Advance Hospital Management System with Multi-User Access

Syed Safiullah Shah
ME- Telecommunication Engineering and Management
Mehran UET Jamshoro

Syed Samiullah Shah
Lecturer Dept. Computer Science
Szabist University Hyderabad Campus

Nafeesa Bohra
Assistant Professor Dept. Telecommunication Engineering
Mehran UET Jamshoro

Abstract: Hospital management systems (HMS) have been developed in recent time with sophisticated modules and upgrades which were previously not available. HMS have reduced the workload of maintaining the data and has increased the efficiency of the management tremendously. Advance Hospital Management System (AHMS) is aimed to connect the patients directly to system via internet where they can check their patient status, check their E-file and all the history of medicine and complications. They can send messages to relevant department for any queries and message their consultant doctors. The idea was to analyze the pre-existing HMS's used by renowned hospitals in Pakistan and provide features which their patient portal systems do not provide. The ability to cross hospital data sharing is enabled so the patient data can be shared with another hospital in case of emergency and better health care for patients.
Keywords: Hospital Management System, Advance Hospital Management System, GUI interface, Patients, E-File, Cross Hospital Data Sharing, Pakistan

I.   INTRODUCTION

Hospital management systems even after significant development and improvement [1] has failed to connect the patients with the management system in Pakistan. The patients have always been neglected in this domain. According to the research directorate, immigration and refugee department of Canada, patient's data, clinical records, diagnosis except of test are still in physical format. Most of the medical data is either lost, destroyed in natural calamities, or is trashed due to inadequate space of storage for the massive data. Not even the data acquired by researchers and academia in the health sector is kept in safe or organized form and eventually meets the same fate[2]. Digitization of patient records has not yet been adopted nationwide or normalized. Since the medical history of patient is not available in digital format or can not be available at the time of emergency, a lot of time is wasted on initial tests on the basis of symptoms and screening and hence results in the horrible consequences for the patients[3]. According to the federal public commission report, it is essential for hospitals to have adequate resources for better healthcare of patients [4]. Digitization of patient records and complete medical history and providing patients a portal where they can interact with doctors, staff and even management. There is also a need of awareness of the patient medical history, background etc [5]. The patient portal will also enable the hospitals to acquire the patient's full medical data and history with respect to confidentiality and rules of safety and procedure act in Pakistan [6]. This will not only enhance existing HMS's but also improve the patient health care in a way which will save many lives and make hospitals more efficient and patients more relaxed.

II.   PROBLEM STATEMENT

A. Digitization of data

Patient record and maintenance is one of the most important tasks for the hospital to do which has the potential to either become asset or liability for the hospital as an entity [7]. Electronic medical record (EMR) and Electronic health record (EHR) defined by [8-9] are used interchangeably but are not the same. From physical files the data is translated in digital format EMR and now the automated machines are creating digital data directly called EHR. One of the key issues in hospitals and health care services is the lack of available data on patients. According [2] most of the data retained by government hospitals for the patients diagnosed with chronic diseases like Aids and Hepatitis is kept in records but that eventually is destroyed or lost with time. The research studies conducted   by scholars also is either lost or destroyed in huge storage where files are stored

physically due to lack of proper maintenance, organized structure or any calamity. Even with the advancement in IT and digitization, Pakistan lacks the digital medical records and record keeping systems such as EMR and EHR. This problem raises serious issues in patient counseling and effective and efficient health care.

B. Unavailibility of Multi layer access portal

There is a lack of standardized medium which enables the hospital chain (Administrators, staff, patients) to communicate with each other. Currently the management systems in use facilitate the administrators on management side, but staff and patients are cut out from this [10]. An effective and much better facilitating system would be to include an access portal which will provide patients as well as staff with the access to the HMS portal. This will not only facilitate the patients and staff but it will also help administrators in their management rolls, with decision making, policy and protocol designing by getting feedback from patients and staff and keeping tabs on status of patients in Realtime[11-12]. Proper patient portal with key features of interacting with doctors, online payments, record keeping and retrieving, appointment booking and scheduling. The doctor's panel for time management with appointment scheduling and calendar organization, online consultation, patient management with status and doctor's notes for future reference of diagnosis.

According to a case study of usability evaluation of HMS in a hospital [13-14], business management of hospital in terms of finance [15-16], data security and information security in HMS [17]. AHMS will provide a highly effective tool for hospital administration in terms of business administration and decision making, financial and cost accounting and data security.

A simple and easy to use multi-layer access portal in HMS would not only be beneficial for patients but for doctors and staff as well with key features for patients such as manage their file, check their health status, manage medicinal doses, update prescriptions without having to come to the hospital physically, check the lab reports and to get discharging from the hospital easily, reminders for annual general checkups and screenings etc.

III. AIMS AND OBJECTIVES

A. Multi layer access portal (Triple layer)

Top Layer (Management):

Multi-layer access portal will be divided in three layers. Top layer of the portal will be for administration and management of the hospitals with the departments and their data control, however they will not be restricted to that, top layer will have maximum privilege in the system and they would be able to monitor all the data, they can check the status of all the patients and doctors, they can check the feedback and respond to any queries received by either patients or from staff members.

Middle Layer (Staff):

Semi restricted layer will be dedicated for the staff, the staff portal will be job specific and no user will be able to access any other user even on the same level. Middle layer user will have the ability to insert data to some extent, like doctors can write and re-write notes write personal diagnosis conclusions etc. Doctors will be able to communicate with their assigned patients, check their file, status, medicine, dosage, prescriptions and make any changes accordingly online, the notification of any change will be sent to the patient and they can check what their doctor have updated like new dosage or prescription. Doctors can reply to their patients who have sent any query message to them.

Lower Layer (Patients):

The lower layer access of the portal would be restricted in privileges, patients would not have the authorization to make any changes to their file, records, history, lab reports, prescription, dosages etc. The patients will be able to make or reschedule appointments, bill payments and receipt notification and confirmation, lab reports checking. Patient will have the ability to send a limited number of messages to send to the doctors for any queries. They can provide feedback and make complaints to the management regarding any issue they might be facing. The lower layer of this portal access for patient will be dedicated for the ease of patients and digitization of medical records.

B. User interface

- User interface of this project and management system will be completely GUI with advance tools and options integrated to facilitate the operator
- Advance design and latest key features based on advance hospital management systems installed around the world following all the health standards and procedures which are mandatory to be present in HMS.
- Minimalistic supervision will be required for the operators and the fields will be self-explanatory.

International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 05 - Issue 09 || September 2020 || PP. 19-26

C. Panel

Panel of the Advance hospital management system will be based on latest features and will have all the options which is a pre-requisite to have in the latest HMS system.

- Smart Dashboard for prioritization of task, notes, and stickers to place in order of preference. Notification bells for emergency and urgent messages etc.
- Clinical survey and management options.
- Telemedicine and online consultation of patients.
- E-Prescriptions with digital authorization and signature of the doctor for medicine.

Table 1: Comparison of existing HMS with AHMS

Sr no:	Services	AKUH	SK	MIF	NMC	KIH	AHMS
1	Reports	Yes	Yes	Yes	Yes	Yes	Yes
2	Appointment	No	Yes	Yes	No	Yes	Yes
3	MR/History	No	No	No	No	No	Yes
4	Payments	No	No	No	No	No	Yes
5	Comm: Doc-Patient	No	No	No	No	No	Yes
6	Comm: Patient-Admin	No	No	No	No	No	Yes
7	Dr. Remote access	No	No	No	No	No	Yes
8	Pharmacy	Yes	No	No	No	No	No

Table 1 show a services-based comparison of existing HMS being used by hospitals in Pakistan. The main aim of the AHMS system is to provide all the necessary services shown in Table 1.

IV. IMPLEMENTATION

Implementation of the project and execution which achieves the aims and objectives mentioned in section III are discussed in detail. It is also shown which tools are used in front-end and back-end etc.

A. Techs and Tools
Front-End:

The tools used in front-end designing and interaction are as follows:
i. HTML
ii. CSS3
iii. jQuery
iv. Bootstrap (Front-end framework)
Back-End:
i. PHP
ii. Code ignitor (Back-end framework)

B. Advance Hospital Management system Services

Advance Hospital Management System (AHMS) provide the adequate services mentioned in Table 1. The detail of the implementation and proper functionalities of the system is described in detail.

1. Reports

Patient can check the lab report status, take a printout of report, or download the file directly from the portal in PDF format. Each lab will also be mentioned with reference no. attached in the patient medical file also.
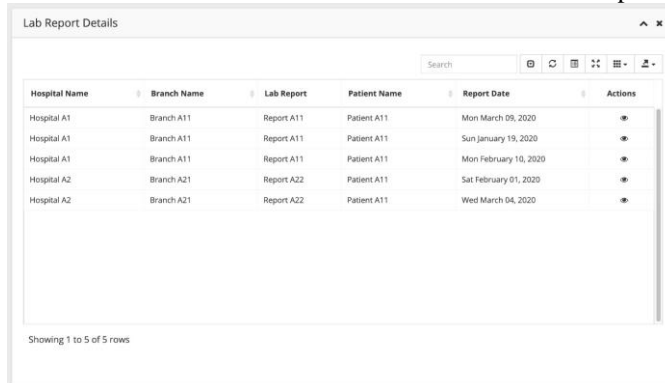

Figure 1: View Reports

2. Appointment

Online appointment scheduling and rescheduling is also one of the main features of AHMS. Using the AHMS portal, a patient can schedule appointment online with any doctor available on the concerned date, this feature also enables patient to either reschedule the appointment to another date and time or cancel the appointment altogether.
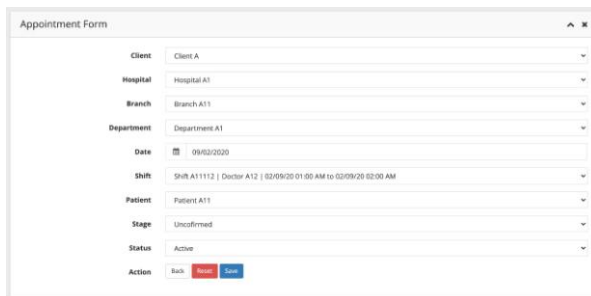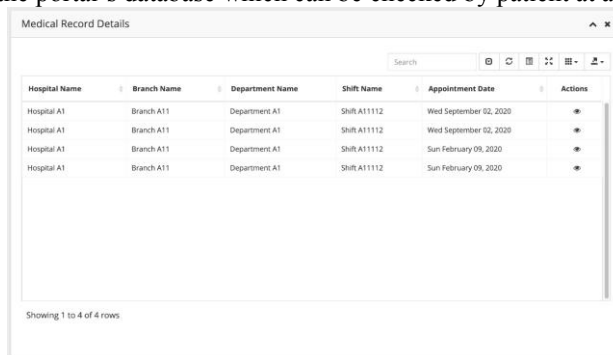

Figure 2: Appointment Scheduling Form

3. Medical record/Patient history

Digitization of medical record is one of the most important aspects and the need of the time for medical advancement and eradication of the global diseases.

In AHMS portal a patient's E-file is automatically maintained and updated after each hospital visit. The prescription, doctor's remarks, diagnosis, and lab reports attached with reference no. (if any) will be shown in order and will be saved in the portal's database which can be checked by patient at any time using the portal.
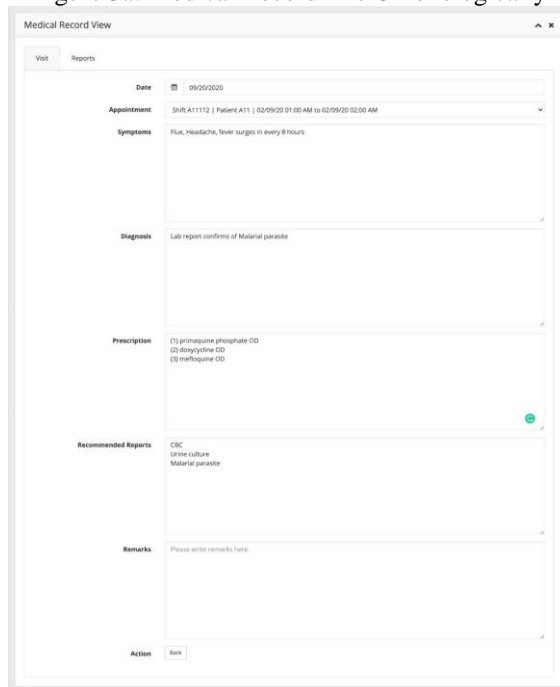

Figure 3a: Medical Record File Chronologically

Figure 3b: View of a record from file

4.   Online Payment
Patient can easily make payments for the lab reports or the OPD appointments.

5.   Communication Patient-Doctor
Patient will have the option to send message to the doctor about any update, prescription, or anything in general. The limitations of how many messages can a patient send in a month will be depended upon the type of patient. Messaging feature could be recharged with a little fee.
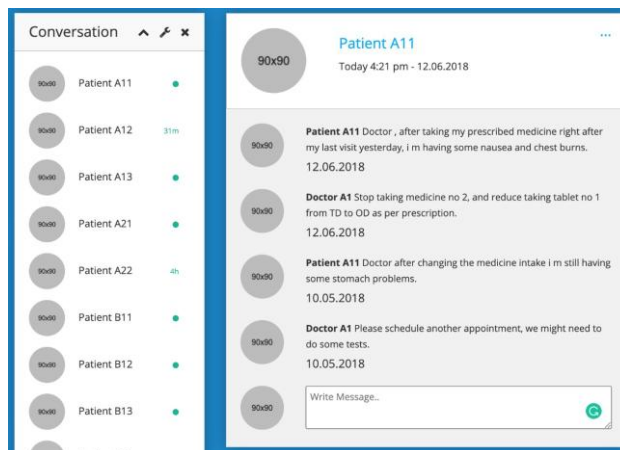

Figure 4: Doctor-Patient messaging

6.   Communication Patient-Administration
Patient can not only send messages to their concerned doctors, but they can also send messages or queries to any admin staff as well such as Finance, HR, Admissions etc.
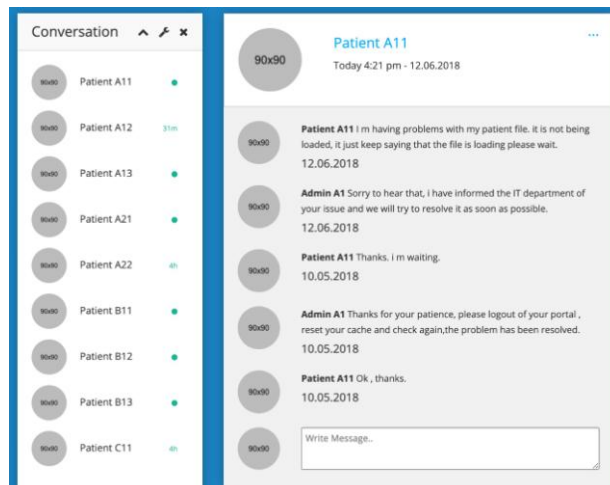

Figure 5: Admin-Patient messaging

7.   Doctor remote access
The multilayer access portal also enables doctors to use it from any remote location, they can check the weekly ROASTER, they can check the scheduled appointments, the can mange and update their current patient's medical file, rewrite prescription, check their lab reports etc. They can also manage their time frame and in case of emergency that a doctor can not make it to the clinic, doctor can inform the hospital about the issue so the patients are updated about the emergency in time to provide convenience. This feature will not only help doctors manage their time effectively, but this will also be beneficial for the patients as it will increase doctor's effectiveness which will increase patient's healthcare.

International Journal of Latest Engineering and Management Research (IJLEMR)
ISSN: 2455-4847
www.ijlemr.com || Volume 05 - Issue 09 || September 2020 || PP. 19-26

Figure 6: Doctor's Scheduled Appointments

C. Advance Hospital Management System Design

AHMS design is defined in the paper in terms of system architecture and multilayer access portal. These two segments of the system will help in understanding of the way system works and behave.

1. Project Architecture

The architecture of the system is simplistic, it is easy to implement and there is scope of expansion.
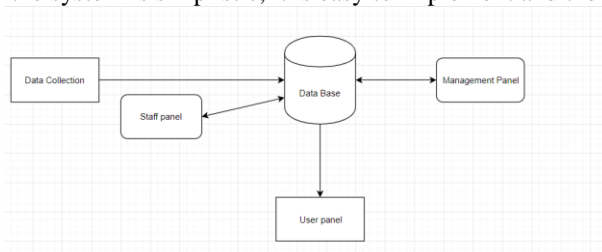

Figure 7: Project Architecture

As shown in figure 7, the architecture is comprised of 5 elements, Data Base, Admin Panel, Staff Panel, Patient Panel and External data collection.

2. Multilayer Access Portal

The system was designed for multilayer portal access. This portal can be accessed by not only admin but for the staff i.e Doctor and patients also.

a. Management Panel

Figure 8: Management Panel

As shown in figure 8, the management panel deals with the managerial departments of the hospital like finance, admissions, IT etc.
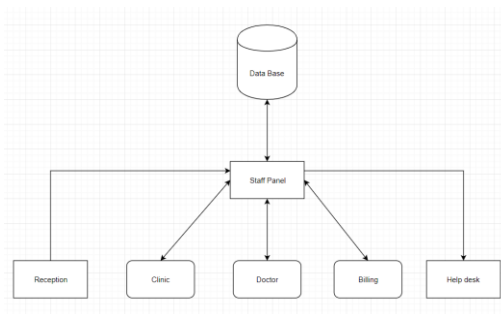
b.   Staff Panel

Figure 9: Staff Panel

As shown in figure 8, the staff panel deals with the non-managerial departments of staff like reception, clinic, doctors etc.
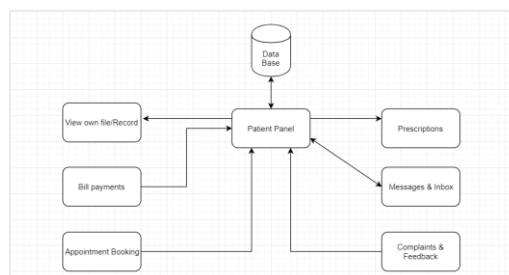
c.   Patient Panel

Figure 10: Patient Panel

As shown in figure 10, the patient panel is dedicated for patient's personal use. The detail of patient portal has been discussed earlier.

d.   External Data Collection

External data collection is for the data collection of the patient from other hospitals. This system provides the feature of cross hospital data sharing in which not only the system can export the patient's data to other hospitals, but it can also import the data from other hospitals with the same feature.

e.   Data Base

Data Base is the core of the whole system which stores and manipulate the data as per requests.

V.   CONCLUSION

The aim of the project was based on the research from multiple sources that Pakistan lacks the digitization and preservation of the patient medical data. The lack of available data of patients, their conditions, symptoms, breakouts has made the healthcare system of the country below average putting Pakistan 154 out of 195 countries [18]. Digitization of the patient record and facilitating not just management but also doctors and patients. The implementation of AHMS across the major hospitals in Pakistan will help in providing better healthcare for the patients, better time management and record keeping for the doctors and help management of the hospitals to make effective decisions in improving the standards and health care system overall.

VI.   FUTURE WORK

The future work for hospital management system which has data storage ability can contribute to the advance machine learning algorithms and predictive modeling for advance medical research.

Data mining is also a field where patient medical records and patient data will have significant impact on future studies which can be used for screening, tumor and leukemia predictions based on global data comparison and modelling.

In future the world and R&D will shift the focus on AI and machine learning where medical records will play an especially important role in training of those algorithms and models. Systems like AHMS will have great input for the future predictive modeling in advance medical research.

ACKNOWLEDGMENT

REFERENCES

[1]   D. H. Gadhari, Y. P. Kadam, Prof. P. Suman, "Hospital Management System," *International Journal for Research in Engineering Application & Management,* vol. 1, no.11, feb. 2016.

[2]   Canada: Immigration and Refugee Board of Canada, *Pakistan: Whether doctors maintain the medical records of their patients or whether patients commonly retain their medical records and then supply them to their doctors when required*, 6 May 2003, PAK41477.E, available at: https://www.refworld.org/docid/3f7d4def23.html (accessed September 2020)

[3]   Dr. Joseph Thomas Kasturba, "Indian Journal of Urology," vol. III, , pp. 384-388, July 2009.

[4]   Federal Public Service – FPS report (2002). Recommendations and quality criteria for hospital information systems. Accessed from: www.health.belgium.be/filestore/8054405/his_v1s_en_8054405_en.pdf, (accessed May 2019).

[5]   Bratan T, Stramer K, Greenhalgh T. 'Never heard of it'- understanding the public's lack of awareness of a new electronic patient record. *Health Expect*. 2010;13(4), pp 379-391.

[6]   Paksitan   Medical   and   Dental   Council   "Code   of   Ethics",   available   at http://www.pmdc.org.pk/LinkClick.aspx?fileticket=v5WmQYMvhz4%3D&tabid=292&mid=845, (accessed 20 September 2020, 11:30 pm)

[7]   Seven attributes of an effective Records Management Program by Thomas D. Norris, February 2002 available at http://www.archives.nysed.gov/a/records/mr_pub61.pdf (accessed 21 September 2020, 12:00 am)

[8]   Sewell J, Thede L. Informatics & Nursing: Opportunities and Challenges. 3rd ed. Philadelphia, PA: Lippincott: , Williams and Wilkins; 2013

[9]   Hebda T Czar P. Handbook of Informatics for Nurses and Health care Professionals. 5th ed. Boston, MA: Pearson; 2012

[10]   N. G. Chaudhry et al., "An Open Source Health Care Management System for Pakistan", *COMSATS Institute of Information Technology*, vol. 10, pp. 1-7, 2006.

[11]   Björn Schreiweis (2010). Modelling the Hospital Information System of the Karolinska University Hospital in Stockholm. University of Heidelberg, Heilbronn University and Karolinska Institutet. Accessed From: http://ki.se/content/1/c6/10/46/20/Diplomarbeit_Bjoern_Schreiweis.pdf   (accessed May 2019)

[12]   D. Stanley O, O. Emmanuela C.M "Interlinked Hospital Management System," *International Journal of Science and Research,* vol. 7, no. 2, Feb. 2018

[13]   H. B. Santoso, A. K. Nisa, R. Fitriansyah "Usability Evaluation of Hospital Management Information System: Case Study of Emergency Installation Application of a Regional Public Hospital," *International Journal on Advance Science Engineering Information Technology,* Vol. 07, no.06, 2017.

[14]   S. N. Hekmat, R. Dehnavei, T. Behmard, R. Khajehkazemi "Evaluation of The Hospital Management Systems in Iran: A case Study in Kerman Province," *Global Journal of Health Science,* Vol. 08, no. 12, 2016.

[15]   Garrido, Terhilda, et al. "Making the business case for hospital information systems‐‐a Kaiser Permanente investment decision." *Journal of Health Care Finance* Vol. 31: pp. 16-25, 2004.

[16]   J. F. D. Oliveira "The Importance of Information Technology as a Strategic Resource for Hospital Management Process and the Skills Required for Managers," *International Journal of Business and Social Research,* Vol. 06, no. 04, 2016.

[17]   M. Masrom, A. Rahimly "Overview of Data security issue in Hospital Information System," *Pacific Asia Journal of The Association for Information System,* Vol. 07, no.04. Dec. 2015.

[18]   Wikepedia   entry   on   pakistan   Health   care   standards.   Accessed   from; https://en.wikipedia.org/wiki/Health_in_Pakistan#:~:text=Pakistan%20ranks%20154th%20among%20195,1990%20to%2037.6%20in%202016. (accessed 22 September 2020, 11:00 pm)