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A Survey on Hospital Management System

Sumedh Chavan[1], Vedant Patil[2], Akshata Raut[3]
[1](Department of Computer Engineering, VIVA Institute of Technology, Mumbai University, India)
[2](Department of Computer Engineering, VIVA Institute of Technology, Mumbai University, India)
[3](Department of Computer Engineering, VIVA Institute of Technology, Mumbai University, India)

Abstract: *Hospital management systems have transformed healthcare by streamlining operations, improving accuracy, and enhancing patient care. This study focuses on systems utilizing the MERN stack (MongoDB, Express.js, React, and Node.js), showcasing its ability to handle complex hospital functions like patient records, scheduling, billing, and staff coordination. The MERN stack's scalability and efficiency help automate tasks, reduce errors, and ensure real-time access to data, leading to better decision-making and improved patient outcomes. The findings emphasize the necessity of adopting advanced technologies to meet the evolving demands of healthcare, ensuring efficient and reliable hospital management.*

Keywords *- Automation, Efficiency, Hospital Management System, MERN Stack, Patient Care.*

1. INTRODUCTION

In today's fast-paced healthcare environment, hospital management systems have become a cornerstone for delivering efficient and high-quality services. Hospitals are required to handle large volumes of data, manage complex workflows, and ensure seamless coordination across various departments, all while maintaining a focus on patient care. Traditional manual systems often struggle to meet these demands, leading to inefficiencies, errors, and delays. As a result, there is an increasing need for advanced technological solutions that can address these challenges effectively.

Modern hospital management systems leverage advanced technologies to automate processes, optimize resource utilization, and improve communication between departments. Among these, the MERN stack—comprising MongoDB, Express.js, React, and Node.js—has gained popularity due to its flexibility, scalability, and ability to develop robust, dynamic web applications. This technology enables the creation of comprehensive systems that streamline critical operations such as patient record management, appointment scheduling, staff coordination, billing, and inventory management.

This paper surveys a range of studies that focus on hospital management systems, particularly those utilizing the MERN stack. It explores how these systems address operational challenges, enhance data accuracy, reduce administrative overhead, and improve overall patient care. The adoption of such systems is not just a technological advancement but a necessary step toward modernizing healthcare infrastructure to meet the growing demands of patients and providers alike.

2. LITERATURE SURVEY

Tiwari et al. [1] proposed a modern hospital management system that aims to improve hospital operations through the integration of advanced technology. The system facilitates efficient management of administrative tasks, patient records, and resource allocation within healthcare facilities. It addresses key challenges in hospital management by streamlining processes, improving communication, and enhancing the overall quality of patient care. By utilizing this system, hospitals can optimize their workflows, reduce errors, and ensure better coordination among different departments, ultimately leading to improved healthcare delivery.

Al-Yaari et al. [2] introduced a Hospital Management System in their 2023 study published in the Indian Scientific Journal of Research in Engineering and Management. This system focuses on optimizing hospital operations through technology, addressing various administrative and clinical tasks. By incorporating advanced

features, the system is designed to improve patient management, staff coordination, and data accessibility, contributing to more efficient healthcare delivery. The study emphasizes the role of modern hospital management software in enhancing the overall quality and reliability of healthcare services..

Musale et al. [3] developed a Hospital Management System Using MERN Stack, as presented in their 2023 study at the Department of Engineering, Sciences and Humanities (DESH), Vishwakarma Institute of Technology, Pune, Maharashtra, India. This system leverages the MERN stack MongoDB, Express.js, React, and Node.js to streamline hospital management processes such as patient record handling, staff management, and appointment scheduling. By utilizing modern web development technologies, the system enhances operational efficiency and simplifies administrative tasks, ultimately improving the overall quality of hospital services and patient care.

K. S. et al. [4] conducted A Study of Advanced Hospital Management System in 2023 at the Department of Hospital Management, Anna University, Chennai, India. The study focuses on modernizing hospital operations by integrating advanced management systems that enhance administrative efficiency, patient care, and resource management. By automating key processes such as appointment scheduling, patient data handling, and staff coordination, the system aims to streamline workflows and improve overall healthcare service delivery. The study highlights the importance of such systems in reducing human error, improving communication, and fostering better patient outcomes within the hospital setting.

Neelima et al. [5] introduced Health Care Connect: A Comprehensive Hospital Management System in their 2023 first edition. This system offers an all-encompassing solution for managing hospital operations, focusing on improving efficiency and coordination across various departments. It covers essential functionalities such as patient care management, appointment scheduling, medical records handling, and staff coordination. By integrating advanced software capabilities, the system aims to streamline workflows, reduce administrative overhead, and enhance the overall quality of healthcare services, ultimately providing a more seamless and organized hospital management experience..

Nishanthan et al. [6] presented The Hospital Management System in their 2022 study published in the International Journal of Engineering and Management Research. The system is designed to streamline and automate various hospital operations, including patient registration, appointment scheduling, and staff management. By incorporating modern software technologies, the system aims to improve administrative efficiency, reduce human error, and enhance the quality of healthcare services. T

Jayasiri et al. [7] developed an Automated Hospital Management System utilizing the MERN stack, as detailed in their 2022 study. The system is designed to automate hospital processes, streamlining operations such as patient record management, appointment scheduling, and staff coordination. By leveraging modern web development technologies, including MongoDB, Express.js, React, and Node.js (MERN stack), the system enhances efficiency and reduces the complexity of traditional hospital management systems. The study highlights the practical implementation of this technology, demonstrating its potential to improve overall hospital functionality and patient care quality.

Misal et al. [8] presented the Advanced Hospital Management System in their 2022 paper published in the International Journal of Research in Applied Science and Engineering Technology (IJRASET). This system is designed to improve the efficiency of hospital operations by integrating various processes such as patient registration, medical record management, appointment scheduling, and staff coordination. The advanced features of the system aim to reduce administrative complexities, improve data accessibility, and enhance the overall quality of patient care. By streamlining hospital workflows, the system offers a more efficient and organized approach to healthcare management..

Liu et al. [9] proposed a Hospital Process Management System based on artificial neural networks in their 2017 study. The system leverages machine learning techniques to optimize hospital processes, such as patient flow, resource allocation, and staff management. By utilizing artificial neural networks, the system is capable of learning from data and improving decision-making within the hospital environment. The study demonstrates how the integration of AI can enhance efficiency, reduce bottlenecks, and improve overall hospital operations, ultimately leading to better healthcare delivery and patient outcomes.

Koyuncu et al. [10] presented the Intelligent Hospital Management System (IHMS) at the 2015 International Conference on Computational Intelligence and Communication Networks (CICN) in Jabalpur, India. The IHMS is designed to enhance hospital management by leveraging intelligent systems and communication networks. It aims to optimize hospital operations such as patient management, resource allocation, and staff coordination by utilizing computational intelligence. The system helps automate various administrative tasks, leading to improved efficiency, reduced human error, and enhanced healthcare delivery. The study emphasizes how intelligent systems can provide a more streamlined and effective approach to hospital management.

Musa et al. [11] introduced A Hospital Resource and Patient Management System in their 2012 study, presented at the International Conference on Systems and Informatics (ICSAI). The system utilizes real-time data capture and intelligent decision-making to optimize hospital resource allocation and patient management. By integrating real-time information, the system enhances decision-making processes for managing patient care, staff

scheduling, and resource distribution. This approach aims to improve the efficiency of hospital operations, reduce wait times, and enhance overall patient outcomes. The use of intelligent systems allows for better adaptation to dynamic hospital environments, offering a more responsive and data-driven management solution.

Mukherjee et al. [12] introduced the Patient Health Management System using an e-health monitoring architecture at the 2014 IEEE International Advance Computing Conference (IACC) held in Gurgaon, India. This system is designed to enhance patient health management by utilizing advanced monitoring technologies and digital communication. The e-health architecture enables real-time tracking of patient health data, facilitating better patient care and timely interventions. By integrating various health monitoring tools, the system aims to improve the management of chronic diseases and enhance communication between healthcare providers and patients. The study highlights the potential of e-health solutions in optimizing healthcare delivery and improving overall patient outcomes through timely and effective monitoring.

Olamide et al. [13] discusses the development and implementation of an advanced hospital management system aimed at improving the efficiency of hospital operations through automation. The system incorporates modules for patient registration, billing, appointment scheduling, and inventory management, with real-time access to patient data for both administrative and clinical purposes. It addresses the limitations of manual systems by enhancing data security, reducing paperwork, and streamlining healthcare delivery. The authors highlight the importance of such systems in modern healthcare to enhance decision-making and improve patient care coordination.

2.1 Analysis Table

The following table presents the objective analysis of the research conducted.

2.1 Analysis Table

Title	Technology Used	Advantages	Disadvantages
Modern Hospital Management System. (2023) [1]	Java, SQL, PHP, JavaScript, HTML, and MySQL	Increased efficiency, improved patient care, lower costs, enhanced communication and improved data security.	High initial cost, learning curve, interoperability issues, data privacy concerns and technical issues.
Hospital Management System. (2023) [2]	HTML/CSS, JavaScript Framework (React.js, Angular, Vue.js), JWT (JSON Web Tokens) and OAuth.	Improved efficiency, data accuracy and consistency, enhanced accessibility and improved security.	Limited functionality, scalability and security risks.
Hospital Management System Using MERN Stack. (2023) [3]	MongoDB, Express.js, React and Node.js.	Enhanced productivity, data precision and reliability, better accessibility, and strengthened security.	Initial cost, learning curve, technical issues and integration challenges.
A Study of Advanced Hospital Managaement System. (2023) [4]	PHP framework (Laravel), HTML, CSS, JavaScript, MySQL database and XAMPP server.	Increased effectiveness, greater data accuracy and uniformity, improved availability, and fortified security.	Limited functionality, scalability and security risks.
Health Care Connected: A Comprehensive Hospital Management System. (2023)	MongoDB, Express.js, React and Node.js.	Boosted operational performance, refined data integrity and coherence, enhanced availability and	Complexity, resistance to change, cost and interoperability.

[5]		strengthened protection.	
The Hospital Management System. (2022) [6]	MongoDB, Express.js, React and Node.js.	Optimized performance, elevated data correctness and consistency, enhanced ease of access, and reinforced security measures.	Initial cost, learning curve, technical issues and integration challenges.
Design and Implementation of an Automated Hospital Management System with MERN Stack. (2022) [7]	MongoDB, Express.js, React and Node.js.	Enhanced workflow efficiency, increased data accuracy and consistency, better accessibility, and bolstered security.	Performance, learning curve and maturity.
Advanced Hospital Management System. (2022) [8]	Java, Python for server-side logic, Laravel (PHP), React, Angular, or Vue.js for a dynamic user interface.	Streamlined operations, enhanced administration and control, superior patient care, strict cost control and improved profitability.	High development cost, integration challenges, and security vulnerabilities.
Hospital process management system based on artificial neural network. (2017) [9]	RESTful APIs, SSL/TLS and machine learning.	Predictive capabilities, pattern recognition and adaptability.	Limited scope, implementation challenges and ethical considerations.
Intelligent Hospital Management System (IHMS). (2015) [10]	JavaScript, HTML, and CSS for front-end development, Backend language like Python or Java.	Greater operational efficiency, improved data precision and uniformity, better access, and enhanced safeguarding.	Limited information, implementation challenges, data privacy, security and cost.
A Hospital Resource and Patient Management System Based on Real-Time Data Capture and Intelligent Decision Making. (2012) [11]	MongoDB, Express.js, React and Node.js.	Refined operational efficiency, elevated data accuracy and coherence, improved accessibility, and fortified security protocols.	Implementation challenges, cost, data privacy and security and user adoption.
Patient health management system using e-health monitoring architecture. (2012) [12]	HTML, CSS, JavaScript, Bootstrap, PHP, MySQL and SQL server.	Real-time monitoring, remote monitoring, improved diagnosis and enhanced patient care.	Data privacy and security, technical challenges, cost and user adoption.

A study of Advanced Hospital Management System. (2012) [13]	Django, HTML, C and SQLite3.	Comprehensive functionality, interoperability, real-time access, improved decision-making and enhanced care coordination.	Implementation challenges, integration issues, data privacy and security, cost and customization.

3. PROPOSED SYSTEM

A MERN stack hospital management system collects user input through React forms, validates and sanitizes it to ensure accuracy, and encodes the data for security. The data is stored or retrieved from MongoDB using Node.js and Express.js. Business logic processes tasks like appointments or billing, and React dynamically displays the results. Users receive clear feedback, ensuring smooth and efficient hospital operations.

3.1 Algorithm

1. Collect user input.
2. Validate and sanitize input.
3. Encode validated data.
4. Store or retrieve data.
5. Process business logic.
6. Render the data.
7. Provide feedback.

4. CONCLUSION

Hospital management systems are vital for addressing the complexities of modern healthcare operations, and the integration of advanced technologies like the MERN stack has significantly enhanced their efficiency and functionality. By automating critical processes such as patient record management, appointment scheduling, and staff coordination, these systems reduce administrative burdens, minimize errors, and improve inter-departmental communication. The studies reviewed in this survey emphasize the transformative potential of such technologies in streamlining workflows, optimizing resource utilization, and enhancing the overall quality of patient care. The MERN stack, with its scalability and dynamic capabilities, has proven to be a powerful framework for building robust hospital management systems tailored to the needs of healthcare facilities. As the demand for efficient and patient-centered healthcare continues to grow, the adoption of these advanced systems is not just an innovation but a necessity. Moving forward, the incorporation of emerging technologies such as artificial intelligence and machine learning can further enhance these systems, enabling smarter decision-making and more efficient healthcare delivery. This underscores the critical role of technology in modernizing hospital management and meeting the evolving demands of the healthcare industry.

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