

Hospital Management System

DIPLOMA PROJECT

Poznań

DETAILS OF THE PARTNERS

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PROJECT ASSUMPTIONS

B1. Project description

1. Research project

Hospital management system

Hospital management system is a computer system that helps manage the information which relates to health care and also aids in the work completion of health care providers effectively and efficiently. They manage the data related to each and every department of healthcare such as, Clinical, Financial, Laboratory, Inpatient, Outpatient, Operation theatre, Materials, Nursing, Pharmaceutical, Radiology, Pathology etc. This system can facilitate the corporate to be additional economical in registration of their patients and manage appointments, records of patients. it'll facilitate doctors read and build changes appointments if needed. The main aim of this project is to computerize all details relating to patient details and hospital details.

HMS came into the picture of hospital administration as early as 1960 and has ever since been advancing and synchronizing with the advances whereas modernizing healthcare offices. In today's world, the administration of healthcare begins from the hands of the patients through their versatile phones. HMS was presented to unravel the complications coming from overseeing all the paper works of each understanding related with the different divisions of hospitalization with privacy. HMS gives the capacity to oversee all the printed material in one put, lessening the work of staff in orchestrating and examining the printed material of the patients. HMS does numerous works like: Maintain the therapeutic records of the understanding Maintain the contact points of interest of the quiet Keep track of the arrangement dates Save the protections data for afterward reference Tracking the charge instalments.

The system is going to be used as an application that serves hospitals, clinic, dispensaries or different health establishments. This system can also manage patient details and their ends up in a sleek manner. In the case of hospital being managed in files or hardware, the hospital needs to place a lot of efforts on keeping the files safe. In other cases, the files can be simply

broken or higher however misplaced by losing necessary information. Information about each Patients is done by just writing their name, age and gender. Whenever the Patient comes up his information is stored freshly and updated in the system. Bills are generated by recording price for each service provided to patient on a separate sheet and at last they all are summed up and a total figure is displayed systematically. Diagnosis information to patients is generally recorded on the document, which contains Patient information. It is destroyed after some time period to decrease the paper load in the office. Immunization records of children are also maintained in pre-formatted sheets, which are kept in a file. Information about various diseases is not kept as any document. Doctors however do this job by trying to recall various medicines. All this work is done manually by the receptionist and other operational staff and lot of papers are needed to be handled and taken care of. Doctors have to remember various medicines available for diagnosis and sometimes miss better alternatives as they can't remember them at that time. Hospitals have undergone a change for the best with this system. The hospital administrations are seeking IT solutions for a much better management, patient care and data security and much more in their hospital campus. Have a quick look at some the most salient features of hospital management software. Day to day operations like patient registration, monitor of the blood bank, management of admission and overall management of a couple of departments can be done with higher accuracy and ease after the installation of this hospital software. The modules used in hospital management software are very user-friendly and simple to access. It has a common UI having a couple of modules. The hospital staff can be able to use these modules in their day-to-day work without any difficulties and make the best possible use of the hospital management system.

Since, every hospital has few or the other points of value those vary in comparison with to its competitors. Hence, majority of the IT experts give straight forward solutions or the features that can be customized. It then implies that hospital information management software can be personalized by specifying personal requirements of the institution. The automated functions of online hospital software make productivity much more effective. This web-based IT solution has a lot of automated operations which enables officials to continue with their work in a sound manner. It then implies that full automation of the hospital software makes productivity easily obtainable. After all this, we come into a conclusion that this enhances the infrastructure of hospital administration. This tool is a comprehensive solution that integrates all the departments by creating a common platform. In summary, hospital management system has all the features that achieve role of all the departments of hospital institute. In fact, these modules

have been competitively designed to make all the operations much simple. For the patient and doctor, the patient who wants to book an online appointment from doctor and also the doctors check their patient using online system. The HMS is an internet based and smartphones enables application that will check individual patient, make an online appointment and provide a much quicker delivery of medicines and report to a particular location at a particular time. Unlike our current hospital management system that patient go to the hospital in order to receive their medical reports, patients who use this system will not just be able to get their medical reports online but they can also discuss their results with the specialist and also have an online medicine payment facility through cards, which will save them a lot of time and increase the patient and doctor overall satisfaction.

Ordering the medicines online and online payment through debit or credit card, delivering is also fast. Be able to obtain the medical reports through the online system. Be able to take appointment from doctors and also contact with hospital in emergency case and also urgent once. Create, delete and update patient records within few clicks. Obtain the disease history, test results, prescribed treatment can be accessed by doctors without hustle in order to make an accurate diagnosis according to past illness and monitor the patient's health. Allows complete data of deferent department to store in the same data base which increase the efficiency, reduce the cost, simplifies the infrastructure and helpful in multiple. It can also improve the management system of the hospital, all data, and data regarding the patient, doctor and medicine could be easily seen by any of the department. Provide the system access through corporate internet, smartphones, tablets and outside internet access by authorized employees.

Features of Hospital Management System:

1. Appointment: Hospitals having their own site, appointments will be integrated onto the site. Patients who are visiting the hospital's webpage can always get an online appointment without too much hustle.
2. Billing Management: Integrated Billing with treatments, Lab and Radiology. Alerts will be sent on Discount Authorisation. Automatic due capture, Option to bill before and after consultation.
3. Prescription Management: Manage commonly and recently used medicines. It gives the options to the user to see all available medicines in the pharmacy and also can be able to see their prices. Patients can buy these drugs online as long as they are not prescription drugs. It also sends SMS prescriptions to patients.

4. Discharge(out-patients): Template based Discharge Summary. There is an option to prevent discharge summary of the patient until IP bill is closed in the system.
5. Operation Theatre Management: Automatic notification can be sent to customers on test results. Lab notifications like email, SMS of the test reports sent from the Automated Lab notification module.
6. Pharmacy Management: Comprehensive Pharmacy Management handles stock, Prescription Integration, Ward Request, Stock Management, Stock Movement and intelligent reports.
7. Lab Management: In this section of comprehensive Lab Management, it is able to handle complete order management, Reports, Notifications, Credit card Settlement, detailed MIS Reports, Analytics and App for Phlebotomist.
8. Master Information Systems, let's you access entire MIS data from your palm. Manage Multiple Locations Any number of branches can be added and managed using a single account.

At this moment we have been able to clarify on some the importance of HMS, it is your responsibility to pick out the right kind of HMS for your needs and purposes. Here we give more information on the benefits of various HMS and the impact it creates on hospital systems. HMS is able to make it possible to access all the data that is related to each patient through a system by the means of a few simple clicks. Information relating to patients like their history, their current illness, the doctors who was involved, tests reports that were taken, billing information and many more can be made visible to the user. All of these data will help to connect each and every dot about the patient, like any specific diagnosis, related treatment, and all medication. This electronic-based medical record system can be viewed as a patient's health chart. It retrieves information based on the patient's name or medical record number or the physician's record number. The patient information can always be kept a hundred percent safe by using HMS in your hospital. It can be made accessible by only a limited amount of authorized personnel. With HMS, all the data is stored on a server or cloud and kept safe by just securing the login information safe. Hospital Management System (HMS) improves the visibility and transparency in the complete management process and in all records. It helps in streamlining the accurate reporting with the help of updated and accurate records. Hospital Management System is able to improve the quality control on the products and services of any hospital that is using it. It also improves the management visibility of hospital, all information, and data regarding the patient, doctor and medicine could be seen by any department easily.

Hospital Management System makes it a lot simple to get logged into the management system webpage for the authorized users and keep it unavailable from any unauthorized personnel. Hospital management system not only saves time in the hospital day to day management but it also reduces cost by decreasing workers working on the system of manual entry of data. The implementation of His will decrease the human intervention into the system thereby avoiding human-caused errors.

2. Justification for selecting the subject

i. Speed

Hospital management system follows the quality in operation procedures, and there are not any probabilities for deviation to happen in any of the effective HMS systems. With the implementation of HMS in your labs or hospitals, you'll be able to treat patients with a much better approach and accessing their period reports and alternative data concerning the patients, and their past clinical information and additional will be done quickly and cause best patient outcomes. Hospital management system make workers work additional in an accessible and improve the speed of the whole processes for higher results.

ii. Less costly

HMS system helps to trace and management finances, scale back leakages still as scale back manual work and thus there's no demand of the upper human work force. Hospital management system helps to chop down the manual work done by humans within the hospitals particularly for the peoples who take care of the record and documentations safely. Hospital management system helps in reducing the human resources prices as most of the work is automatic. Cut down the value associated with storage and alternative associated needs. If your hospital is entirely HMS enforced, then your hospital can go paper-free one, it's enough if you maintain the obligatory documents and alternative connected ones in your hospital to fits the regulation standards.

iii. Reduces error

Hospital management system can facilitate in reducing differing types of errors that created through interventions like missing asking, operational failure, clinical errors, value leakages, missing appointments etc. Every method on the hospital management system is machine-controlled, and there are lots of tasks provided to the software package to perform while not

the human intervention also as accurately, this reduces the error considerably. For example, associate degree IPD patient final bill quantity may be simply generated if your hospital enabled of Hospital management system as his reports and alternative samples bill are already beaked and safe below the patient distinctive Hospital ID, and so the asking govt has to generate from the system and supply the statement to the patients. If your hospital isn't HMS enabled then you wish to travel with manual entries that involves too several human errors, therefore preferring HMS can build your asking section easier, faster, correct and additional clear.

iv. Data security

In a hospital management system, they're one in every of the cloud-based package wherever everything gets interlinked, and thus there aren't any possibilities for breaches to occur as they need high information security. Evidence-base medication needs the retrieving ability additionally as information ability compulsorily, and this simply achieved through a hospital management system. If you have got Hospital management system on your hospital, then you'll simply access the operational, clinical and money information of your hospitals.

v. Improved patient care

Enhanced work potency and improved patient knowledge access mean quicker and higher clinical selections. A practician orders the answer to implement once he gets the diagnostic report on his hand, thus its necessary to possess speedier support for receiving the reports quickly. All departments within the hospitals area unit interconnected and integrated with this automation, and this enhances the patient care quality in addition because the hospital turnovers.

vi. High quality

Every hospital ought to send a report of birth, and death occurred, their reasons and connected solutions to the NABH enfranchisement monthly. It's tough to rearrange them manually thus preferring the most effective HMS helps you to send the reports quicker and at the proper time-frame. Every report is monitored and managed within the Hospital Management System fastidiously and with efficiency for the correct results. Every one prefers HMS for his or her hospitals for coordinated and speedy care, reduced prices, reduced waiting time and admission, increased patient safety and clinical care

3. Project's scope in terms of subject matter, object of research, time and space

- I. Patient registration
- II. Appointment scheduling
- III. Billing and payments
- IV. Security of the whole system
- V. Pharmaceutical drug equipment
- VI. Staff management (work roster, availability, etc)
- VII. Management functions (report generation, accounting...)
- VIII. System administration
- IX. Resource allocation
- X. Comprehensive database
- XI. Web interface (UI)

4. Work methodology (research methods and techniques)

Data Diagram

A Data Flow Diagram (DFD) or a Bubble chart is a tool that describes the glide of statistics and methods that change, or rework statistics all through the machine. This tool is built with the aid of using the usage of a fixed of symbols that don't suggest a bodily implementation. It is a graphical device for dependent evaluation of machine necessities DFD fashions a machine with the aid of using the usage of outside entities from which statistics flows to a process, which switch the statistics and creates, output-statistics-flows which visit different outside entities or documents. statistics in documents many to methods as inputs.

Data Flow Diagram may be hierarchically organized, which assist in partitioning and reading big systems. As a primary step, one Data Flow Diagram can depict a whole machine, which offers the machine overview. It is referred to as context Diagram of degree zero DFD. The Context Diagram may be in addition expanded. The successive growth of a Data Flow Diagram from the context diagram to the ones giving extra information is referred to as levelling of Data Flow Diagram. Thus, a pinnacle down technique is used, beginning with an outline after which running out the information. The principal benefit of Data Flow Diagram

is that it could offer an outline of machine necessities, what statistics a machine could process, what transformation of statistics are done, what documents are used, and wherein the consequences glide.

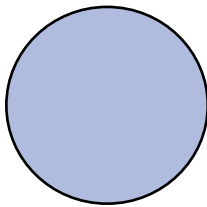
Symbols used

Fig. 1 Arrow



A facts glide is a route, which permits packets tour shape one factor to another. Data might also additionally glide from a supply to a processor and from facts keep or process. An arrow line depicts the glide, with arrow head pointing withinside the course of the glide.

Fig. 2. Circle.



A system represents transformation wherein incoming records flows are modified into outgoing records flows.

Fig. 3. Rectangle



A supply or sink is someone or a part of a company which input or gets facts from the device however is taken into consideration to be the competition of data model.

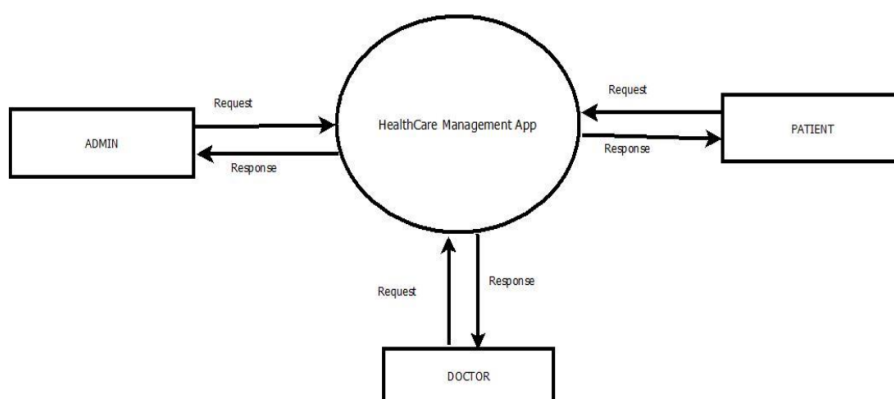
Fig. 4. Open Rectangle



Statistics keep is a repository of statistics this is to be saved to be used with the aid of using a one or greater technique can be as easy as buffer or queue or state-of-the-art as relational database. They have to have clean names. If a technique simply makes use of the content material of keep and does now no longer adjust it, the arrowhead is going simplest from the shop to the technique. If a technique alters the info in the shop, then a double -headed arrow is used.

Data Flow Diagrams

Fig. 5. Context level diagram (It gives us a small representation of how our website looks.)



Sample webform.

In the figures below we present sample pictures of the user interface. The entire project can be found in [4].

Fig. 6. Homepage (This is the home page of our system.)

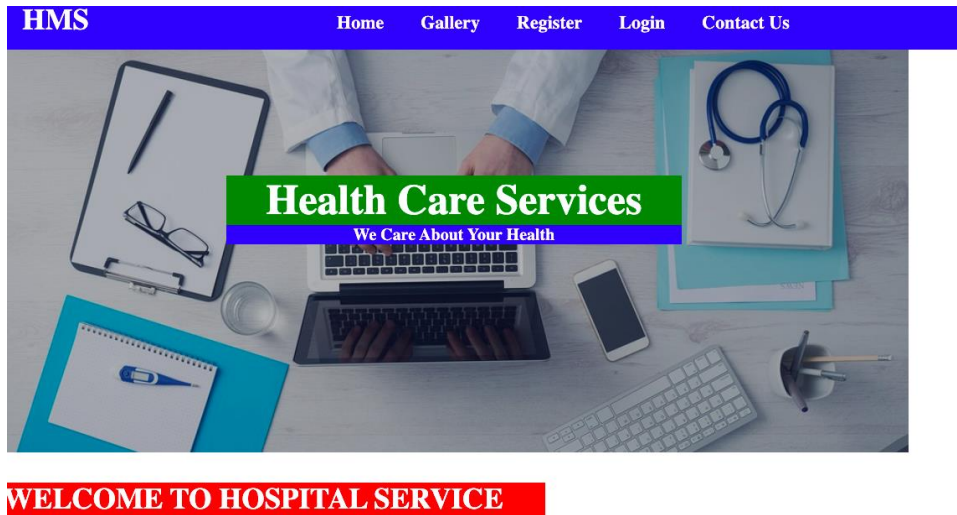


Fig. 7. Registration page (This is the registration page of our system.)

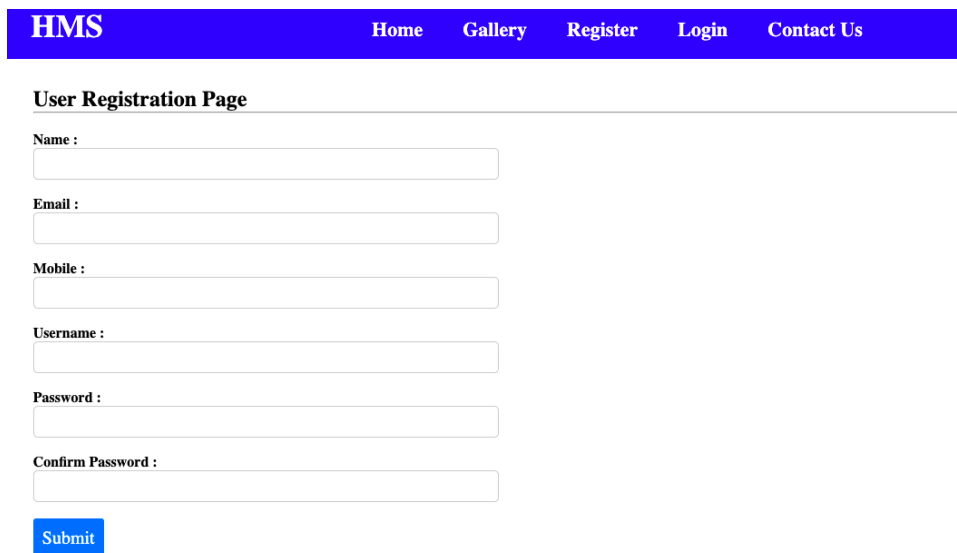
The image shows the registration page of the HMS web application. It has the same blue navigation bar as the homepage. Below the navigation bar, the title 'User Registration Page' is displayed. The page contains several input fields for user registration: 'Name :', 'Email :', 'Mobile :', 'Username :', 'Password :', and 'Confirm Password :'. Each label is followed by a text input field. At the bottom left of the form, there is a blue 'Submit' button.

Fig. 8. Gallery page (This page contains a couple of images of different hospital departments)

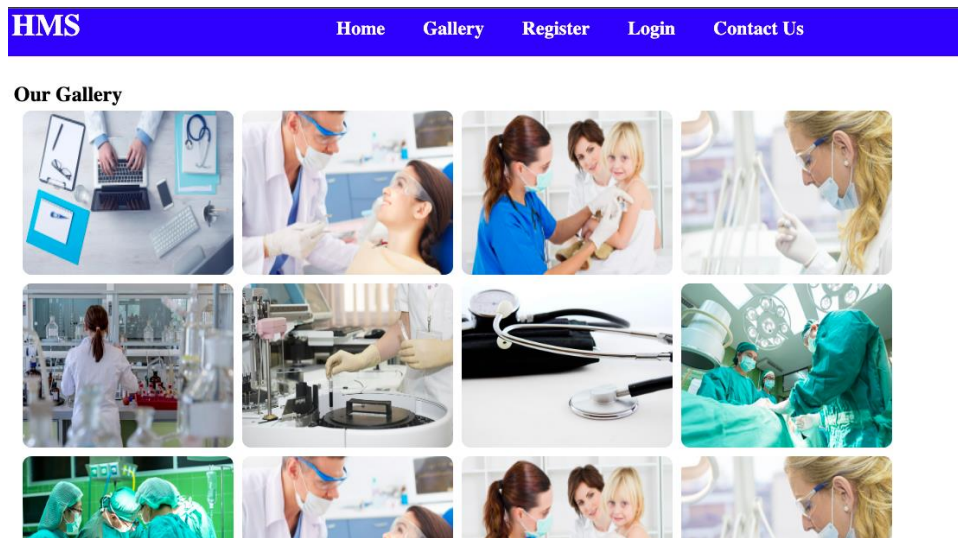


Fig. 9. Login page (It represents the log in page of our website)

HMS
Home
Gallery
Register
Login
Contact Us

Login Page

Username :

Password :

[Login](#)
[Login staff](#)
[Register New User](#)

Forget Password ? [Click Here](#)

Services
[HEPATOLOGY](#)
[MEDICAL DRESSAGE](#)
[LABORATORY](#)
[VACCINATIONS](#)
[WHITENING](#)

About Us
[Company Overview](#)
[Management](#)
[Initiatives](#)
[Carrers](#)
[Our Doctors Achieve](#)

Contact Us
[Post A Query](#)
[Apollo Clinics](#)
[Reach Hospitals](#)
[Apollo Cradle](#)
[Ask Question](#)

Facilities
[HEPATOLOGY](#)
[MEDICAL DRESSAGE](#)
[LABORATORY](#)
[VACCINATIONS](#)
[WHITENING](#)

B2. Project objectives

The projects' objective include;

1. Design a system for better patient care. An example scenario is that, there will be automatic notification that can be sent to customers on test results. Lab notifications like email, SMS of the test reports sent from the Automated Lab notification module.
2. Provide top management a single point of control hence better co-ordination among the different departments. Also be able to add any number of branches and manage them using a single account.
3. Make an accurate system and a lot of faster and every one the main information is properly kept. The responsibility of the system will be greater since the storage of information is way safer and easily retrievable.
4. Create a planned approach towards work, it'll Make it easier to work and notice information. Hence reduce redundancy since the storage is correct and no information will be continual. successively there's consistency in information saved.
5. Immediate storage of data. within the case of a paper system, it's cumbersome to store large data. Also, immediate retrieval of data. it'll be fast and simple to retrieve any data within the system with a straightforward search button.
6. Provide MIS (Management Information System) report on demand to management for better decision making. Also create Front Office/OPD Management and be able to access entire MIS data from your palm.
7. Have patient management (scheduling, registration and long-term care). For hospitals having their own site, appointment widgets will be integrated onto the site. Patients visiting the hospital's website can book online appointments with ease.
8. Integrated Billing with treatments, Lab and Radiology. Alerts will be sent on Discount Authorizations. Automatic due capture, Option to bill before and after consultation.
9. Comprehensive Pharmacy Management handles stock, Prescription Integration, Ward Request, Stock Management, Stock Moment and intelligent reports, also manage commonly and recently used medicines. Option to show medicines available in the pharmacy. SMS prescriptions to patients.
10. Have financial Accounting online (billing, insurance processing, materials management, accounts payable/receivable, payroll and general ledger)

11. Have template-based Discharge Summary. ICD10 integration. Option to prevent discharge summary till IP bill is closed.
12. The Comprehensive Lab Management should handle complete order management, Custom Reports, Smart Notifications, Credit Settlement, detailed MIS Reports, Analytics and App for phlebotomist. [5]

IMPLEMENTATION

C1. Project tasks

Task 1

Task name	IDENTIFY NEEDS AND BENEFITS
Entities involved in the fulfilment of the task	A questionnaire on doctors and patients
Short description of the task	I identified the needs and benefits of this software.
Task completion outcomes	There was a problem in the way data was stored and how patients received their results.
Start date of task execution	1/9/2021
End date of task execution	15/9/2021

Task 2

Task name	REQUIREMENT ANALYSIS
Entities involved in the fulfilment of the task	Using online drawing tools.
Short description of the task	Detailed analysis of the project Creating Data flow Diagram Data Dictionary
Task completion outcomes	Created a data flow diagram and a data dictionary
Start date of task execution	16/9/2021
End date of task execution	1/1/2022

Task 3

Task name	PROJECT MANAGEMENT
Entities involved in the fulfilment of the task	A step-by-step process on creating the project.
Short description of the task (max. 5 sentences)	Computing F.P. and Effort Schedule table Risk Analysis Timeline Chart
Task completion outcomes	created the entire project.
Start date of task execution	1/10/2021
End date of task execution	15/1/2022

Task 4

Task name	DESIGN ENGINEERING
Entities involved in the fulfilment of the task	Used visual studio code,
Short description of the task	Architectural Design Data Design
Task completion outcomes	Created a simple website for the hospital system by deigning how the user interface looks.
Start date of task execution	15/12/2021
End date of task execution	30/1/2021

Task 5

Task name	TESTING
Entities involved in the fulfilment of the task	White-box testing Black-box testing Unit testing
Short description of the task	<ol style="list-style-type: none">1. Testing with knowledge of inner working of the system.2. Testing without knowledge of inner working of the system.3. Combined code and unit test phase of software life cycle.
Task completion outcomes	<p>All the test cases mentioned above passed successfully. No defects encountered.</p> <p>Acceptance Testing:</p> <p>User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.</p> <p>Test Results:</p> <p>All the test cases mentioned above passed successfully. No defects encountered.</p>
Start date of task execution	15/1/2022
End date of task execution	30/1/2022

C2. Project implementation

1. Theoretical assumptions

A Hospital is a place where Patients come up for general diseases. Hospitals provide facilities like: -

- Consultation by Doctors on Diseases.
- Diagnosis for diseases.
- Providing treatment facility.
- Facility for admitting Patients (providing beds, nursing, medicines etc.)
- Immunization for Patients/Children.

Various operational works that are done in a hospital are: -

- Recording information about the Patients that come.
- Generating bills.
- Recording information related to diagnosis given to patients.
- Keeping record of the immunization provided to children/patients.
- Keeping information about various diseases and medicines available to cure them.
- These are the various jobs that need to be done in a hospital by the operational staff and Doctors. All these works are done on papers.

The work is done as follows: -

1. Information about Patients is done by just writing the Patients name, age and gender. Whenever the Patient comes up his information is stored freshly.
2. Bills are generated by recording price for each facility provided to patient on a separate sheet and at last they all are summed up.
3. Diagnosis information to patients is generally recorded on the document, which contains Patient information. It is destroyed after some time period to decrease the paper load in the office.
4. Immunization records of children are maintained in pre-formatted sheets, which are kept in a file.
5. Information about various diseases is not kept as any document. Doctors themselves do this job by remembering various medicines.

All this work is done manually by the receptionist and other operational staff and lot of papers are needed to be handled and taken care of. Doctors have to remember various medicines available for diagnosis and sometimes miss better alternatives as they can't remember them at that time.

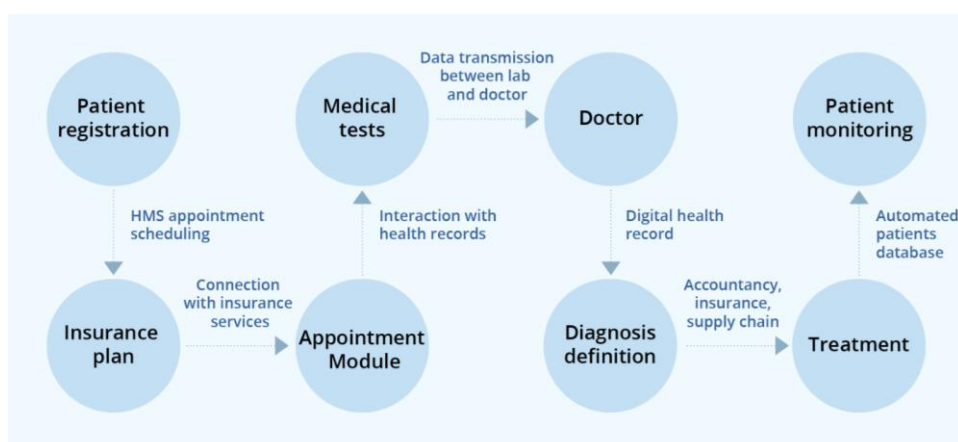
The main concept of hospital management software

As its name suggests, hospital management software is cloud-based or on-site software created for various healthcare institutions to store, process, and manage medical, administrative, and financial data. Three main categories of users use the HMS:

- Medical staff
- Hospital administration
- Patients

In particular, HMS helps to automate routine tasks, optimize staff coordination, improve communication, distribute the workload, store different types of information, and provide financial and HR management. Moreover, HMS helps healthcare institutions comply with governmental regulations on providing quality patient care, protecting data, and facilitating medical training management. Here is an example of how HMS typically works.

Fig. 10. Diagram of dataflow of the system



The different types of HMS

- **Operational**
This one is all concerning ordering and classifying monetary info a few patients, medical instrumentality, and hospitalization reservation.
- **Administrative**
This type of HMS manages all the interactions between patients and doctors.
- **Subject-based**
This type of HMS stores Electronic Medical Records (EMRs) or Electronic Health Records (EHRs). Compared to the executive sort, these collects all the patients' information, as well as the demographics, case history, history of present sickness.
- **Task-based**
The task-based sort is sort of a good task calculator. It prioritizes and distributes tasks between workers supported this hospital state of affairs.
- **Billing**
This type of hospital management system is accountable for observation and managing the finances of all the hospital departments. The goal of a digital product for a hospital is to unravel users' wants and serve a particular hospital's needs [6].

2. Description of facts

Hospital Management System is the subject of this project.

There are two levels of users in the project: -

1. Administrator Level-Doctor
2. User Level-Data Entry Operator

The following are the main features of this project: -

- Keeping track of indoor and outdoor patients.
- Keeping track of a patient's diagnosis and recommended tests.

- Providing various test facilities to a doctor for patient diagnosis. Stool Test X-Ray Urine Test Sonography Examination Gastroscopy Examination Colonoscopy examination Test of the Blood Test of Biochemistry Keeping track of the injections given to patients.
- Keeping track of a patient's prescriptions, medications, and dietary recommendations.
- Billing information for both indoor and outdoor patients.
- Maintaining data backups in accordance with user requirements (between mentioned dates).
- If a user forgets his or her password, a clue question can be used to retrieve it.

The data for this project was gathered from various pathology labs. The database will be automatically updated with test results, prescriptions, precautions, and diet advice. Users can create related test results, patient details reports, prescription and billing reports according on their needs. A patient's record can be searched by name or registration date by a user or administrator.

3. Empirical research

Improved Manual System: - one amongst the choice solutions is that the improvement of the manual system. Anything, which might be done by using automatic strategies, may be done manually. However, the question arises the way to perform factor manually with a sound manner. Following measure some suggestions, which might be helpful within the manual system. A lot of sophisticate register maintenance for varied Patient data, Doctor data, protection details and an honest system for writing bill quantity staff and stock availed for the shoppers may be maintained at central place. Adequate workers could also be maintained in order that change square measure created at the terribly moment at a similar time. correct person for correct work ought to be created accountable in order that a higher potency can be achieved. This wants loads of labour force.

Batch System: - Another various answer may be used of computer-based batch system for maintaining the data relating to purchase details, customers and staff. A batch system refers to a system within which knowledge is processed during a periodical basis. The batch system is ready to realize most of the goals and sub goals. However, a batch system knowledge is processed in serial basis. Therefore, batch system isn't recommended.

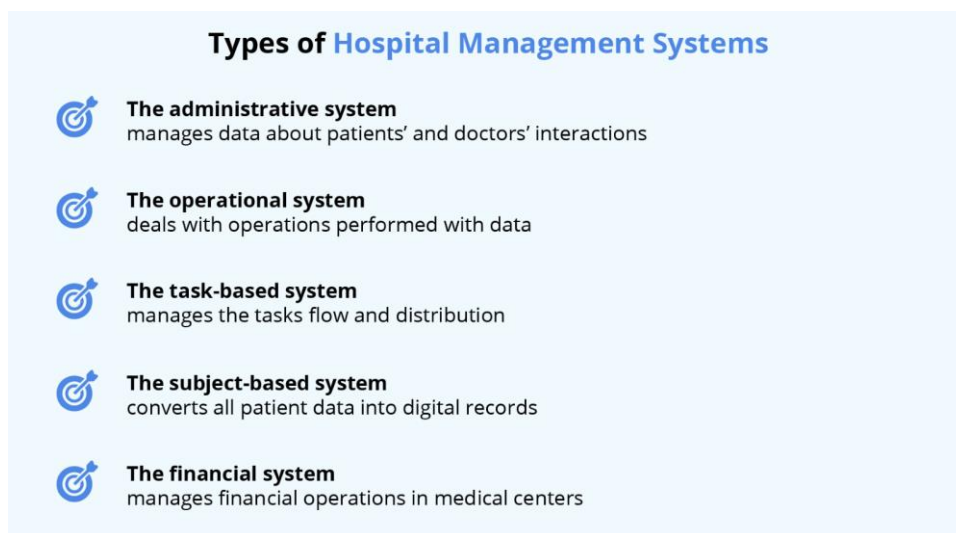
Online System: - this technique (HMS) provides on-line storage/ change and retrieval facility. this technique guarantees terribly less or no paper work and conjointly provides

facilitate to doctor and operational workers. during this system everything is hold on electronically therefore much less quantity of paper work is needed and data may be retrieved very easily while not looking out here and there into registers. this technique is been mentioned here.

Types of hospital management systems

Hospital management software can be divided into several categories according to its functions. Before you start to build an HMS, let's learn about its basic types and examples in the market.

Fig. 11. Types of hospital management system



1. The administrative system. This type of HMS is in charge of collecting, storing, and analysing all data related to patients' contacts with clinicians. The treatment course, medical history, medical aid, drugs, and other essential details are all included in the patient's data. In addition, the administrative HMS examines patients' medical information and generates reports on treatment effectiveness and overall patient care.
2. The tactical and operational system. Medical data errors can have serious consequences for institutions and patients. The operational and tactical hospital system can aid with this. The goal of this system is to organize and classify essential medical data within the covered entity. Healthcare data becomes genuinely accessible and interoperable at every level of the business with the help of this technology. It can also spot discrepancies in medical data across the board. Despite the information comparability, the operational HMS has distinct data access levels for different user statuses.

3. Task-based systems. Every day, any medical organization must complete thousands of duties. What is the best way to allocate these responsibilities among medical personnel? How can you keep track of how they're being carried out? Employees find out about work details and deadlines in a variety of ways. A task-based HMS is the best approach for managing and supervising tasks. Rather of wasting time and resources on manual job distribution, this technology can assist clinics in creating and assigning assignments to the necessary specialists automatically. Workers receive messages with specific descriptions and timeframes after the task is generated.
4. Subject-based systems. This hospital management software is a medical system that turns paper data from patients into Electronic Health Records (EHR) or Electronic Medical Records (EMR) (EMR). Papers are simple to misplace and difficult to keep track of. As a result, subject-based systems are critical for hospitals, as they significantly reduce the risks associated with paper documents while also assisting in data management. Furthermore, these systems allow for virtual data sharing, updating, and deletion.
5. Financial or billing systems. Another important aspect of hospitals is their finances. Healthcare organizations must deal with billing and insurance operations in addition to administrative, operational, and medical services. Integrating a financial system into a medical practice is critical for long-term financial success. Following the receipt of medical services, this system processes the patient's treatment record and submits it to the patient's insurance company to expedite reimbursement. Billing systems also save and record all financial data so that it can be retrieved promptly when needed.

When constructing an HMS, there are a few things to keep in mind.

Because healthcare is such a specialized sector, developing hospital management software necessitates a wide range of particular features not seen in other industries. The functionality of a hospital management system can be separated into two categories: managerial tasks and patient care.

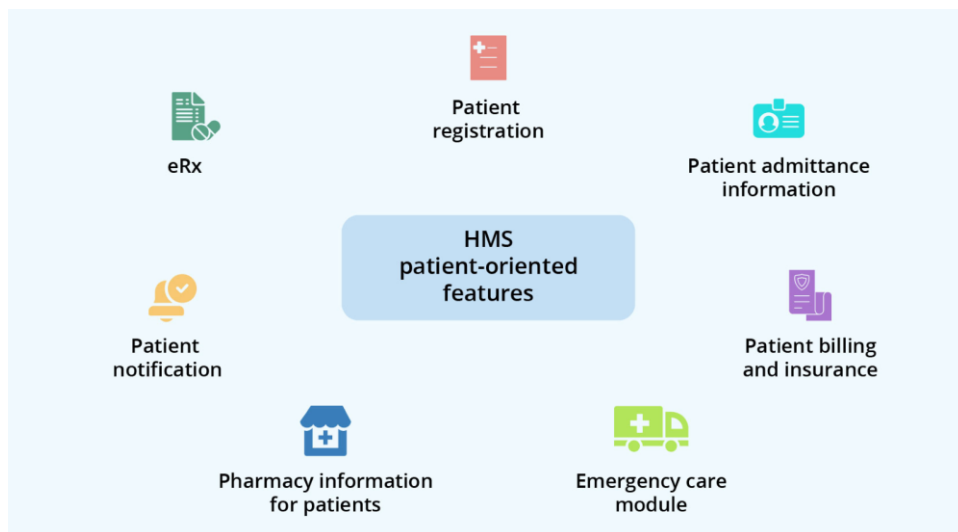
Let's look at the features you'll need in a hospital administration system in more detail.

HMS management-oriented features

1. Doctor timetables. Caregivers can use this function to look over their schedules, make appointments, and share schedules with patients.

2. Operation room management. This allows employees to better arrange and manage the hospital's surgical facilities, as well as better distribute resources connected with their utilization.
3. Ward management. This aids caregivers in planning, tracking, and managing the hospital's many departments.
4. Pharmacy management. These aids medical personnel in keeping track of medicine inventories.
5. Food supply management. Patients' diets are usually restricted when they are in hospitals for medical treatment. This module assists cafeteria personnel in ordering and preparing meals according to each patient's needs.
6. Inventory and purchase management. Except for pharmaceuticals, this component keeps track of the inventory levels of hospital supplies. For example, it keeps track of ambulance fuel costs, as well as water and energy usage.
7. Patient registration. This feature allows patients to register for hospital admission.
8. Patient admittance information. After a patient has been admitted, this function collects and saves electronic health records. It also keeps track of and retrieves patient information.
9. Patient billing and insurance. This is where patient financial operations, like as billing and insurance, are managed.
10. Emergency care module. This module aids in the quick registration of emergency room patients.
11. Pharmacy information for patients. This facilitates the ordering and refilling of pharmaceutical prescriptions for patients.
12. Patient notification. Patients are notified of their appointments, medication timings, and discharge suggestions, among other things. A separate web or mobile application linked to the hospital management system could perform this role. Existing messenger apps might potentially be used to provide the reminder capability.
13. Integrations between eRx and e-prescription services.

Fig 12. Hospital management-oriented features

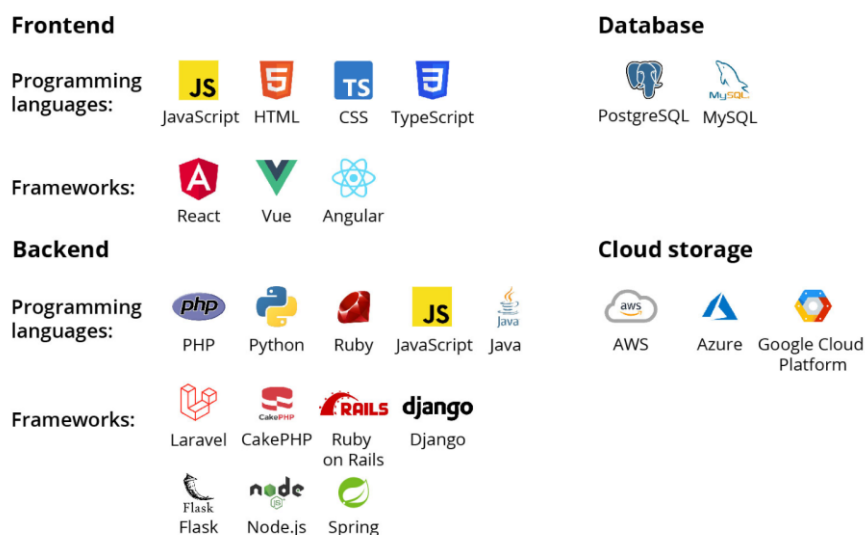


The HMS technical side

We can move on to looking at the tech stack of your future HMS now that we've covered the many types and characteristics of a hospital management system.

We've enlisted the help of our top professionals to offer the framework, programming languages, databases, and cloud storage technologies required to construct hospital administration software.

Fig. 13. programming languages needed



The architecture of hospital management software is being designed.

We made a small HMS with only the frontend completed after considering what we've discussed so far. First, determine which procedures you'd like to streamline and automate with your hospital management system. The feature set that will be necessary to implement these processes has been decided. The particular tech stack you'll need to achieve this functionality has been finalized. You've decided the platforms you'd like to develop (mobile, web, or cloud.). Your HMS's roadmap has been created in depth. Check to see if your HMS is compatible with the hospital's, IT system. Ensure that all medical staff requirements were elicited and documented. Create an intuitive user experience by working on user interface design. Keep a flexible mindset in mind. Begin small and work your way up. To test, create an MVP of your product and grow gradually. Started the frontend side [7].

C3. Project outcomes

1. Improved diagnosing and Treatment

The main outcome of a sensible hospital management system is that it improves patient designation and treatment. The patient's health report and medical record from the past to this, similarly because the unwellness he's full of and also the care he received, will all be other to and accessed via the HMS. victimization this data, doctors will higher assess patients' health issues, ultimately empowering them to supply the simplest care attainable.

2. Seamless Functioning of The Hospital Facility

Every hospital may be a machine in itself. a part of the hospital is interconnected, whether or not it's employees, physicians, inventory, or finance. Therefore, so as to supply a more robust performance overall, all the elements should be in sensible operating order and operate in bicycle-built-for-two. this will be accomplished with the assistance of a hospital management system. The sensible hospital management system ensures that each element of the hospital facility is in sensible operating order which the simplest attainable results area unit achieved.

3. Higher Inventory Management

Any hospital, whether or not multispecialty or surgical, includes a wide inventory of medicines, medical instruments, perishable things like masks, gloves, and syringes, patient refreshment, bedding product, and far a lot of. All of those things should be preserved to this point in the slightest degree times to make sure the hospital's swish running. Using HMS, it is able to get a daily update on the market stocks and so effectively manage your inventory.

4. Availability of data At Fingertips

The hospital's information permits you to trace and monitor varied events to enhance your approach and set performance targets. With a sensible hospital management system, you may have all of the small print you wish at your fingertips, as well as the patient's medical record, inventory, finance, workforce, and more. you'll be able to use this data to work out what flaws there are units within the system or within which department and the way to mend them. the data additionally aids you in developing a long strategy for your building.

5. Cut on expenses

When all of the hospital's operations are handled manually, there's a high risk of data escape and irregularities. Because, as humans, we tend to have habits of creating mistakes. These errors can have serious consequences within the long-term. However, with the help of a sensible hospital management system, we will be able to simply management all of the hospital's operations, even with fewer human resources. Moreover, this can additionally limit human interference within the system, leading to lower operational prices and fewer escape.

6. Increased information Protection

Another vital advantage of hospital management systems is improved information protection. Since everything is finished through a secure system, solely licensed people have access to the particular information assortment. what is more, in an exceedingly cloud-based hospital management system, everything is interconnected, guaranteeing that there aren't any risks of {information} loss which the patients' medical record or condition information remains fully protected.

7. Real time information Access

Since a sensible hospital management system may be a centralized system, doctors, body personnel, and alternative workers will access information in period of time, sanctioning them to create the simplest selections attainable. as an example, the period of time information regarding the inventory can assist management in replenishing and change the inventory. Similarly, the period of time information regarding the patient's treatment can assist doctors in creating clinical selections with no area for error or ambiguity.

8. Needs Less workforce

To keep hospitals running swimmingly or to handle variety of functions and activities manually, you'll actually would like many trained personnel. However, a lot of human resources mean a lot of expenses within the long-term. But, with the assistance of a sensible hospital management system, you'll be able to considerably cut back the personnel strength. Since the HMS software package can handle each operation, you may not would like a similar range of workers as manual management.

9. Accuracy of the system was much higher and every one the small print was properly stored.

10. The reliability of the system is larger since the storage of data is way safer.

11. Any organization using this application has a planned approach towards work, it's well organized.

12. It is easier to control and find data.
13. There is no redundancy since the storage is accurate and no data will be recurrent.
Successively there is consistency in data stored.
14. Immediate storage of information. Within the case of a paper system, it's exhausting to store massive data. Immediate retrieval of information. it's fast and simple to retrieve any data within the system with an easy search button.
15. Enhanced productivity and facilitate daily routine. Users' day-to-day activities should be simplified by software, allowing them to do tasks faster and more reliably. As a result, work efficiency is greatly improved, and the risk of human-caused errors is significantly reduced. For instance, hospital management system should provide an automated solution for quick update of patients' histories to add or remove symptoms; alter a list of medications based on a patient's condition, etc. This also helps to reduce downtime and queues for medical equipment and operation rooms. When a patient cancels an appointment, for example, the appropriate doctor's schedule is changed in real-time, and the changes are noted.
16. Promoted communication between hospital departments and wards. To deliver efficient services, a hospital is a complex institution that requires exact coordination and swift responses from all of its parts. The hospital management system should enable for the retrieval of necessary data in digital or printed form, as well as in a timely, dependable, and secure manner. Analysis results, operating room scheduling, pharmacy inventory, and other forms of data are examples of good data.
17. Improved patients' experience during any interactions with the hospital. A dependable and convenient system will increase patients' trust in medical services, attracting more customers and improving the facility's reputation. Furthermore, a well-designed system should alert patients about visits with their doctors or daily prescription regimes, for example.
18. Optimized payment and billing. A hospital is a commercial entity that incorporates all financial transactions between a service provider, executives, clients, suppliers, insurance companies, and other entities. Different kinds of payment for medical services and products should be allowed by the hospital administration system, which will be a big benefit for all financial operations. Treatments, lab, and radiology billing are all integrated. Discount Authorizations will trigger alerts. Automatic due date reminders, as well as the option to bill before and after a consultation.

19. Structured data on employee performance was provided. By tracking the performance of hospital employees and giving complete information to the administration, a management system provides an extra business advantage. These extensive reports may be used by hospital administration to determine which sorts of hospital services generate more money and which unprofitable departments may be cut in funding or terminated, either temporarily or permanently. It also aids in identifying and resolving potential issues before they grow and spiral out of control, so avoiding financial and reputational harm.
20. Provide management with MIS (Management Information System) reports on demand so that they may make better decisions.
21. It creates better co-ordination among the different departments and also provides top management a single point of control.
22. Create Front Office/OPD Management. Have patient management (scheduling, registration and long-term care). For hospitals having their own site, appointment widgets will be integrated onto the site. Patients visiting the hospital's website can book online appointments with ease.
23. Modules for patient care management and departmental management (radiology, pharmacy and pathology labs)
24. Stock, Prescription Integration, Ward Request, Stock Management, Stock Moment, and intelligent reporting are all handled by Comprehensive Pharmacy Management.
25. Manage commonly and recently used medicines. Option to show medicines available in the pharmacy. SMS prescriptions to patients.
26. Have financial Accounting online (billing, insurance processing, materials management, accounts payable/receivable, payroll and general ledger)
27. Customers can be notified automatically when test results are available. The Automated Lab Notification module sends out lab notifications such as email and SMS of test reports.
28. Have a discharge summary that is based on a template. Integration with ICD10. Option to keep the discharge summary hidden until the IP bill is paid.
29. The Comprehensive hospital management should handle complete order management, Custom Reports, Smart Notifications, Credit Settlement, detailed MIS Reports, Analytics and App for phlebotomist
30. You have the ability to access entire MIS data from your palm.

31. You are able to add any number of branches and manage them using a single account.
Thus, in spite of the high investment, it is a good deal. Furthermore, it is possible to keep track of minute details such as room occupancy, staff availability, and operational data.
32. Improved clinical decision-making The system ensures that operational and hospital decisions are made quickly, accurately, and efficiently. Doctors and medical support professionals are aided by the quick, single-view access of data points.
33. Data security has improved. Experts have stated that hospitals that use manual methods are more vulnerable to data theft and leaking than those that use automated systems. Every piece of information in a full-fledged hospital management system is kept safe from unwanted access.

C4. Usefulness of project

The project Hospital Management System (HMS) is for computerizing the working in a hospital. The software takes care of all the requirements of an average hospital and is capable to provide easy and effective storage of information related to patients that come up to the hospital. It generates test reports and provides prescription specifics to the patient and doctor, including numerous tests, food counselling, and drugs recommended. It also gives injectable information and invoicing services based on whether the patient is an indoor or outdoor patient. The system also has a backup feature that can be used as needed. Here's a detailed look at how effective a hospital management system may be.

1. It processes Speed and Results: Hospital management systems adhere to standard operating protocols, and no deviations are possible in any of the effective HMS systems. With the deployment of HMS in your labs or hospitals, you will be able to better treat patients by immediately obtaining real-time reports and other information about them, as well as their previous clinical data and more. This will result in better patient outcomes. For improved results, the hospital management system makes employees' work more accessible and improves the speed of the entire process.
2. It is cost effective: HMS information system helps to track and control finances, reduce leakages as well as reduce manual work and therefore there is no requirement of the higher human workforce. Hospital management systems assist in reducing the amount of

manual work performed by humans in hospitals, particularly for those who are responsible for keeping track of records and documents. Because the majority of the job is automated, the hospital management system aids in lowering human resource expenses. Reduce the costs associated with storage and other related requirements. If your hospital has fully implemented HMS, it will become paperless; however, maintaining mandatory paperwork and other associated documents in your hospital to meet regulatory standards is sufficient. Every process is automated, reducing staff workload and increasing productivity with an HMS solution. Manpower is reduced as a result of the software. Obviously, why devote resources to a task that software can readily handle? As a result, you'll be able to save money. Because the system is now fully automated, hospitals that have integrated HMS no longer require paper records, physical storage places, or operators to control the workflow. Because of actual operational performance, there is also a reduction in operating costs. There is no need for more resources to manage operations when processes and systems are automated. It means that a faster break-even point and a higher return on investment can be easily reached.

3. **Reduction in Errors:** Hospital management system helps in reducing different types of errors that made through interventions like missing billing, operational failure, clinical errors, cost leakages, missing appointments and much more. Every process on the hospital management system is automated, and there are plenty of tasks provided to the software to perform without the human intervention as well as accurately, this reduces the error significantly. For example, An IPD patient final bill amount can be easily generated if your hospital enabled of Hospital management system as his reports and other samples bill are already billed and safe under the Patients unique Hospital ID, and therefore the billing executive needs to generate from the system and provide the statement to the patients hence an accurate result each and every time. If your hospital is not HMS enabled then you need to go with manual entries which involves too many human errors, so preferring HMS will make your billing section easier, faster, accurate and more transparent. Nullify every error and track complete details: Managing a hospital is not much easy, and there are chances for some mistakes to occur. A manual system can ensure 100% accurate processing and fool proof. There are higher chances for mistakes and errors in this case. To eradicate this, the best decision is to install an automation hospital management system that highly nullifies every mistake and also you can avoid lawsuits and compliance issues, which is considered to be the two most significant drawbacks of hospitals and medical centres. Apart from this, tracking the accurate details

of staff availability, operational information, and room occupancy can also be readily available at your fingertips by using the automated Hospital Information System. Significantly, you make use of the state-of-the-art system with centralized controls. Make sure you are not implementing a standalone home-grown one. There are no chances for errors when an access-controlled system manages everything as the information availability relies on user rights. It's also one crucial reason why hospitals, rehabilitation centres, clinics, trauma centres, and nursing homes make use of the high quality and automated Hospital Management System.

4. The effective distribution of resources is vital to good care and the overall well-being of the organization. A well-managed workload and efficient budgeting, in particular, allow for optimal planning of hospital performance. Subject-based alternatives due software with extensive scheduling capabilities can also improve doctor-patient communication. In addition, it is possible to keep track of clinical, patient, and financial data if all records and transactions are preserved in the system.
5. Data Security and Retrieving Ability: In a hospital management system, they are one of the cloud-based software where everything gets interlinked, and therefore there are no chances for breaches to occur as they have high data security. Evidence-based medicine requires the retrieving ability as well as data ability mandatorily, and this easily achieved through a hospital management system. If you have Hospital management system on your hospital, then you can easily access the operational, clinical and financial data of your hospitals. Since the HMS solution holds and maintains large volume of sensitive health data, test results, and treatments, the software is securely designed and developed to protect all this sensitive information. It is technically safeguarded through various healthcare regulations and compliances. Data transmission using a secure protocol and the possibility to manage user access levels provide you with the opportunity to flexibly control access to data and be sure it is safe. The experts have reinforced and highlighted the fact that the hospitals, medical centres, and clinics depend on the manual system. It can lead to higher data leakage and theft when compared to automated ones. Installing a complete and automated HMS indicated that your pieces of the information stay safe and protected from any unauthorized sources and accesses.
6. Improved Patient Care: Enhanced work efficiency and improved patient data access mean faster and better clinical decisions. A clinician orders the solution to implement once he gets the diagnostic report on his hand, so it is necessary to have speedier support for receiving the reports rapidly. All departments in the hospitals are interconnected and

integrated with this automation, and this enhances the patient care quality as well as the hospital turnovers. Today with increasing technological advancements, patients' expectations for improved care delivery are on the rise. Patients want greater efficiency, convenience, and comfort. An HMS solution has it all. The software comprises many features that improve care delivery, outcomes, and costs. For instance, an online appointment scheduling portal allows patients to schedule and book an appointment with a doctor online. It helps them in saving waiting time and money. Another example, patient's data collection and storage, its easy accessibility enables Doctors to make error-free, quick decisions. Thus, improving patient care and clinical processes.

7. **Quality and Compliance:** Every hospital shall send a monthly report to NABH accreditation detailing all births and deaths, as well as their causes and solutions. It's difficult to organize them manually, so choosing the finest HMS can help you send reports faster and on time. Every report is carefully reviewed and maintained in the Hospital Management System to ensure accurate results. For coordinated and speedy care, decreased expenses, reduced waiting time and readmission, and improved patient safety and clinical care, everyone favours HMS for their hospitals.
8. **Revenue management:** Humanity is served by a medical centre or hospital. Aside from that, profit is more crucial because it is also a business. One of the most important aspects is revenue management, as running a hospital requires a lot of luck. Furthermore, using the old-fashioned manual system, it is impossible to track the same thing. An automated HMS that is tailored to the demands of the organization can assist in efficiently completing the task. It generates accurate and timely management and transactional data, giving you a comprehensive picture of how your company is doing. What are the debts, interest, and pending invoices, as well as the due amounts?
9. **Enhanced decision-making in hospitals:** A precise Hospital Management System ensures that clinic decision-making is precise, quick, and useful. Medical support employees and doctors' benefit from a single perspective and easy access to data points.
10. **Obtain the best quality ratings:** If you want your hospital to be the best-rated and most recommended by insurance providers, you'll need to establish a Hospital Management System. Only when the hospital has an automated system do insurance and Medicare firms rely on digital data. If your clinic is capable of sending and receiving patient information, such as medical records, digitally, it signifies that your hospital will be the top choice among patients. Among other nursing homes, medical centres, and hospital

competitors, an accurate and quick Hospital Management System stands out. It offers tremendous value to your hospital and establishes a market reputation.

11. Make your hospital look technologically advanced. HM portals can create a more focused environment for hospital personnel, doctors, groups, and patients, as well as manage workflows. Portal solutions may even merge legacy programs, items from other portals, and handle a large number of user queries, allowing for an unrestricted flow of information between employees, doctors, and patients.
12. Reduced Hospital Readmission. A hospital management system improves patient experiences by promoting communication between doctors and patients. The frequent interventions and connected care that are made possible after patients are discharged from the hospital to post-acute care lowers the likelihood of readmission. Because regular and timely online check-ups and follow-up procedures taken by the patient lessen the severity of sickness. For example, connected care allows doctors to recognize early indications and symptoms of probable diseases and treat them immediately or prepare the patient for the next phase of their care before they become a health risk. As a result, clinicians will be able to reduce hospital readmissions.
13. Increased productivity. An HMIS solution enables health-care providers to evaluate clinical documents, diagnosis reports, patient medical records, and history in real time. As a result, they will be able to make more precise decisions and increase hospital productivity.
14. Access to data in real time. Doctors, administrative professionals, and other employees may access data in real-time thanks to the centralized nature of a smart hospital management system, allowing them to make the best decisions possible. The real-time inventory data, for example, will aid management in refilling and updating the inventory. Similarly, clinicians will be aided in making clinical judgments with no opportunity for error or ambiguity thanks to real-time data about the patient's therapy.
15. It necessitates less manpower. Hundreds of trained workers are required to keep hospitals functioning efficiently or to physically execute a variety of functions and activities. More human resources, on the other hand, means higher long-term costs. You can, however, considerably cut workforce strength with the help of a clever hospital management system. Because the HMS software will handle all operations, you won't need as many workers as you would with manual management.
16. Diagnosis and treatment have improved. A smart hospital management system's key value is that it enhances patient diagnosis and treatment. The HMS can be used to

contribute to and access the patient's health report and medical history from the past to the present, as well as the ailment he is suffering from and the care he received. Doctors can better assess their patients' health concerns using this information, allowing them to deliver the best care possible.

17. **Seamless Functioning of The Hospital Facility.** Every hospital is a self-contained machine. Staff, physicians, inventory, and finance are all interwoven parts of the hospital. As a result, in order to deliver a higher overall performance, all of the components must be in good functioning order and work together. With the help of a hospital management system, this can be accomplished. The smart hospital management system ensures that all of the hospital's components are in good functioning order and that the greatest potential results are obtained.
18. **Improved Inventory Control** Any hospital, whether multispecialty or surgical, keeps a large supply of pharmaceuticals, medical tools, biodegradable materials like masks, gloves, and syringes, patient refreshment, bedding supplies, and other items on hand. To maintain the proper operation of the hospital, all of these items must be kept up to date at all times. You can get a daily update on available stocks using HMS, allowing you to better manage your inventory.
19. **Information is readily available at one's fingertips.** You can use the hospital's data to track and monitor numerous events in order to enhance your approach and create performance goals. You'll have all the information you need at your fingertips with a smart hospital management system, including the patient's medical history, inventory, finance, workforce, and more. You can use this information to figure out which departments or systems have weaknesses and how to solve them. The data can also help you plan a long-term strategy for your healthcare centre.
20. **Reduce Unnecessary Expenses.** There is a substantial risk of information leakage and irregularities when all of the hospital's operations are managed manually. Because we are all prone to making blunders as humans. In the long run, these blunders will have major implications. You may simply control all of the hospital's operations, even with less human resources, with the help of a smart hospital management system. Furthermore, human intervention in the system will be reduced, resulting in lower operational expenses and less leakage.
21. **Access from any device.** Cloud-based technologies are used in modern hospital administration software. As a result, once staff have access to the Internet, they can

operate with the system from anywhere. Working on a tablet or smartphone is possible with a software mobile version.

22. Detailed efficiency analytics. You can examine your business efficiency or profitability as a whole or separately while recording critical performance indicators and generating reports.
23. Patient data single source. A hospital management system with a patient database allows you to store and retrieve the most up-to-date and relevant information on the clinic's clients in a single location.
24. Resource optimization. A hospital management system with a patient database allows you to store and retrieve the most up-to-date and relevant information on the clinic's clients in a single location.
25. Time and money saving. Patient request processing is sped up, and many operational activities are automated, thanks to hospital management software. You can limit the danger of data loss and lessen the possibility of errors.
26. Services quality improvement. Hospital CRM enables a more tailored patient experience, which boosts customer retention and encourages them to return rather than go to your competition.
27. Improved workflow. A hospital's efficiency can be considerably improved by using a system that can manage all forms of medical data, inventory, outcomes, and reporting. Furthermore, the software automatically filters data, resulting in faster operational operations and the elimination of time-consuming, repetitive tasks that humans must perform.
28. Human errors are the second most common cause of healthcare mismanagement, and the hospital management system greatly reduces the chances of this happening. Improved data management, for example, reduces the possibility of duplication, record typos, and other problems. [8].

C5. Project self-evaluation

As I was doing this project, I have exhibited a great work ethic, problem-solving skills and a desire to create new and better ways to do my project.

I have gathered a lot of helpful information for ways I can improve my work function and how I operate as an individual. Because I am passionate about my work, I tend to take on many tasks at once and avoid delegating to other teammates. With this, I have learned to be mindful of my responsibilities, in that I realised that I had to do a lot of work of which I could have allocated to different members had it been a team work.

An ambitious self-starter, I intend to grow in this field of study and use my knowledge to learn as much as possible about information technology. I am heavily considering earning a Master's in IT to be better at my skills and expertise. As I learn and grow, I hope to own a business in this field one day, and treasure the experience I have gained from this project.

C6. Materials and bibliography used to carry out the project

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C7. List of annexes