Computerized Clinical System for EFFAT University

Amani Kabbas[1], Khulood Rambo[2], Wejdan AlJohani[3], Shahad Almeteb[4]

[1,2,3,4]College of Engineering, EFFAT University, AnNazlah Al Yamaniyyah, Jeddah, 22332, Saudi Arabia

aakabbas@effatuniversity.edu.sa[1], krambo@effatuniversity.edu.sa[2], waljohani@effatuniversity.edu.sa[3], salmeteb@effatuniversity.edu.sa[4]

Abstract

In this study, a computerized clinical system for EFFAT University that is expected to add significant advantages for both medical staff and patients of EFFAT University clinic. Current EFFAT University clinic system was based on the manual non-computerized/automated medical system which had various limitations. However, the clinic system that developed aims to provide the clinic medical staff with more convenient meant that allowed the users to perform their work tasks in an easy, efficient and more organized manner. This system created medical records for the patients, stored their medical information and treatment history with the clinic wrote medical prescriptions and send notification for the instructors about student illness. This system was provided an audit of medicine availability in the clinic's pharmacy.

Keywords: *Clinical System; Students; Medical Staff; Personal Information*

1. Introduction

The rapid development of medical sciences in recent years has resulted in the doctors needing more information to treat patients. The traditional methods which involve manual/handwritten health records have been time consuming and insufficient to record vast amount of required information. The manual method had two major inadequacies such as misunderstanding due to handwriting and difficulty in searching and saving on traditional paper records.

Medical errors is defined as any preventable which contributes to inappropriate medication or patient harm which medication is in the control of the health care professional, patient or customer [1,2,3]. Medical errors caused due to prescribing and administration errors. In previous systematic reviews had found median error rates between 8% and 10% in medical and administration [4].

The medical error is 14th of causes lead to mortality [5]. The medical errors contributed to severe morbidity, long hospital stay, unnecessary diagnostic tests, mortality and unnecessary treatment [6]. Approximately 1.5 million people and lead thousand mortalities case which contributed mortality cause in United States of America [7,8].

The use of non-computerized medical records has various limitations [9]. There are various costs associated with using manual patient records such as duplication of the medical records, staff needed to distribute the medical records, and more space needed to store the hard copy records. In additions, personnel is unable to sort data fields in the manual paper records consequently it will lead to loss of productivity. The electronic medical records comprise of various components which work together in automating access to information that streamlining the workflow of clinicians [9]. The system allows for more accurate and efficient patient care while reduce long term costs for healthcare practices.

Electronic medical records are electronic versions of patient health information that are generated and managed using health information management systems. The electronic medical records allow easy information backup, remote access to patient records, efficient information storage and reduction in office space among other things [10-12]. The study aim to computerized clinical system for EFFAT University which add significant advantages for both medical staff and patients of EFFAT University clinic.

2. Methodology

There were many tasks that needed to be accomplished using the clinic system in EFFAT University. There were different functional requirements for the system based on the user types. However, all users had register/login used EFFAT ID and password to access the system and edit with change passwords through banner system.

The patient records were unavailable in electronic form which inconvenient to view the records in certain instances. The manual system implied that clinic staffs using hand writing on patient diagnosis and treatment. The patient history needs be created by added patient information and keep the record electronically. The staff was generated sick leaves records allowed students to be excused from classes. The clinic staffs added or deleted quantities of medications to keep record and order medication if needed.

The patients needed an electronic medical system that enable to view their electronic record. The banner login page for the student account showed personal information tab. The students had accessed personal information. In this section, the patients had updated their account passwords as well as their personal information. In additions, students had accessed the view sick leaves and medical record available in the system.

The users was used their EFFAT identification number (ID) to access the account in the banner system. In the registration page, the users set their password and only the person who had these details log into the specific account. Building an ideal electronic medical record platform required the system and user problem. The system required building a database which efficiently store both current and future patient data, created computable representation of various clinical concepts, developed an efficient and sophisticated reported engine and create a workflow representation was adjustable for different users. In additions, the platform needs to security features and offer support for data exchange and provided flexibility.

The system design was based on software architecture as well as efficient access control methods. The system architecture had two main parts such as background and foreground. The background for system administrator while foreground for medical staff and the patients.

A use case model showed the functionality of the clinic system which clarified functional requirement of clinic system and interaction between users and clinic system.
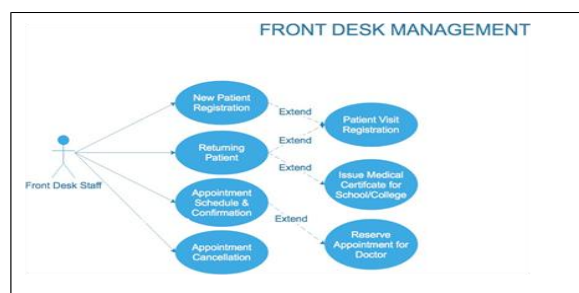

Figure 1: Front disk use case.

The context diagram of EFFAT clinic system represented all external entities that interacted with the system without any details about the internal activities.
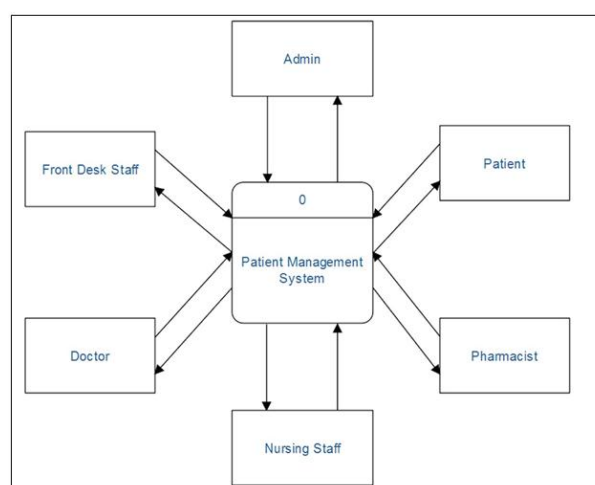

Figure 2: Context diagram.

The data flow diagram showed data flow through the clinic system as shown in Figure 3 and 4.
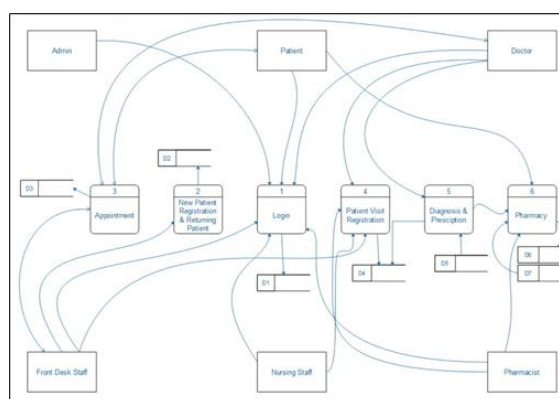

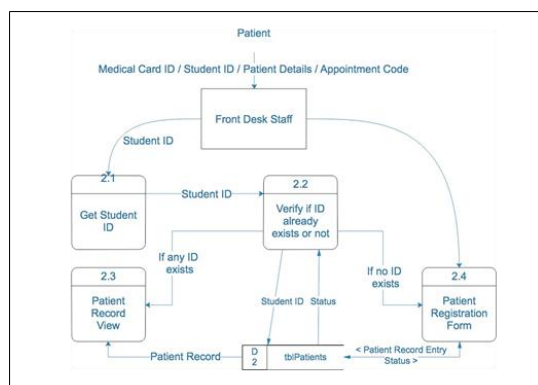Figure 3: Data flow diagram system level 0.
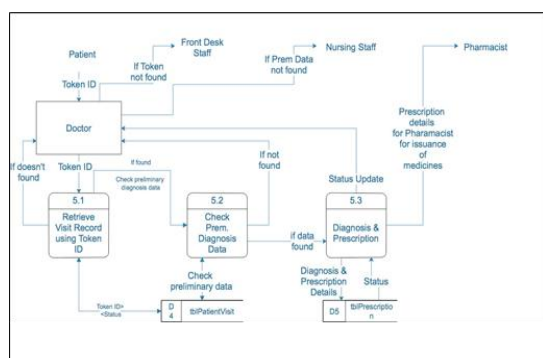
Figure 4: Patient registration.

Figure 5: Data flow diagram for patient diagnose and prescription.

The patients were only able to access their personal information and medical records. In additions, the patients had no authorization to add or delete their medical records and the patients were allowed upload external sick leaves to the system.

The medical staff also needed to register on the system but the patients had chosen the doctor role. The medical staff added new medical records for the patients but unable to modify the existing medical record content without authorization from the administrator.

The administrator was responsible for managing the background part of the system. The administrator did not visit the personal information or medical records of any users. However, the admin able to add or delete the medical facilities that participated in the information sharing. The administrator also authorize medical staff to update patients medical record. Therefore, an administrator acted as confidential third party who controls the information and medical record sharing between medical staff and patients.

The prototype visualize the final look of actual application which helped the client to request for changes. The clients or users had chance to evaluate the system through the prototype and identified what needed to add or removed. For the clinic system , the prototype had been provided for login page, medical staff menu,

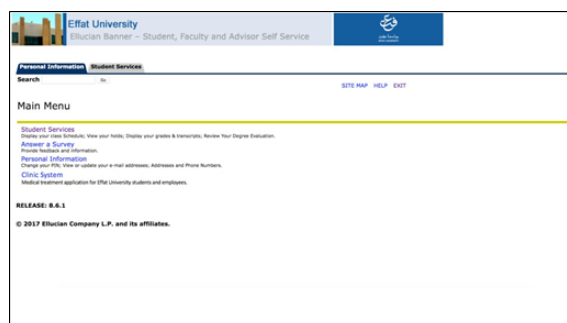patient page, check-up page, doctor check-up page and medication management page.

Figure 6: Banner login page.

The system of banner identified if the user was patient or medical staff by EFFAT ID. If the ID belong to the student or patient was displayed with many services. The students were allowed to view record, prescription and sick leaves.
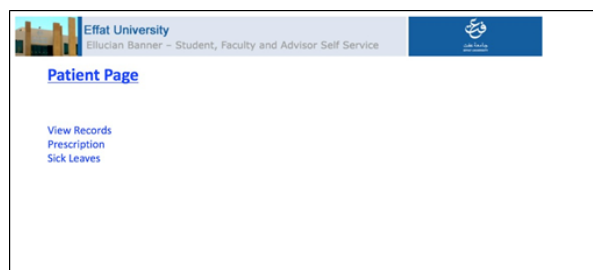

Figure 7: Patient page.

The clinic menu also displayed for clinical staff which admit patients and created records in the system. The medical staff had edited medication system management to help in keep tracking medicine quantities. The system was allowed medical staff to send a notification letter to the lecturer to notify about student visit to the clinic.
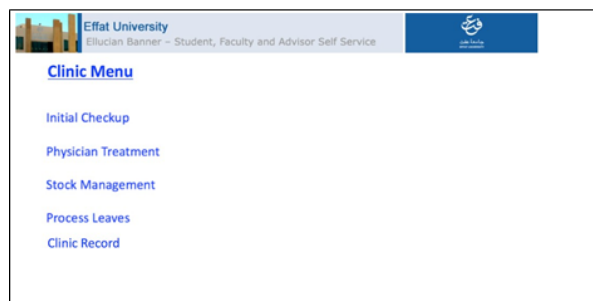

Figure 8: Clinic menu.

Figure 9: Nurse check-up page.

The doctor check-up page which the doctor had viewed and edit patient record. The doctor had updated the record and save in the patient record and refer patient a gain to the nurse to give the prescription and its detail to the patients.

Figure 10: Doctor check-up page.

Figure 11: Medication management.

3. Verification and Validation

The system description that described the data maintenance and data usage. The tools that used to implement the system were HTML, JavaScript and Oracle database. The clinic software was integrated to EFFAT banner system so the banner database was used in the clinic system. The banner system was allowed access by using EFFAT ID and password. The database included all academic information for all students such as college, level and courses. A staff had used student ID to display the student information from the banner database. The name, college and phone number was displayed to the clinic system automatically by using student ID.

EFFAT University had its database that included all student academic information as well as staff information. The clinic system was using EFFAT ID to identify which user was using the system. Based on the user, an appropriate page was opened. A student page was displayed and included menu such as view record. The student only viewed record and did not edit these records. However, the staff page was displayed during using staff ID and password and allowed staff to use the clinic system. The clinic system was included the information, physician treatment, sick leaves and stock management.

Testing phase included delivered the software to the clinic staff with assurance that all requirement had been met. An empirical investigation during this phase was used to confirm that clinic system function properly.

The clinic software had retrieved correct information for the students and staffs to provide the access to the correct page. Once the staff was used student ID, the student information was displayed in order created and save record for each student. All tests were used on the clinic system and confirmed that the clinic system was interacted with the banner system appropriately.

The testing plan was verified that the clinic system had been implemented and satisfied the system requirement and design specification. The clinic system delivered to the clinic staff to allow in trying the system and give feedback. The clinic staff had chance to use the system and experienced the system was worked. Figure 12 showed stock management for medicine test. The medical staff had entered the data of each medicine and saved in the record. The medical staff had chance to delete, add and specify the quantities. The system also showed edited date so the medical staff had full information about medicine stock.

Figure 12: Stock management test.

4. Conclusion

In conclusions, the advancement in technology had resulted in many aspects of life being digitized. The browser/server architecture was used to design the electronic medical record system because various advantage that offered. These advantages included easy sharing of information, development and maintenance expansion of different server functions by adding appropriate web pages and convenience of conducting certain services such as query and browsing. In additions, there were three types of users in the system such as patient, medical staff and administrators. The patients had the role of updating their personal information and viewed their medical records. However, the users did not manage modified their medical records. On other hand, the medical staff had role of adding medical records of patients and accepted external records. Finally, the administrator acted as confidential third party who controls the information and medical record sharing between medical staff and patients. The system was provided simple and useful way of accessing the medical record of patients. The system was reduced workload of medical staff as well as provide necessary information about patients in timely and efficient manner. In additions, the information had shared between different medical facilities. All system features increased efficiency and convenience in the diagnosis treatment and provision of other medical care to the patients.

References

[1] Majid, A. K. 2012. The roles of clinical pharmacy in reducing medication errors. *International Research Journal of Pharmacy.* 3,9,76-83.

[2] Salmasi, S., Khan, T.M., Hong, Y.H., Ming, L.C. and Wong, T.W. 2015. Medication errors in the Southeast Asian countries: a systematic review. *PLOS ONE.* 10,9.

[3] Abdel-Latif, M.M.M.2016. Knowledge of healthcare professionals about medication errors in hospitals. *Journal of Basic and Clinical Pharmacy.* 7,87-92.

[4] Nguyen, H., Nguyen, T., Heuvel, E.R., Ruskamp, F.M. H. and Taxis, K. 2015. Medication errors in Vietnamese Hospitals: prevalence, potential outcome and associated factors. *PLOS ONE.*10,9. DOI= 10.1371/journal.pone.0138284.

[5] Babaei, M., Mohammadian, M., Abdollahi, M. and Hatami, A. 2018. Relationship between big five personality factors, problem solving and medical errors. *Heliyon.* 4,2018.

[6] Karthikeyan, M., Balasubramanian, T., Khaleel, M.I. Sahl, M. and Rashifa, P. 2015. A systematic review on medication errors. *International Journal of Drug Development and Research.* 7,4, 9-11.

[7] Johari, H., Shamsuddin, F., Idris, N. and Hussin, A. 2013. Medication errors among nurses in government hospital. *Journal of Nursing and Health Science.* 1,2, 18-23.

[8] Leahy, I.C., Lavoie, M., Zurakowski, D., Baier, A.W. and Brustowicz, R.M. 2018. Medication errors in a pediatric anesthesia setting: incidence, etiologies, and error reduction strategies. *Journal of Clinical Anesthesia.* 49, 2018, 107-111.

[9] Haus, R. 2006. Health information systems-the past, present, future. *International Journal of Medical Informatics.* 75,3, 268-281.

[10] Hoerbst, A. and Ammenwerth, E. 2010. Electronic health records. *Methods of Information in Medicine.* 49,4,320-336.

[11] Hussain, A., Mkpojiogu, E. O. C., & Kamal, F. M. (2016). Mobile video streaming applications: A systematic review of test metrics in usability evaluation. *Journal of Telecommunication, Electronic and Computer Engineering*, *8*(10), 35–39

[12] Hussain, A., Razak, H. A., & Mkpojiogu, E. O. C. (2017). The perceived usability of automated testing tools for mobile applications. *Journal of Engineering Science and Technology*, *12*(Special Is), 89–97