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E-Hospital Management & Hospital Information System – Use of IOT

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ABSTRACT

To operate successfully and efficiently, a healthcare institution needs high-quality data and information management. To say that many companies, organizations, or government agencies are critically dependent on the use of database systems for their success, especially in hospitals, would be an understatement. This work aims to develop an improved hospital information management system using an activity-based approach. This study presents an effective hospital information management system that can be used to handle patient information and its administration. This aims to solve the issues that the current hospital information system has with inappropriate data retention, erroneous reports, and time wastage when storing, processing, and retrieving information to increase the overall effectiveness of the medical facility. Express.JS, Mongo DB, React.JS, and Node.JS were used to create the system. The technology offers a crucial storage and retrieval platform for information in hospitals. Many tests have been carried on, and they are attached and discussed in the document.

Keywords— SLIIT, MERN Stacks, Hospital Management, Doctor Management, Ambulance Management, Operation Management, Camping Management, Mongo DB, Web Application

I. INTRODUCTION

A hospital is a healthcare facility that provides patients with skilled personnel and tools. In general, hospitals are funded by the government, for-profit or nonprofit healthcare businesses, health insurance providers, or nonprofit groups, including funding from direct charitable donations. However, historically, religious institutions, charities, and political figures have frequently created and sponsored hospitals. Most of the medical professionals working in hospitals today are qualified physicians, surgeons, and nurses.

[4] Designing an automated system to manage patient data flow in a hospital is the major goal of this effort. It exists to address most clinical administration issues that arise manually in hospitals. In a manual system, hospital staff must regularly seek access to all patient files in the records.

The project's goal is to develop a system that offers the following services:

- I am an organized data collector and data keeper.
- Precise data processing and communication.
- Data security ensures that healthcare information and data are centrally kept in a reliable, secure database.

According to Bose (2003), e-success health's is essential for the integrated exchange of clinical and medical knowledge, as well as for the collection, analysis, and transfer of knowledge both inside and between healthcare organizations. a detailed understanding of the developing technology, societal views, governmental funding policy, and commercial objectives is necessary to successfully utilize the emerging social and economic benefits of e-healthcare.

II. RELATED WORK AND LITERATURE REVIEW

The research of the literature identified contextual issues and provided a succinct historical overview of the hospital management system. The provision of adequate care and treatment to the public is the hospital's main goal. Several operational works done in a hospital include recording information about the Patients, doctors and ambulance details. Also, recording camping details related to the purpose of the camping and medicines availability. In most hospitals, these tasks are completed manually. This necessitated the creation of an electronic means of keeping records, querying of data, ambulance details and better accountability. In general, information technology provides intra organizational networking that promotes efficient information flow among the different parts of a company. As the quality of patient care in modern times appears to depend on the prompt gathering and processing of clinical information pertaining to the patient, the application of information technology in health care is continuously improving. In their study on the information system for managing health care services in Chinese hospitals, Diapente al. [1], 2005 presented the HSMS, which aims to increase service quality while also locating opportunities for cost savings and performing analyses and rating/evaluation of health

care services. Numerous models and plans for hospital interventions and development have been used in hospitals over the years [2]. The ability to save and retrieve patient data is essential for enhancing hospital medical care capabilities, decision-making processes, and operational effectiveness. To have a better understanding of their work descriptions and the difficulties they encounter in carrying out their responsibilities, various medical professionals were questioned. They were examined to determine how their doctor information, camping trip itinerary, and operation results ledger are referenced, preserved for future works, and the platform for automating the information.

III. METHODOLOGY

A. Requirements Analysis

Gunathilake C.D. et al System analysis must include requirement analysis. The hardest part of developing software is this. Perfect requirement analysis is a necessity while developing any system because mistakes made at this stage could cause the entire system to fail. Setting up the analysis phase of the project by making the appropriate preparations and deciding on the initial study's scope is what requirement analysis entails. The current system's system process and data structure are investigated in great depth. The stage of developing the requirements for the system and what the new system must perform is called requirement analysis. As a result, it entails determining who, where, when, and how needs what information. At this step, the new systems' data, process, and interface needs are also identified. By analyzing the existing hospital systems and current processes of national hospitals, we came up with a hospital system design with better system diagrams and tools and technologies to develop the system.

B. Use case of the proposed system

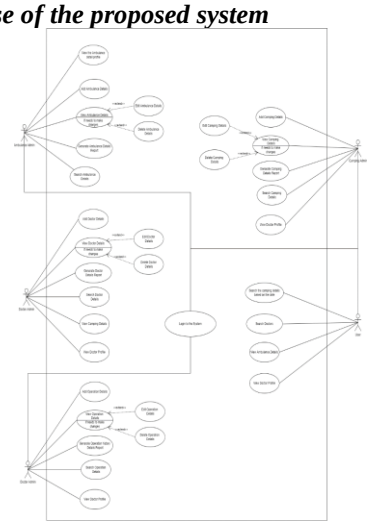

Figure 1: Use Case Diagram

C. Architecture of the Proposed System

A three-tier application architecture will be used for the hospital information management system. React Framework and packages like HTML, CSS, and JavaScript will be used to handle the presentation. Express JS will take care of the controllers and application logic, and MongoDB database software will handle the database. The suggested system's visual overview is depicted in the diagram below.

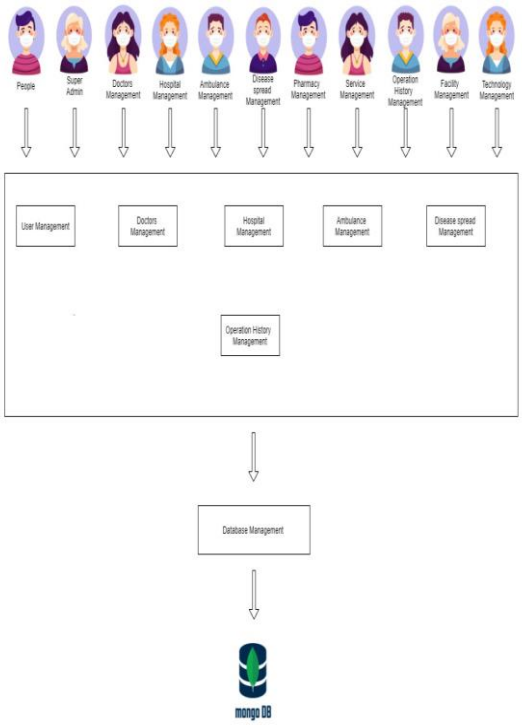

Figure 2: High-Level Diagram

D. System Design and Implementation

Interfaces of the system will be implemented using React library to have smooth-running interfaces. To maintain the function reusability in the system, REST API will be used to develop the backend services. It is quite convenient for developers to reuse the same functionalities in different cases. As the backend development framework, we use Express framework with NodeJS. NoSQL will be used as an alternative to traditional relational databases. MongoDB is the open-sourced NoSQL database management tool which capable of manage and store document-oriented data. MongoDB will be used to host the database among the different users of the system. GitHub will be used to control the version of the tools and technologies. It allows developers to integrate their work with others remotely. For coding the modules, Visual Studio is going to be used as the development IDE. It is provided much for functionalities and plugins to the system.[3]

- Backend development – Express and NodeJS
- Frontend – HTML/CSS, JavaScript
- Frontend UI Library - React
- Architecture – MVC architecture
- DBMS - MongoDB
- Version Control - GitHub.

E. Algorithms used in the System

- **Binary Search** (For Searching)

  It is an intermittent search algorithm, and it employs the divide and conquer strategy. It is used to locate a specific element within a sorted array or list. Because of its quickest search speed, it is regarded as the greatest searching algorithm (though it has a special condition that the array should be sorted). It is frequently referred to as a logarithmic search or a half-interval search. A binary search splits a sorted array in two and determines if an element is present in the first or second half. The process is then repeated until the element is located or the available elements are depleted. Binary Search begins from the middle of the array, drastically cutting down on search time. Binary Search has a time complexity that is always O. (login).

- **JWT**

  An open standard called JWT, or JSON Web Token, is used to safely transfer data between two parties (RFC 7519). It's crucial to first grasp session tokens in order to comprehend the JWT idea in full. To identify Session Instances, Session Tokens are encrypted, distinctive strings. When a user joins a website and registers with his or her information, consider any website that has registration forms. This information instantly reaches the server, which then sends a token for that specific browser. The token is kept in the browser's cookie and can remain active until the user logs off or for any amount of time.

  Our Node.js project uses JSON Web Token, or JWT, for user authentication. I highlighted the primary use case for using JWT on the diagram above. User authenticates, and a JWT is returned. Only Auth Service is in possession of a private key, and it is used to generate a JWT with a jwt.sign() function that can contain any payload (userId in our case). A JWT expiration time is also set up via jwt.sign(). No backend services are required; it is the client's responsibility to persist JWT. Any other service that receives a request from a user with a JWT checks the JWT using the jwt.verify() function and then uses a Public Key to retrieve the payload (userId). The userId can be used to handle additional requests.

IV. PROPOSED SYSTEM

A. Ambulance Details Management

Ambulance service is an essential service in a hospital. This is a 24-hour service which is used to transport patients quickly to the hospital. A driver's office board and ambulances are required to run this service. Usually, Hospitals store all ambulance and driver staff information as hard copies. By using our system, all ambulance and driver details can be managed. If a new ambulance needs to be added, the hospital staff or system administrator can register the new vehicle and enter the record into the system. If the administrator wants to make a change to an existing record, that can also be done. The system can generate a report of all the ambulance and driver details based on the data stored in the database. Finding the current location of the ambulance is important for the hospital and the patients. To track the ambulance location, it is necessary to install a GPS tracker for each ambulance vehicle. GPS tracker updates live location to the system. As an additional feature, patients can check whether the hospital has an ambulance or not. If the ambulance is available, the patient can contact the driver through the system or by phone call. When a patient requests an ambulance service from a hospital, a notification is sent to the hospital and the patient through the system once the ambulance arrives at the scene.

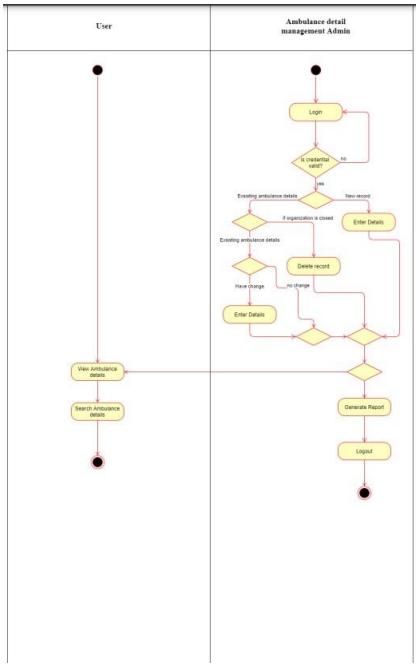

Figure 3: Activity Diagram of Ambulance Management

B. Doctor's Details Management

A hospital is a place where patients receive medical treatment from trained personnel and advanced tools [3]. Hospitals are typically sponsored by the government, health organizations (commercial or nonprofit), health insurance providers, or charity, including money from direct donations. However, historically, philanthropic people or religious institutions have frequently created and sponsored hospitals. Most of the medical professionals working in hospitals today are licensed doctors, surgeons, and nurses. Designing an automated system to regulate the flow of doctor data across the hospital is the primary goal of this effort. This will address most issues with the manual medical

administration system used in hospitals. In the manual system, the hospital personnel must constantly request access to all the patient files in the records. The "Hospital Management System" incorporates computerized billing in the pharmacy, laboratory, and doctor registration. It also includes doctor data storage.[3] Our program can automatically store each doctor's and the staff's information while also providing a unique ID for each doctor. It has a search feature so you can find out the status of any room right now. Using the ID, a user can look up a doctor's details and availability. In this system admin can perform add, edit, and delete doctor. We have only used the functionalities stated above thus far. In the future, we are going to add a few additional features. In future, the details regarding the patient will be sent to the doctor in advance by email.

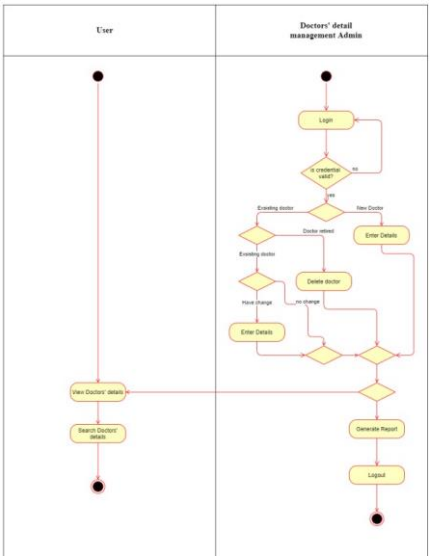

Figure 4: Activity Diagram of Doctor Details Management

C. Camping Details Management

In the hospital management system, camping is the one of the important things. As an admin he/she can add camping details to the system such as camping name, address, venue, time, and description. But may be the admin could add some irrelevant data to the system. So, some validation added to the system to make sure the user that they inserted data correct. Also, after inserted if anything changed, the admin could update the camping details. Moreover, if an admin decides to delete a specific detail about camping, he/she has the access to delete that. each hospital may organize a lot of camping. so, it is difficult to find a specific camping form the list of camping. To overcome this issue, there is a feature added to the system to search the camping based on the camping name. Each hospital must generate monthly report. So, to fulfill that requirement generate the camping report feature was added to the system. As the user side, the user can show all the camping details inserted or published by the hospital. There is need a feature to filter the camping details according to the user needs. So according to the user requirements filter function and search function are added to the system to make the user to easily access the system and get the details about what the user needs. Because of that action the user could show list of favorited camping. Other than this, user can make appointment by filling a form. So, the user's time will not be waste. Moreover, the user can make a specific camping as favorite by click on related icon.

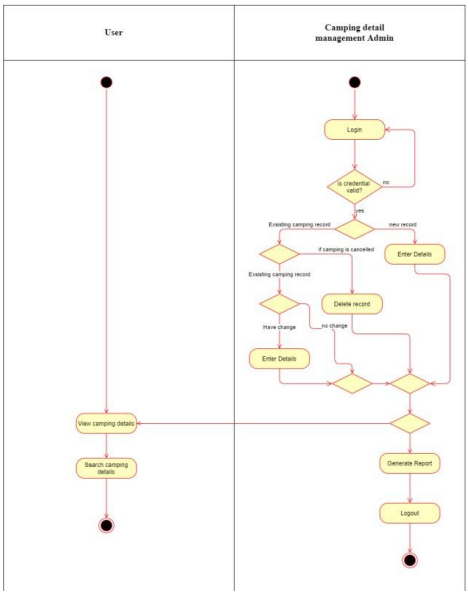

Figure 5: Activity Diagram of Camping Management

D. Operation History Details Management

Hospital information infrastructures are increasingly called upon to cope with increasing population preferences and provide additional assistance [3]. Train medical doctors and clinic providers and support staff to deliver on time and accuracy. There are various Metrics needed to evaluate overall performance and successful implementation of offerings such as clinic industry and the use of hospital records gadget bureaucracy plays a key role. Hospital registration structures should be in place in maximum cases the customized design and in a few cases the soft goods market that wants to be made to his liking A custom designed software program is primarily based on the exact clinic requirements (consumer requirements). The paper seems to evaluate and identifying critical components. There are two parts in this system. One is user side and the other is admin side. User side can perform limited actions only. User side can know the operation related news in the hospital so far, admin side can add, edit, and delete user. Advanced hospital management system can be entered using username and password. This is access through admin or receptionist. Only they can upload statistics to the database. Statistics may Easily restore. The interface can be very user friendly. Figures are well wrapped and made for non-public use Statistics are processed amazingly fast. So far, we have implemented only the above-mentioned features.

We are going to implement some more features in the future. That is, the details regarding the operation to be performed by a doctor will be sent to him via email.

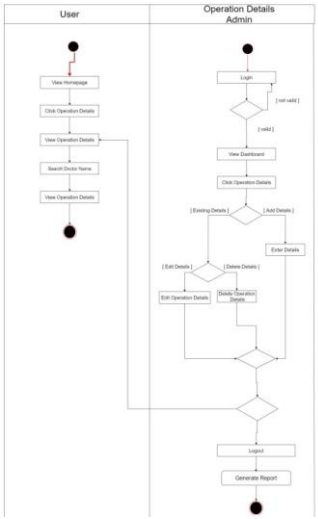

Figure 6: Activity Diagram of Operation Management

Sample user interfaces of this system are shown below.

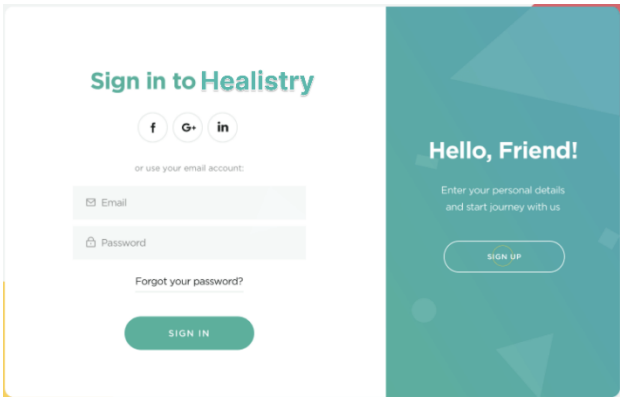

Figure 7: Registration Page

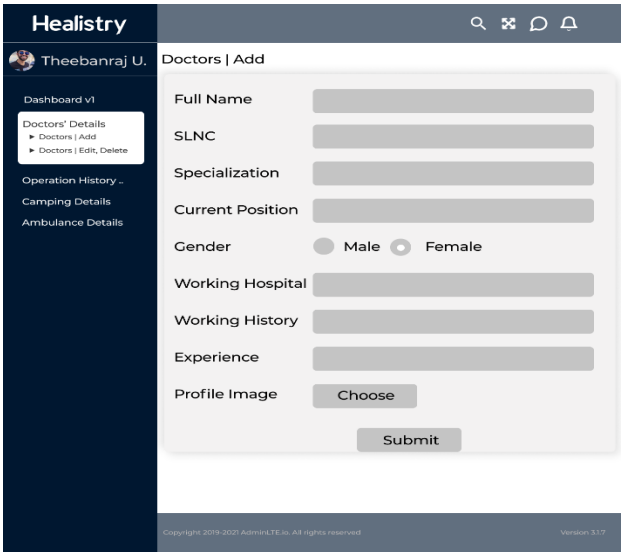

Figure 8: Doctor Registration Page

V. DISCUSSION

A. Testing

Testing of Hospital System will be done in two methods to make sure that the system runs more reliable and easier to manage the system. The maintain idea of this section is to provide a good, user friendly & best performing system.

1) Integration Testing

- The purpose of this level of testing is to expose
- faults in the interaction between integrated units.
- Whenever one function is done with unit testing. The purpose is to validate that each unit of the software performs as designed.
- Integration testing will be done to make sure all sections and pages in particular functions are working properly

2) System Testing

- System testing is a level of testing that validates the complete and fully integrated software product.
- The purpose of a system test is to evaluate the end-to-end system specifications.
- This will be the last & most important testing of the system because this will check the errors in the system very fast & the way system behaves at the special test cases.
- The system performance is the main eye in this section. This will be done by inputting selected manual data in company documents. The group will be testing whether the output value is same as in the manual documents.
- System Testing is a series of different tests whose sole purpose is to exercise the full computer-based system**.**

VI. CONCLUSION

Although we were novices in certain areas, such as developing HTML that is accessible through browsers other than Chrome and Safari, the team came to the table with an excellent working grasp of the ideas reflected in the provided guidelines. Knowing how important "alt" tags are to increasing website accessibility helped steer the design in the direction of a simpler foundation (not graphics-heavy). Being forced to learn about the medical systems from scratch was one of the major disadvantages we had to deal with early on. Time could have been saved if we had a far better understanding of the "overall picture" of the system and how the details linked to the whole. On the other hand, not knowing anything about the Medical related organizations helped the technical team provide a more objective look at the process. Not having a vast knowledge of medical system placed us at an advantage in outlining the site structure. Moreover, in this project we added the whole things what needed for an

online hospital management. We made the UI easily to access by the user so everyone can easily get the service by using the application. Multiple platforms.

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