

# Hospital Management System: A Review of Modern Hospital Management Methods

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**Abstract:** Healthcare in India, like many other parts of the world, is grappling with the growing demand for effective medical treatment and streamlined services. One of the key highlights of this system is the accurate and efficient management of patients' medical records. Doctors rely on accurate documentation, as it is essential for diagnosis, treatment, and future reference. The project, named Medicare, is a Hospital Management System (HMS) built using .NET Framework and LINQ in C#. Its goal is to transform the old-fashioned manual record-keeping into a fully automated and secure digital platform. Medicare is designed to address the problems faced by manually managing hospital data, such as inefficiency, inaccuracy, and limited access, by introducing a computerized system that manages patient registration, outpatient and inpatient records, doctor and nurse assignments, and billing processes in pharmacy and laboratory departments. Each patient is assigned a unique ID and their information is stored securely, making it available to authorized personnel as and when required. The system has smart search features, such as checking room availability, confirming doctor schedules, and retrieving patient information using their ID. With a user-friendly interface, the system is easy to navigate, and LINQ integration allows for robust data querying and manipulation within the application. A notable feature of Medicare is the ability to store patient consultation reports in a centralized database, which patients can access remotely, meeting the modern demand for medical records to be available anytime, anywhere. Using .NET technology and LINQ, Medicare provides a reliable, accurate, and efficient solution for hospital operations and patient care management, reducing time spent and increasing overall hospital productivity.

**Keywords:** LINQ in C#, Hospital Technology, MVC5, MSSQL, Website, Patient, Doctor

## I. INTRODUCTION

MediCare Hospital Management System is a robust software solution that aims to improve and automate critical hospital functions, making healthcare services more efficient and accurate. Developed on the .NET Framework and LINQ in C#, the system converts current hospital processes from patient registration to billing and resource management into a contemporary, centralized, and user-friendly healthcare management system. MediCare has crucial features like patient registration, automated unique patient ID assignment, safe storage of patient and staff details, and computerized billing at pharmacies and labs. It includes room management modules with real-time availability updates and robust search to verify physician availability or search by patient ID information. The user interface is minimalistic and easy to understand, intended for speedy navigation and straightforward use by non-technical individuals. Access to the system is secured via safe login details and role-specific permission. Entry or alteration of information in the system can be performed only by approved staff, e.g., administrators and receptionists. The information stored in the system is encrypted and shielded, guarding against privacy infringement as well as ensuring healthcare data compliance. MediCare not only streamlines hospital administration, but also decreases the time spent on manual activities by a great extent, enabling hospital staff to devote more time to delivering quality patient care. Designed for medium to large multi-specialty hospitals, MediCare caters to a broad spectrum of hospital management activities. It enables smooth communication and data sharing through end-to-end integration across departments. The software facilitates clinical



decision-making, enhances financial accounting, and aids administrative planning by offering timely access to valuable information. Hospitals had many management and efficiency-related problems prior to systems such as MediCare.

## **II. PROPOSED SYSTEM**

### **A. Research Motivation:**

The rise in healthcare sophistication and the rise in the demand for quality patient care have added to the requirement of effective hospital management solutions. Paper-based solutions usually result in inefficiencies, information overload, human mistakes, and patient treatment delays. All these hinder hospital processes and, further, compromise the quality of healthcare. This research is driven by the urge to create and implement an all-encompassing Hospital Management System (HMS) with the capability to automate administrative procedures, ensure data flawlessness, and grant instant access to medical reports. Through the amalgamation of patient registration, appointment management, billing, diagnosis, and employees' management modules into a single electronic platform, the proposed HMS aims to enhance efficiency, workload reduction, and patient satisfaction. Moreover, the research is driven by digital technologies' ability to transform healthcare infrastructure, support decision-making based on data, and provide scalable solutions for public and private healthcare organisations

### **B. Project objectives:**

- Computerization of patient and hospital data:

Create a computerized system for storing, handling, and retrieving in-depth information regarding patients and hospital functions with less manual record-keeping and fewer chances of errors.

- Effective appointment booking:

Allows for easy and effective scheduling of appointments between doctors and patients. The system should provide maximum time management for doctors with minimum patient waiting time and scheduling conflicts.

- Updating accurate and current patient records:

Make sure that patient data is regularly updated and stored in the system. Historical information such as previous diagnoses, treatments, and visits must be retained for future use, which aids in improved diagnosis and continuity of care.

- Integrated billing system:

Streamline the billing process by automating invoice creation, payment tracking, and insurance claims, making it transparent and timely.

- Inventory Management:

Tracking and controlling inventories of medical supplies, pharmaceuticals, and equipment, reducing waste and availability when required.

### **C. Overall System:**

Whole system is divided into two modules. They are Admin/

Doctor, User/Patient.

**Admin/ Doctor** – Here admin and doctors can login into the system. Under Admin includes pharmacists, lab assistants, Staff, Nurse, Helper, etc. Under Doctor includes doctors, specialists, etc. Doctors according to his/her speciality get categorize and view their new appointments and their details. They can update their status whether they are available or not.

**User/Patient**- A user can schedule an appointment according to their diseases and can complete the appointment form in which they can describe their problem. Several users can login simultaneously.

## **III. LITERATURE REVIEW**

"International Journal of Healthcare Management (2021)" – The transition from manual to computerized Hospital Management Systems (HMS) has been a phenomenal change in healthcare operations. Kumaran et al. (2017) identify some of the drawbacks of conventional systems, where instances of delay, loss of information, and security problems



can actually hamper patient treatment and administrative activities. These problems are especially witnessed in congested public hospitals. To overcome these challenges, research recommends the implementation of computerized systems that ease patient registration, doctor allocation, billing, and data storage. From this concept, a "Medicare" Hospital Management System has been developed based on the .NET Framework and LINQ in C#. This new solution not only boosts performance but also strengthens data security and streamlines data manipulation using LINQ, which eases backend operations and enhances system responsiveness. Medicare has critical modules like appointment booking, real-time room and doctor availability updates, and role-based login access. Its user-friendly interface and well-structured data management allow it to be utilized easily by employees, even those with minimal technical expertise. The system minimizes paperwork expenses, saves precious time, and guarantees accurate record-keeping. In conclusion, this literature decisively attests to the employment of sophisticated, adaptable HMS systems such as Medicare to satisfy expanding healthcare demands while at the same time maximizing operating efficiency and patient satisfaction.[1]

"Applications of Queuing Theory in Hospital Management Systems (Volume 9, 2020)" – In this paper, the authors embark on the exciting universe of queuing theory and how it applies to hospital management systems, as discussed in Volume 9, 2020, Zone 9, 2020. The authors consider how this method of analysis can optimize patient flow and eliminate those irritating wait times. Queuing theory, which is mathematically studied from waiting lines, is especially applicable in medicine, where patient flow may be unpredictable and there are limited resources. This study points out how queuing models can assist hospitals in allocating patients evenly among departments, considering both urgent and available treatments. It solves typical issues like congested emergency rooms, lengthy delays in outpatient departments, and idle resources. Through queuing theory used to simulate patient flow and service procedures, hospital administrators are better equipped to make more intelligent staffing, scheduling, and facility planning decisions. The research adheres to the practice of "first come, first served", a common practice throughout much of healthcare. Yet, it also teaches prioritizing based on the degree of urgency, bringing urgency into the queuing system. This pairing guarantees that important cases are addressed in good time while still ensuring overall efficiency in service. Lastly, this paper describes how queuing theory can give crucial information to make hospital operations more efficient and enhance patient satisfaction. [2]

"Hospital Management Systems Using Web Technologies (2020)" - This paper is about the growing significance of web-based technologies in defining contemporary management systems, particularly in healthcare. As digital infrastructure rapidly evolves and the demand for efficient, accessible services increases, various industries, including healthcare, are turning to digital platforms. In particular, the healthcare sector is moving from traditional paper-based systems to more efficient, secure, and user-friendly web-based solutions. This paper focuses on the idea of a hospital management system that uses web technology to streamline operations and enhance the overall quality of patient care. This shift enhances the effectiveness of medical procedures, minimizes the potential for human error, and makes patient files easily accessible throughout the hospital in real time. Furthermore, this system streamlines the management of physician calendars by scheduling appointments and monitoring availability, resulting in improved time management as well as minimizing patient waiting times. With universal access to patient information, healthcare professionals are able to make quicker, better-informed decisions, which in turn enhances the responsiveness and quality of care. The argument presented in this paper is that in today's fast-paced environment of healthcare, outmoded and duplicative approaches to gathering information can slow progress down. Through the implementation of a web-based hospital management system, healthcare organizations can gain increased organization, better resource management, and more consistent departmental communication, all of which help to make for a more efficient and patient healthcare setting.[3]

"Hospital Management and Control Systems, Volume 7, 2020" – The paper discusses the increasing significance of networked medical records as a response to increasing demands for high-quality healthcare services. With increasing patient expectations, health practitioners are confronted more than ever before by the pressing necessity to access timely and accurate medical information. Healthcare facility management now depends on strong patient management systems, which serve as important drivers of quality, accuracy, and fast service provision.[4]

"A Review of Smart Hospital Management System Technologies" – This article proves that multiple performance measures are needed to measure the efficiency of healthcare systems, one of the most crucial of which is the proper



usage and implementation of patient information systems. In many cases, generic software solutions need to be tailored or even entirely redesigned to suit the unique demands of various healthcare providers. Accordingly, hospital information systems (HIS) need to be adapted to patient populations, organizational business processes, and regulatory needs.

HAMS: Hospital Management Systems to Improve Information Sharing - In this field of study, special focus has been laid on improving communications in emergency conditions. This indicates the need to share information in real-time regarding available beds, staff capacity, and other valuable resources at hospitals. This improved information sharing enables first responders to better direct patients, enhances response time, and makes healthcare more resilient. Thus, transparent and trustworthy data sharing is critical for successful emergency management.[5]

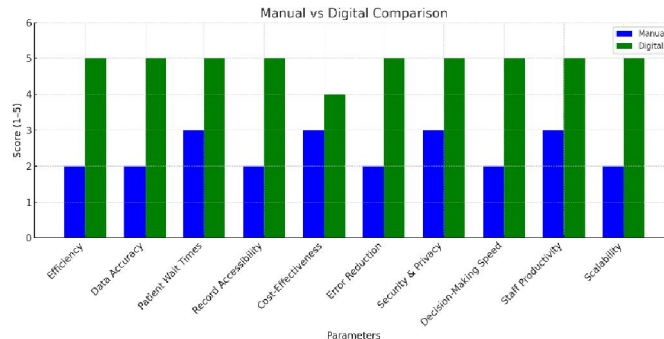
"Hospital Management Systems (International Journal of Research in Engineering Application and Management)" – The paper, which appeared in the International Journal of Research in Engineering Application and Management, explores the development of a computerized hospital management system aimed at improving the front office functioning of health establishments. The prime goal was to develop a simple, effective, and cost-effective software solution that would automate patient and doctor records. Earlier, hospitals used to have manual recording, which was not only time-consuming but also error-prone. This new system overcomes such drawbacks by facilitating quick registration, storage, and retrieval of vital information like patient demographics, diagnostic information, and physician allocations.[6]

#### **IV. METHODOLOGY**

The architecture of the Medicare Hospital Management System is divided into a number of phases to bring a secure and user-friendly solution. The first one is to design and provide a well-designed database that is the foundation for securely and efficiently storing and maintaining all hospital information. After the database schema is determined, the next task is to implement and design a user interface intuitive, easy-to-use, and role-based for doctors, pharmacists, administrators, and patients for the hospital. Last, the interface shall be written totally in C# under the .NET Framework and use LINQ for querying and processing of data. A comparison of currently existing hospital management systems was conducted as part of planning. This included studying the functionalities, advantages, and disadvantages of existing software programs. Knowing the pros and cons of the systems, the development team can design an improved performing, responsive, and scalable solution. The core of the Medicare system is founded on five central modules: Appointment Management, Pharmacy Management, Physician Management, Human Resource Management, and Healthcare Services Coordination. These modules are intended to automate hospital operations and improve service quality overall. The final feature and functionality choices are made by strictly looking at current products to implement best practices and the end product aligns with modern healthcare requirements.[7] The initial and the most crucial process of developing a local database for a "Medicare Hospital Management System." For instance, an ID of a patient can be related to his/her appointment history, prescriptions, lab test reports, and bills. These associations are critical in creating a relational database model which allows the easy flow of data across the system. This hierarchical method not only offers data normalization and consistency but also lays the foundation for constructing LINQ-based queries within the .NET Framework, which enables quicker and more stable operations across the application.[8] The Medicare Hospital Management System was implemented in C# and LINQ based on the .NET Framework, a robust and widely used technology stack renowned for its performance, reliability, and scalability. The .NET platform facilitates rapid development and has a vast set of libraries and tools that automate backend logic and interface integration. For developing an intuitive and aesthetically pleasing interface, the development team utilized front-end technologies like HTML5, CSS, Bootstrap, and an inbuilt modern UI framework to improve responsiveness and interaction on devices. Extra care was taken in making sure the patient, physician, administrator, and support staff experience is fluid. C#, which involves Entity Framework and LINQ, was utilized for backend development in order to make data operations as efficient as possible. LINQ helps minimize intricate queries, thereby simplifying interaction between database and application logic to become intuitive and manageable. Backend structure is designed with an accent on security, authentication, authorization, input validation, and optimization. Methods like hashing, role-based access control, and data validation libraries were utilized to secure confidential medical data. The data is kept in a relational database,



namely MSSQL-2019,MVC5 which is selected due to its robust support for structured data as well as being part of the .NET ecosystem. The database is able to process and store voluminous amounts of structured data such as patient information, doctor details, laboratory test results, pharmacy stock, and medical program information. The database schema is well suited to facilitate modification, scalability, and maintain data integrity by using defined relations, constraints, and indexes. With its streamlined design, the system enables rapid appointment scheduling, data access, and reporting features, making the application very user-friendly and responsive for hospital personnel and patients alike. In all, Medicare offers a secure, scalable, and reliable solution built on the strengths of the .NET Framework and LINQ to address the changing demands of contemporary healthcare administration.[9]



## V. FUTURE SCOPE

- The Medicare Hospital Management System is scalable and future-proof. The system will be equipped with some advanced features in future updates to further improve healthcare delivery and user experience.
- The most significant enhancements will be the integration of artificial intelligence (AI). AI operations will allow for better patient information analysis, predictive early-stage diagnoses, automate administrative work, and assist physicians in making clinical decisions that enhance patient care.
- Another important feature in the works is the integration of real-time video consultations. This will enable patients to consult doctors remotely, enable virtual check-ups, track long-term conditions, and follow-up after treatment, without physically visiting a clinic. Such telemedicine features are particularly beneficial for patients residing in remote or underserved communities.
- With medical systems becoming more digital, cybersecurity will be a major concern. Subsequent versions of the system will include strong security features to safeguard sensitive medical data from possible breaches and ensure compliance with healthcare data protection regulations.
- We also plan to introduce new functional modules in the future, such as inventory tracking, analytics dashboards, patient feedback systems, and integration with mobile apps. These will render the system flexible, future-proof, and responsive to the evolving needs of modern healthcare organizations.

## VI. CONCLUSION

The design of the Medicare Hospital Management System is directed towards computerizing the operations of a renowned hospital. Leveraging the capabilities of .NET Framework and LINQ in C#, the system accurately automates and simplifies the day-to-day activities of the hospital. The system is planned considering the duties of various users such as patients, pharmacists, lab assistants, to provide thorough and safe access control for different departments. The system is organized into five primary modules: Physician Management, Appointment Scheduling, Pharmacy Management, Human Resources, and Patient Services. With this single integrated module, major hospital procedures like patient data management, scheduling laboratory tests, creating laboratory reports, monitoring pharmacy stock, and managing employee information are completely digitized. The utilization of LINQ makes data operations easier, improves query performance, and keeps real-time data retrieval fast and accurate. Medicare also includes an efficient search function that enables instant access to information about the patient, availability of the physician, and





transactions. The system enhances data storage, organization, and backup significantly, reduces dependency on manual methods, and ensures minimal data loss. Medicare System generally provides a proven, scalable, and easy-to-use solution that enhances the efficiency and accuracy of hospital procedures.

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