatment plans.

2.1 Application Design

This application has been programmed with ASP.NET C# language with the help of Microsoft Visual Studio IDE (integrated development environment). The interface of the application has been designed using HTML, JavaScript, and Bootstrap framework for making the web application screen responsive. In the application, the smart searching mechanism has been constructed with the assistance of Ajax Library and Visual Studio Web Services features. MYSQL Open source database management system has been used for storing dentists and patients' information. Moreover, the whole application is hosted in the Cloud which is powered by Microsoft Azure Cloud computing Service. Lastly, for the application security, username and password, session object, and Captcha-Code are used for securing application login and SQL Parameter for securing the database of the application against being destroyed.

2.2 Application Function

The app consists of admin, dentist, and patient and each of them has different pages and the following components.

Admin/ Assistant of the dentist can

- Edit admin user information
- Manage Dentist information
- Add new patient and patient visit information

The admin of the application can be opened by accessing admin.aspx page and entering Captcha-Code, admin username, and password which is shown in Figure 1. And the admin page can be seen in Figure 2.

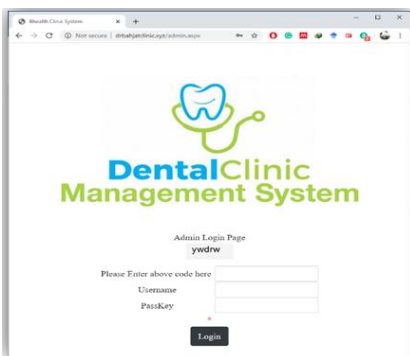


Figure 1: Login into the admin page

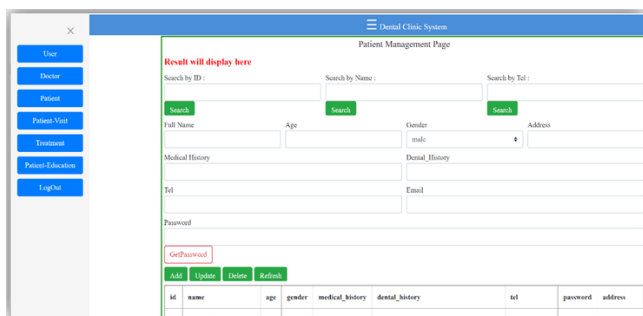


Figure 2: Admin page of the application

2.3 Dentist can

- Add and edit treatments
- Add and edit Patient Education

The dentist of the application can be opened by accessing dentist.aspx page and entering Captcha-Code and Dentist Password which is shown in Figure 3. And the Dentist page can be seen in Figure 4.

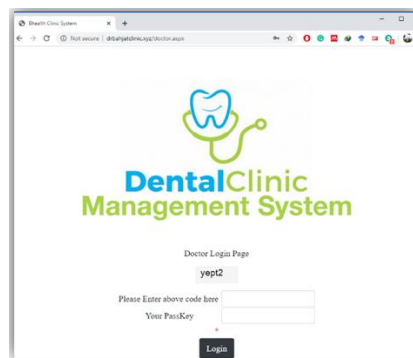


Figure 3: Login into the Dentist page

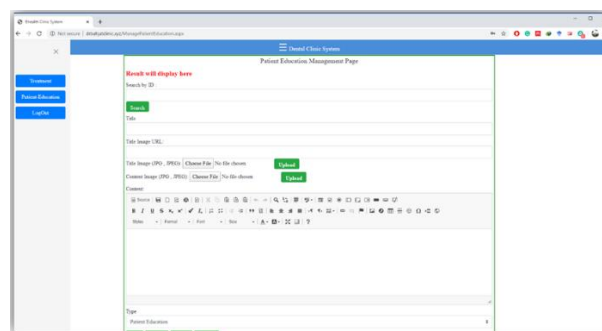


Figure 4: Dentist page of the application

2.4 Patient can

- See complete information about their visits
- See their treatment and treatment plans
- See many posts which are related to patient educations

The patient page of the application can be opened by accessing default.aspx page and entering Captcha-Code and Patient Password, these can be seen in Figure 5 and Figure 6 respectively.

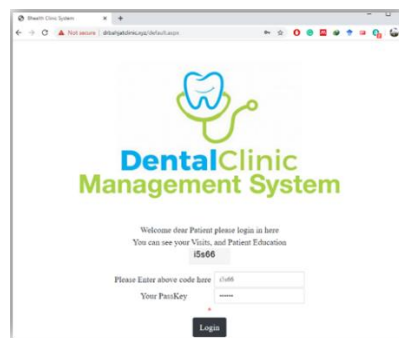


Figure 5: Login into the Patient page

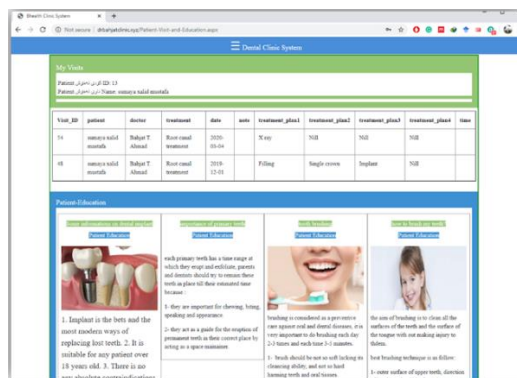


Figure 6: Patient page of the application

3. RESULTS

To get feedback on the workability and accuracy of the system, a questionnaire has been conducted. 25 patients have been invited to use and evaluate the application. The evaluation was carried out through a google form questionnaire. The questionnaire included 10 different statements, each statement is related to a specific feature of the application. The Results of the questionnaire are shown in Table 1. For each statement, they chose one of (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree).

The results of the questionnaire show that the majority of the participants which is 75.2% agree and strongly agree with all features of the application. The highest rate of agreement to the features got through the statements is for ease of accessing the app and the time it saves for patients in arranging appointments as compared to visiting the clinic in person and waiting long to see the dentist. All participants agree with these features. Whereas, the minority of the participants which is 3.60% disagree with statements 6, 8, and 9. The points are about if the patients get useful information from the application, application design, and if the app supports multiple screens. Only, 21.20% were in between agree and disagree and chose neutral for statements 2, 3, 5, 6, 7, 9, and 10.

Table 1: Evaluation results

| Statements | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|-------------------|----------|---------|-------|----------------|
| 1. It is easy to access the app. | 0 | 0 | 0 | 12 | 13 |
| 2. The app is efficient and easy to use. | 0 | 0 | 3 | 13 | 9 |
| 3. I get answers to my questions from the instructions. | 0 | 0 | 3 | 13 | 9 |
| 4. It saves a lot of time in arranging appointments. | 0 | 0 | 0 | 9 | 16 |
| 5. The app changed my behavior toward dental treatments and procedures. | 0 | 0 | 13 | 3 | 9 |
| 6. App provides useful information and meets my needs. | 0 | 3 | 9 | 3 | 10 |
| 7. App contents can be copied, printed, and shared. | 0 | 0 | 13 | 9 | 3 |
| 8. The app supports multiple screens/devices (mobile, Tablet, and Computers). | 0 | 3 | 0 | 3 | 19 |
| 9. The application design is interesting. | 0 | 3 | 9 | 3 | 10 |
| 10. Overall Rating. | 0 | 0 | 3 | 9 | 13 |
| % Total | 0.00 | 3.60 | 21.20 | 30.80 | 44.40 |

4. DISCUSSION

This paper indicates that a web application for educating and managing patients can be developed. The application increases the interaction between the dentist and the patients. It is successful in documenting patients' information such as dental and medical history and patients' visits. Also, it can be used anywhere in the globe because it is an online application. By accessing the web app patients, through using their smart devices, can get useful information about their treatments easily, quickly, and efficiently. The application is successful in managing patient's information and educating them based on treatments. Features of the application make the app to be significantly used in different clinics not only dental clinics. So, this can be easily established for different clinics only by using a domain name and small hosting. The results of the work strongly confirm that the application meets its objectives of educating and managing patients. But, the application design is not very attractive and it can be more improved in the future version as required by the clinic. This research differs from similar related works (5,9,10) because it merges educating and managing patients together.

6. CONCLUSIONS AND FUTURE WORK

In this paper, a web-based dental clinic application, for educating and managing patients of a dental clinic has been designed and developed. Through the application, patients' information such as patients' visits, medical and dental history of patients can be kept in a secure place. Also, multimedia documents are provided for educating patients. The application can be accessed by any smart device at any time because it is responsive to different screens. An evaluation of the application confirms that the application achieves its objectives. Therefore, future work includes improving application design, updating, and extending the application for use in various hospitals, clinics, and universities for researching purposes. Lastly, adding advanced reporting features for the application makes the application more sufficient.

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