

Database System for Medical Record Keeping and Retrieval

Dua Amna^{1,*}, Fayaz Ahmed Memon², Farida Memon¹, Imtiaz Ali Halepoto², and Ali Raza Bhangwar²

¹Mehran University of Engineering & Technology, Jamshoro, Pakistan

²Department of Software Engineering, Quaid-e-Awam University of Engineering, Science & Technology Nawabshah, Pakistan.

*Corresponding Author

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Abstract: The field of healthcare is producing a lot of information in the form of data and knowledge. Medical knowledge is increasing day by day. The data needs to be accessed for providing health services and for administrative, economic, and legal purposes. Most of the health sectors use a paper-based system, which due to its certain limitations can affect the quality of care. Modern medical systems observed the need for the use of medical databases. Medical Database System (MDS) is an advancing concept and is defined as a systematic collection of online-based health records in any health facility that helps to overcome the limitations of conventional paper-based systems. The problem remains in the existing methods of medical record keeping and retrieval, which are less efficient as well as accurate. Recent systems have problems in their systems, such as inaccuracies in data, inefficiencies in their workflows, and other potential security weaknesses. Thus, there is a need for a database system specifically designed for medical record keeping that can overcome these problems and can offer a reliable, secure, and efficient solution for storing and retrieving medical records. In this research, an online-based health record system is designed that can keep, manage, and retrieve medical health records. The system's frontend, as well as backend, are designed on Microsoft Access 365. Microsoft Access 365 offers suitability in keeping medical records, cost-effectiveness, integration capabilities, user-friendly interface, and scalability which also support the objectives and requirements of our project. The system includes patient registration for reception, a questioner and data retrieval for cancer diagnosis, and a complete pharmacy system including multiple forms and ledgers as well as the reports to get the summary of data where desired. Furthermore, the system contains a login system to make it secure. Our proposed database system shows a very significant improvement over existing systems in terms of efficiency, scalability, security, retrieval capabilities, and societal impact in medical record keeping and retrieval with significant societal impacts. This system can further be improved in the future, expanding its design by including other hospital services, like laboratories, finance departments, and consultation appointments. Nowadays artificial intelligence is performing an excellent role in each domain. Implementing artificial intelligence in this database system can lead this database system to the next level.

Keywords: Medical record, Retrieval, Medical Database System, Electronic Health Record, Hospital Database System

1. Introduction

The field of healthcare is producing a lot of information in the form of data and knowledge. Medical knowledge is increasing day by day. The data is needed to be in providing better health to patients. As medical data and knowledge are increasing day by day, the demand for managing and supporting this data is also increasing. Medical records need to be accessed for providing health services and for administrative, economic, and legal purposes [1]. Thus, the medical records need to be accurate, rapid, easy to be retrieved with efficient information flow[2]. Most of the health sectors of Pakistan uses a paper-based system, where all the data and information are stored in the paper-based health record systems. This system is easy to use, but it has certain problems. Firstly, it is very much time-taking to access the previous medical records. Secondly, the hospitals find it difficult to share the data timely with other healthcare providers, which also causes a lack of coordination among the healthcare providers. Thirdly, there is difficulty in keeping medical records for future referrals.

Modern medical systems observed the need for the use of medical databases[3]. Medical Database System (MDS) is an advancing concept and is defined as a systematic collection of online-based health records in any health facility. Contrasted with conventional paper-based health records systems, the medical database system can provide many basic benefits, that includes being easily accessed and computerized. Besides the basic benefits, from the perspective of system-level, online-based health record systems can also have functionalities that hold great promise in improving the quality of care and reducing costs at the health care system [4]. As compared to the traditional paper-based medical records, EMRs are superior in that it greatly improves the accuracy of patient information recording to facilitate the clinical diagnosis process, also provides a platform to efficiently maintain and retrieve patients' healthcare information in a continuous manner over time and space [5]–[7]. In this Research, an online-based health record system is designed that can keep, manage, and retrieve medical health records. The system's frontend, as well as backend, are designed on Microsoft Access 365. Microsoft Access 365 was chosen for this Research keeping in mind its features: suitability in keeping medical records, cost-effectiveness, integration capabilities, user-friendly interface, and scalability. These factors also support the objectives and requirements of our Research, making it an applicable choice for our proposed medical database system.

The system includes patient registration for reception, a questioner and data retrieval for cancer diagnosis, and a complete pharmacy system including multiple forms and ledgers. In the end, the system's limitations and future scope will also be discussed.

2. Related Work

Due to today's need for health facilities as discussed in the previous section, a great interest has been developed in moving from a conventional paper-based system to modern healthcare systems with MDS. Till now, much research has been done in the development of an online medical database system.

The hospitals aim to have such a management system that provides satisfaction to patients, doctors, and staff. There are many patients who visit a hospital daily so managing the patient's records is a challenge for management staff [8]. The management system is responsible to cope with the requirements of patients. When it comes to medical records of patients then it has been seen that in many hospitals the record functionalities are still performing manually. The staff is responsible to keep the record properly managed, time to time updated, properly stored, and easily accessible. The management describes itself as it must comprise technical features and advancements to achieve predetermined goals. To achieve the goals of advanced management the telemedicine domain has evolved new features and terminologies to make the management more supportive and effective. The aim relates the telemedicine is to provide ease in the management of hospitals. A lot of research is going on with telemedicine-related systems for providing the new uprising system to the hospitals

for their better management and the motive of telemedicine of providing better healthcare services to patients with new features and advancements.

Kufeld et al., [9] developed a database and integrated this database into a heterogeneous network for radiosurgery treatment center that supports not only patient care and documentation as well as quality assurance and scientific research. The developed database stores all medical information of patient i.e. basic, treatment and follow-up information. This data is then integrated to the radio surgical process so that it can be easily and quickly accessible at any workspace in the center.

S. Jothiraj et.al [10], presented a methodology for the design of healthcare management systems. Such system designing will lead hospitals toward better healthcare of patients. The healthcare management provides services to patients of remote areas as they are having very little access to health services so the technology should provide advanced benefits to such local areas as well. The healthcare management system includes patient registration, data management, services management, pharmacy management, staff management, financial management.

K. Saimanoj et.al [11], described the methodology to overcome barriers of the conventional paper-based system by designing data storage, data sharing, and data management. Such a database system can be implemented throughout the hospital management system, such as for laboratory records, pharmacy records, financial records, and staff management. All the manual activities can be summed up and a common system can be designed to have all the facilities of management throughout the hospital and quick access to the system can provide a less time-consuming and easily manageable system for medical staff as well.

T. H. Tebeje et.al [12], presented the applications of e-Health to Support Person-Centered Health Care at the Time of COVID-19 Pandemic through the literature review. In their studies, they independently assessed the eligibility of retrieved records. They indicated that the e-health system has the potential to improve the quality of health care and personalized health systems during the COVID-19 pandemic. However, the mistrust of health care systems has played a major role in increasing hesitation of vaccine during COVID-19 pandemic [13]–[16].

At the end, plenty of further research should be done to better understand the applications of e-health to improve the quality of health care and patients' outcomes and evaluate its cost-effectiveness. Also, a Blockchain technology can be used for the protection of data from unauthorized access and transparency of transactions [17]–[23].

3. Methodology

In this paper, we propose an online system that can manage and retrieve medical records in hospitals including patient registration, diagnosis, and pharmacy. Figure 1 shows the overall system design model.

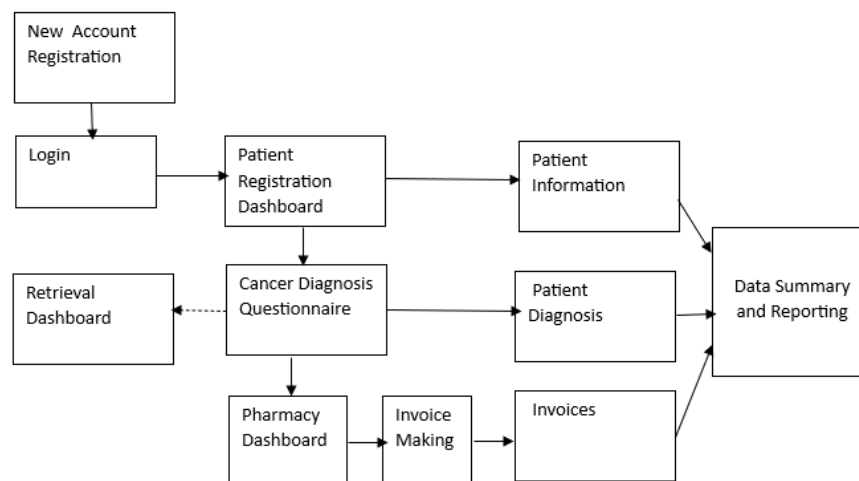


Fig. 1 – Proposed System Model

As per Figure 1, our proposed system starts from the registration of patient. After the registration, the patient always goes for the cancer diagnosis. Here we have designed a Cancer diagnosis questionnaire. Our cancer diagnosis questionnaire assists the doctor in the diagnosis. The previous diagnoses made by doctors can be accessed through the Retrieval Dashboard we have designed. Then we have a pharmacy dashboard here. After the diagnosis, the system shifts to the Pharmacy department where system generated invoices are issued to the patients based on the doctors' prescriptions. The system is made accessible for only those employees who have a unique login ID and Password already. For new candidates, unique ID and Password can be provided. The registrations have an accessibility limitation based on their departments to ensure data safety. Admin ID can have the whole system's access.

The database system (backend as well as for the frontend) is developed using Microsoft Access 365. At the backend, the forms are created relationally and at the front end, a graphical user interface is designed to access those forms and the whole record will be listed at the backend as well. A few features of Microsoft access are used such as forms, tables, queries, reports, and macros. We found Microsoft Access 365, the most suitable tool to be used for this Research since it is easy to use, and its licensed version is easily accessible, that has many advanced features. The backend design includes the use of tables and queries, where all the basic fields and their respective data types are selected as per the specification of the respective form. The data type can be an auto number, a general number, an alphabet-based short/long text, or date/time, etc. While the front end includes the forms, reports, and ledgers designed using queries, macros, and Visual Basic codes. Finally, the data will be connected through relationships. Figure 2 shows the backend containing tables and queries with their relationships. Forms in the front end include patient registration for reception, a questioner and data retrieval for cancer diagnosis, and a complete pharmacy system including multiple forms and ledgers. The reports are also included to get the summary of data where desired. Furthermore, the system contains login system to make it secure.

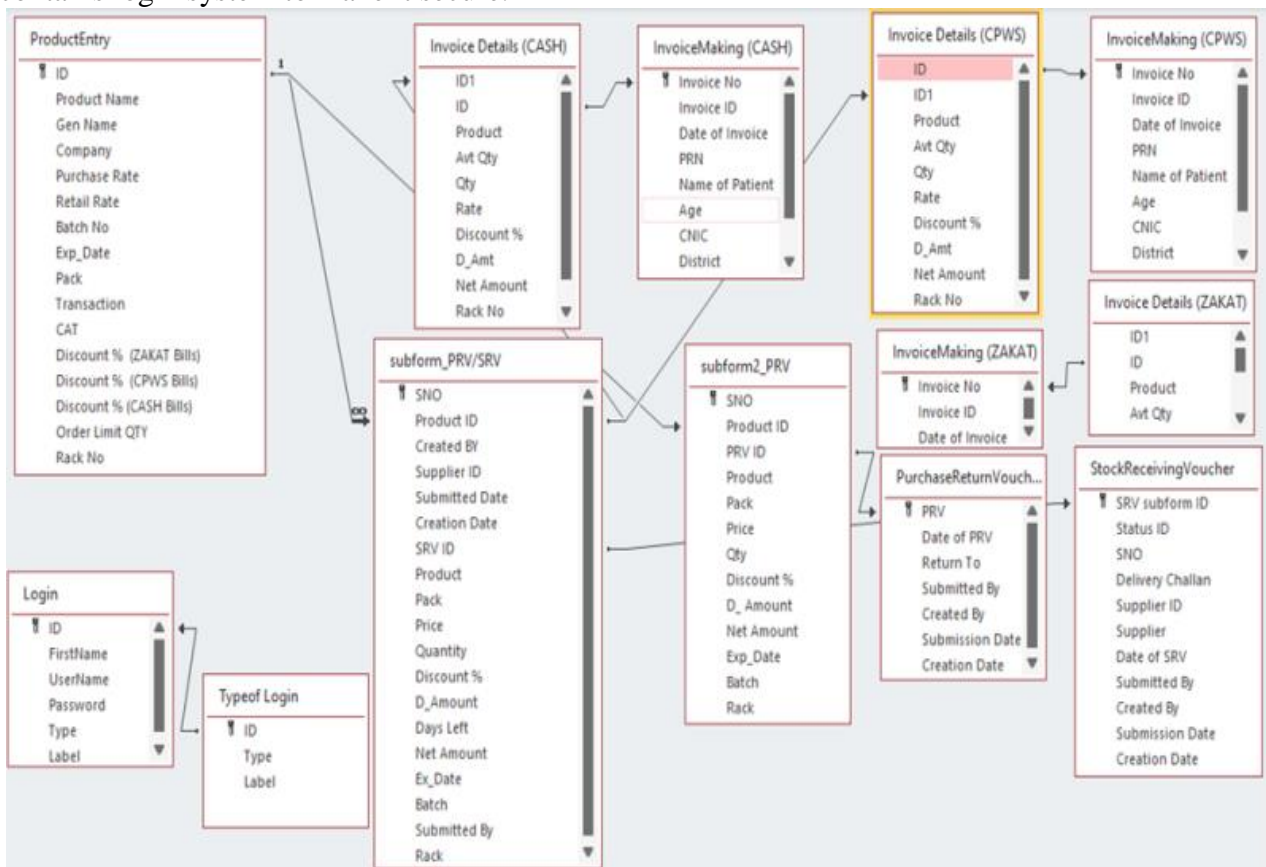


Fig. 2 – Backend Design: Included Tables with Their Relationships

4. Results and Discussion

As mentioned in the sections above, the system is an online system that can manage and retrieve medical records in hospitals including patient registration, diagnosis, and pharmacy. Figure 3 (a) shows the User Login page of the system that asks for the username and password from the user. The new users will access the new user registration option (see Figure 3(b)) where they will also be asked the respective department. The user will be provided limited accessibility of the main page as shown in Figure 4 for the sake of data security, depending upon their department. Only the admin is provided full access to the system.

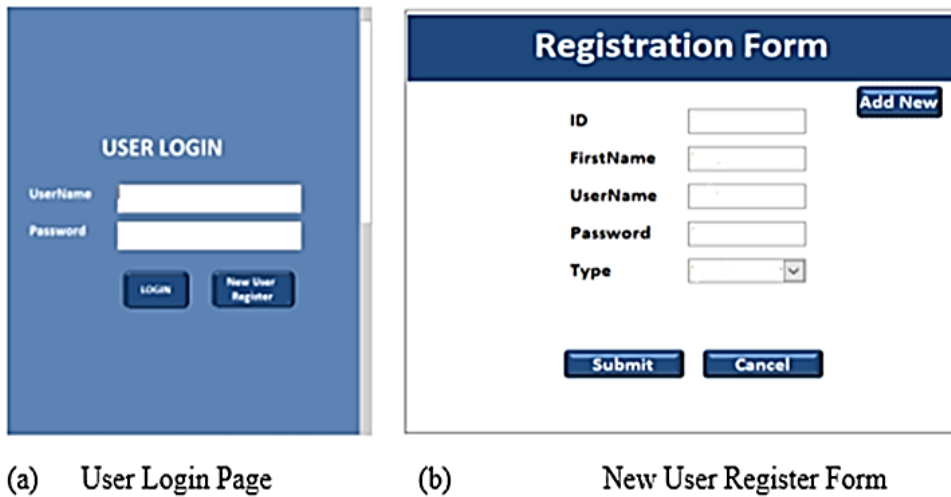


Fig. 3 – User Login and Register Dashboard

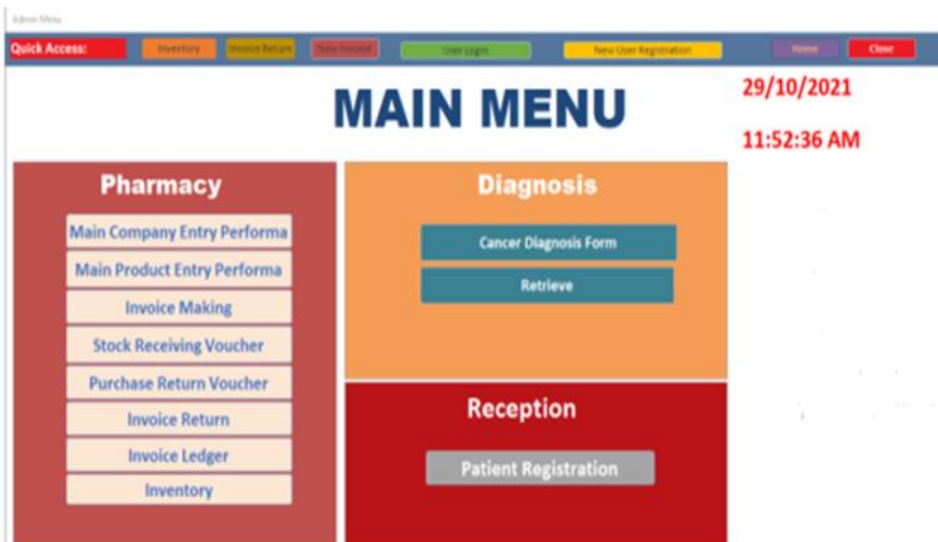


Fig. 4 – Main Menu Page of the System

As mentioned in the above section, the system includes patient registration for reception, questioner and data retrieval for cancer diagnosis, and a complete pharmacy system including multiple forms and ledgers. Patient registration as shown in Figure 5 takes information from the new patient at reception. Here the patient registration number (PRN) will be provided to each new patient which will be used in other departments to retrieve this data. Figure 6 shows a questioner form that asks symptoms of the disease from the patient and Figure 7 shows data retrieval form to assist doctors in diagnosing the disease by retrieving the related previous diagnosed records.

Patient Registration

Basic information

Patient ID:
 PatientName: S/O,D/O,W/O:
 Age: Gender: Female
 City: Habits:
 Status: Socioeconomic Status: Marital Status: Single
 Visit Date: 18/10/2021
 Contact No:
 Occupation:

Medical Details

Prev Medical History:
 Prev Surgical History:
 Socioeconomic History:
 Family History of Cancer:
 History of anyother Cancer in Past:
 History of Prior Irradiation:

History

Number of Marriages: Age of Menarche: Age at 1st Child Birth:
 Pre-Menopause: Post-Menopause:
 obs/Gynae History:
 History of Harmonal Therapy:
 Lactational History:

Search:

Record: 1 of 2 | Filter: Search:

Fig. 5 – Patient Registration Dashboard

Cancer Diagnosis Form

PRN:
 Your Name: Enter your Body Weight:
 Doctor's Statement:

Experiencing Body Pain?
 Where?
 At what times?

Feeling Skin Changes?
 Select the skin changes?

Having stomach pain?
 From how many days?

Difficulty in eating or swallowing?
 Any lesions in mouth? Select:
 From how many days?

Do you feels long lasting fatigue most of time?
 Sleep hours per day?

Select the symptoms if any?
 Give description, if you have anyother symptoms?

Attachment:

Fig. 6 – Cancer Diagnosis Questioner Dashboard



Fig. 7 – Retrieval Dashboard for Cancer Diagnosis

The pharmacy system in this Research contains Company Entry Form, Product Entry Form, Invoice Making and Return Forms, Stock Receiving and Return Vouchers, Invoice Ledger, and Inventory. Figures 8-12 show the complete pharmacy system. The company entry form as shown in Figure 8 keeps the new company entry details. The product entry form as shown in Figure 9 keeps the new product entry details. These details then will be entered in the stock receiving voucher. If any product is needed to return to the supplier, then purchase return voucher will be used to remove the product details from the system. For selling any product, the invoice making form as shown in Figure 10 will be used, while in case the buyer returns the products, the invoice return form will be used to re-enter the products in systems. This all details will automatically be updated in the inventory as shown in Figure 12, where the user can keep track of the products. The inventory will indicate if any product quantity gets decreased in stock. The invoice ledger as shown in Figure 11 will be used for generating reports of any random invoice number at any time. The system has the capability to automatically calculate the total bills when user enters the quantity required and will also display in the report.



Fig. 8 – Pharmacy Products’ Companies Entry Dashboard

Main Product Entry Performa

ID

Product Name Gen Name

Company Transaction Order Limit QTY

Purchase Rate Retail Rate Pack CAT

Discount % (ZAKAT Bills) Discount % (CPWS Bills) Discount % (CASH Bills)

ID	Product Name	Gen Name	Retail Rate	Transaction	Pack	CAT	Order Limit	Search	Discount %	Discount %	Dis
1	panadol	adc	8.00	45	4	TAB	55.00		0.00%	500.00%	
2	cvf				0	SYRUP	0.00		0.00%	0.00%	
3	vvg				0		0.00		0.00%	0.00%	
4	vvg				0		0.00		0.00%	0.00%	
5	vvg				0		0.00		0.00%	0.00%	
6					0		0.00		0.00%	0.00%	
7					0		0.00		0.00%	0.00%	
8					0		0.00		0.00%	0.00%	

Fig. 9 – New Pharmacy Product Entry Dashboard

Invoice For CPWS Bills

Invoice No

Invoice ID Date of Invoice

PRN Name of Patient

Age CNIC District

Invoice Details

Product ID	Product	Avl Qty	Rack No	Qty	Rate	Discount	D_Amt	Net Amount	Total
0		0.00		0.00	0.00	0.00%	0.00	0.00	

Fig. 10 – New Invoice Making Dashboard

Invoice Ledger

Enter Invoice No.

Fig. 11– Invoice Ledger

ID	Product Name	Price	Qty	Stock	Return	StockIn	StockOut	Qty on Hand
33	Proton	0.00	0.00				0	0
34	Proton	0.00	0.00	20			15	0
35	Proton	0.00	0.00	30	10	20	60	-40
36	Positron	0.00	30.00				0	0
37	Zetro	0.00	100.00	100	10	90	30	60
38	Leflox	0.00	150.00	150	20	130	-42	172
39	Disfin	0.00	500.00	500			0	0
40	PanadolCF	0.00	60.00				0	0
41		0.00	0.00				0	0
42	ABCDE	0.00	500.00	500	100	400	150	250
43	ASDF	100.00	1000.00	1500	500	1000	100	900
44		0.00	0.00				0	0
45	rizek	100.00	100.00	1200			40	0
46	ASDF	0.00	0.00				0	0
47	QWER	10000.00	500.00	500			0	0
48	Rigix	100.00	100.00	100	30	70	0	70
49	ASDDFG	0.00	10.00	9			0	0
50	AWE	0.00	10.00	15			5	0

Fig. 12 – Inventory Dashboard

Table 1 shows the comparison of our proposed system with the existing systems. The existing systems were limited in terms of their usage for a hospital database system with limitations in data storage, accuracy, and performance. From table 1, it is clear that our system is improved compared to existing systems, based on the limitations observed in the existing systems. Our proposed system has improved the performance with high accuracy, accessibility, and security.

Table .1 - Comparison of A Proposed System with the Existing Systems

Works	(M. Kufeld <i>et. al</i> 2009)	(S. Jothiraj <i>et. al</i> 2020)	(K. Saimanoj <i>et. al</i> 2020)	(U. Chelladurai <i>et. al</i> 2022)	(K. T. Akhter <i>et. al</i> 2022)	Proposed
System	FileMaker Pro	BM-DBMS	*	Smart e-health system	*	HDS-RKR
Methodology	Multidimensional Database System:	Multispecialty Web based Database system	A web-based platform	A Blockchain based EHR Platform	A blockchain website for doctors and patients	A Hospital Database System using Ms. Access 365
Accuracy	X	*	*	*	*	√
Data Safety	*	√	*	√	√	√
Record Keeping	√	√	√	√	*	√
Performance	*	√	X	√	X	√
Scalability	*	X	X	X	X	√
Data Accessibility	*	*	√	√	√	√
Data Retrieval	X	X	X	X	X	√

*Data not Available
 √ Feature Available
 X Feature Not Available

5. Conclusion and Future Scope

The online database system focused on the limitation of a conventional paper-based system. As the title suggests, it is designed for medical records keeping, management and retrieval using Microsoft access. The Microsoft access platform with its multiple features is responsible for the successful design of the database system. We included three main departments for medical record keeping and retrieval, which include reception, diagnosis, and pharmacy. The designed system can help hospital management system to manage all medical records electronically. The features in the database system include, the medical record being stored, it can be retrieved, and is managing all the activities. Up till now, the system has been designed for registration of the patient, cancer diagnosis form, pharmacy management, and record retrieval.

Our proposed database system shows a very significant improvement over existing systems in many factors. Firstly, it improves the efficiency and accuracy of the information workflow, updating documentation processes which eventually guarantees the quality of medical data. Secondly, it improves adaptability of the system which allows for easy customization. Furthermore, our proposed system also improves data security and privacy. It also possesses search and retrieval features, which enable quick access to relevant patient information. Finally, our system reflects the societal impact by enabling information exchange and participating to environmental sustainability. Overall, our system's improvements enhance efficiency, scalability, security, retrieval capabilities, and societal impact in medical record keeping and retrieval.

Our system also offers a significant social impact. This is because the implementation of our proposed database system improves healthcare services and patient care. It facilitates smooth information exchange that leads to better coordination and treatment outcomes. Since the records are digitized, these enhances accessibility, accuracy, and environmental sustainability with privacy and security of patient's data. Finally, our research can lead to healthcare innovation and research. Overall, our Research certainly impacts society by improving healthcare, promoting sustainability, and driving advancements in the field.

This system can be improved further in the future. In future work, this whole system can be centralized using LAN connection or using SQL server as it can be accessed in all departments of that hospital if required. Furthermore, its design can be expanded by including other hospital services, like laboratories, finance departments, and consultation appointments. Nowadays the artificial intelligence is performing an excellent role in each domain. Implementing artificial intelligence in this database system can lead this database system to the next level.

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