Project Title: Hospital Management System

Deliverable 2

Group Name: Geeky Techs Group

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Description:

A hospital's many procedures can be streamlined and optimized with the help of the Hospital Management System (HMS), a complete software package. The system consists of several interrelated parts, each of which performs a certain job to guarantee effective administration of patient care, office work, and general operations.

The Hospital Management System (HMS) operates through a few interrelated workflows and processes to guarantee the efficient running of different hospital departments and services. An outline of the system's functionality is provided below:

System structure:

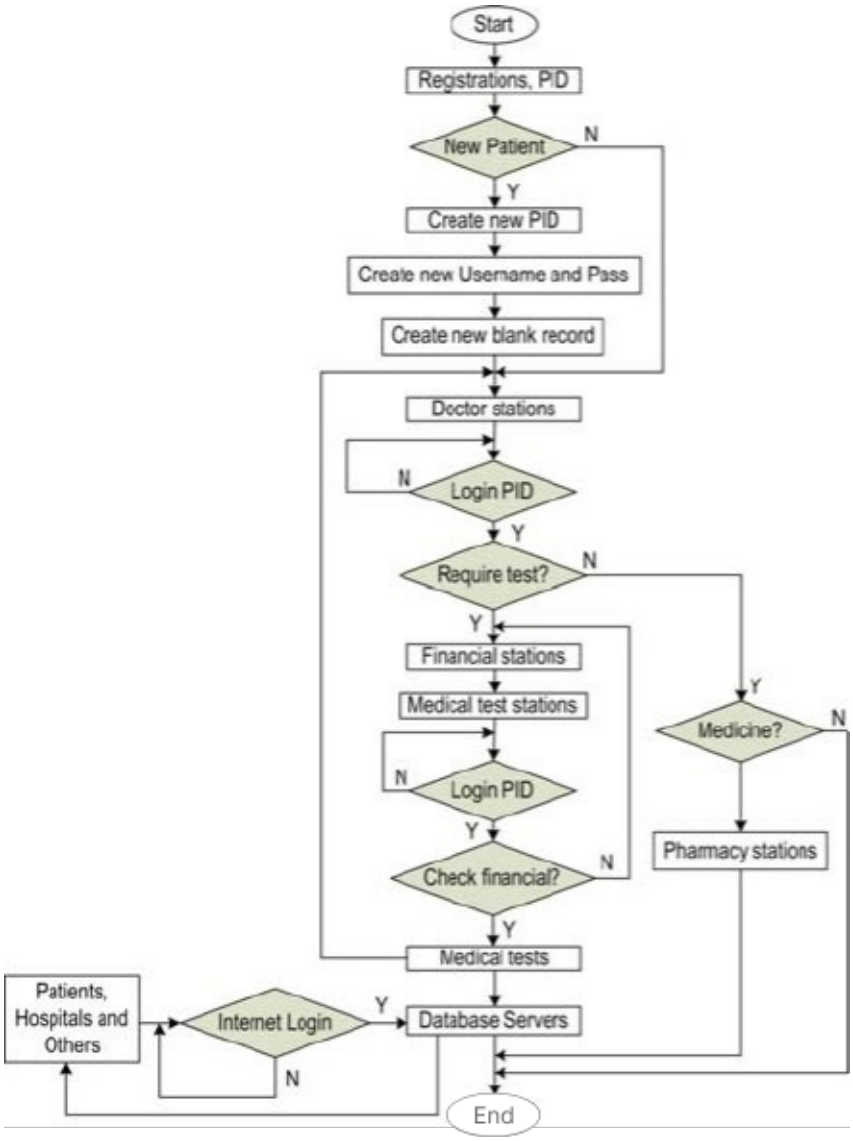
User Interaction:
Users, such, as administrators, physicians, nurses, patients, and other staff members engage with the system via the user interface. Upon logging in they are presented with a dashboard that displays information and functionalities based on their roles and access rights.

Patient Management:

When a new patient arrives at the hospital the registration process begins at the reception desk. The hospital staff input the patients information into their system, which includes details such, as insurance coverage, medical background, and personal information. Each patient is assigned an identifier to help with identification and record keeping within the system. Throughout their stay medical staff update the patients records with information on diagnosis, treatments, medications, and other important detail

Appointment Scheduling:

The system provides a calendar view that shows time slots for healthcare providers. Doctors and administrative staff use this module to book appointments, for patients. Additionally, patients may have the option to request appointments online through the portal.



Electronic Health Records (EHR) Management:

Healthcare providers utilize patients EHRs to check lab results, treatment plans, medical backgrounds, and other pertinent information by logging into the system. Doctors review lab results, treatment plans, medical histories and other relevant data stored in patients electronic health records (EHRs) by logging in.

Billing and Invoicing:

Healthcare providers enter billing information into the system following the provision of medical services.
Based on the services provided and related billing codes, the system creates invoices for patients.
The system allows users to electronically submit insurance claims, and it tracks the progress of such submissions to guarantee prompt reimbursement.

Inventory Management:

Pharmaceuticals, medical equipment, and supplies are tracked and managed by hospital staff using the inventory management module.
Real-time inventory monitoring is done, and alerts are sent out when things expire or there is insufficient stock.
Orders are placed straight through the system to restock inventory.

Integration of Laboratory Information System (LIS):

The LIS module is used by laboratory workers to handle test requests, sample processing, and reporting of results.
For ease of access by medical professionals, test results are stored in the system and connected to patients' electronic health data.

Pharmacy Management:

The pharmacy administration section is worked by pharmacists to lookup for prescription requests, drug dispense, and keep record of their inventory.
To protect patients, dose recommendations and notifications of potential drug interactions are given.

Reporting and Analytics:

The reporting and analytics module is used by administrators and department heads to create reports on patient outcomes, financial performance, and hospital operations.
Tools for data visualization make it easier to spot trends, patterns, and potential improvement areas.

The Hospital Management System functions, as a centralized platform that simplifies duties fosters communication, among healthcare providers and enhances the quality and effectiveness of patient care.

Requirement and Specification:

Project scope:

Basically, our **Project Hospital Management System (HMS)** is a software application which will help's in processing its assigned task and people providing homecare services, as an extension service offered by hospitals. The system will schedule doctors and keep track of the patients attended to. It will hold information about each patient, including the medication schedule, and assign doctors according to a preset algorithm. The patients will also have access to the doctor's information assigned to them.
However, this will only provide basic information, such as the doctors contacts.

The HMS will have various inputs including:

a. The patient information: such as name, contact, medical history, and insurance cover. This can also include the patient's preferred schedule. This information will be input by the hospital staff.

b. Medical Schedule: This will include the treatment plan of each patient, medication details, dosage, and any other details provided by an attending physician. The information will be provided by the pharmacy and medical staff such as the attending physician/doctor.

c. Physician Details: The physician details will entail the name, schedules, availability, qualifications, and preferences. The physician information will be input by the Human Resources department and the Physician Scheduler.

d. Treatment Record: This information will be entered by each doctor after attending to the patient. It will act as a monitoring and evaluation tool to verify the physician attended to the patient and the services provided.

Processing Functionality:

a. Patient and doctor Matching:

The system will analyze each doctor schedule to check for availability. The system will provide a list of available caregivers which is then selected by the Physician Scheduler. However, the system can also assign doctor automatically based on availability. The assignment done by the system is editable. The system will also prioritize the preference of the patient when assigning doctor.

b. Medication Scheduling:

The system will create medication schedules for each patient. The system will ensure correct dosage and frequency. It will integrate an alarm system that will alert the doctor and the patient of the pending medication.

Output:

a. A list of doctors assigned for each patient and the scheduled visit dates. The report will be accessible through the system and will be downloadable. The patient will also have a report on the upcoming visits up to one week.

b. Each patient and doctor will also receive automated and personalized reminders to ensure timely medication administration. This will include SMS, email, and in-system alerts.

c. Various reports on the number of visits per doctor, and records of medications provided.

d. The system will also generate activity logs for security purposes.

Major software functions:

The major software functions will include:

a. Patient and doctor scheduling

b. Patient information management

c. Medication schedule management

d. Provide patients access to doctor information

Functional Requirements:

Patient management includes the following tasks:

- Registering new patients
- Updating and recording patient demographics
- Giving patients unique identifiers
- Managing patient admissions and discharges
- Monitoring patient visits and appointments
- Creating patient identification cards or wristbands

Appointment Management includes the following tasks:

- Organizing doctor's, specialists', and other staff members' appointment calendars
- Scheduling patient appointments
- Reminding patients of upcoming appointments by phone, email, or SMS
- Rescheduling or canceling appointments as necessary
- Assigning appointment slots in accordance with patient preferences and provider availability

Medical Records Management including the following:

- Creating and managing patient electronic health records (EHRs).
- Recording and keeping track of medical histories, diagnoses, treatments, and results.
- Recording clinical notes, progress reports, and discharge summaries.
- Organizing lab results, radiology images, and other diagnostic reports.
- Guaranteeing adherence to legal requirements for data security and privacy.

Billing and Insurance Management including the following:

- Producing statements and invoices for patient services
  Verifying the eligibility and validity of patients' insurance.
- Filing insurance claims and handling reimbursements.
- Handling billing disputes and appeals.
- Integrating with financial systems for revenue cycle management and accounting

Prescription and Medication Management including the following:

- Monitoring medication inventories and expiration dates.
- processing prescription orders from healthcare providers.
- keeping track of medication administration and dispensing.
- alerting patients to drug interactions, allergies, and contraindications.
- facilitating pharmacy communication and electronic prescribing

Clinical Decision Support including the following:

- Notifying clinicians of potential safety risks, medication errors, and adverse events.
- Providing clinical decision support tools for healthcare providers.
- Providing evidence-based guidelines and protocols for diagnosis and treatment.
- Supporting diagnostic reasoning and differential diagnosis.
- Integrating with medical knowledge databases and literature resources

Inventory and Supply Chain Management include the following:

- Controlling the amount of drugs, equipment, and medical supplies in stock
  Monitoring product recalls, expiration dates, and quality control.
- Automating purchase orders and supplier transactions.
- Tracking stock movements, consumption trends, and reorder points. and Optimizing inventory logistics and distribution channels

Electronic Medical Imaging and PACS Integration includes the following:

- Providing tools for image analysis, annotation, and reporting.
- Integrating with Picture Archiving and Communication Systems (PACS) for the storage and retrieval of medical images.
- Displaying radiology images, scans, and diagnostic tests within patient records.
- Enabling clinicians and specialists to access imaging studies remotely.
- Guaranteeing compliance with DICOM standards for medical image exchange.

Laboratory Information System (LIS) Integration includes the following:

- Creating lab test requisitions and specimen labels.
- Tracking specimen processing, analysis, and reporting workflows.
- Integrating with Laboratory Information Systems (LIS) to manage lab test orders and results. Transmitting electronic lab orders and results between healthcare providers and laboratories. Supporting interoperability with various lab equipment and testing platforms

Interdisciplinary Care Coordination includes the following:

- Encouraging coordination and communication between interdisciplinary care teams.
- Managing interdisciplinary rounds, conferences, and case discussions.
- Coordinating care plans, referrals, and consultations between healthcare providers.
- Exchanging real-time patient data and updates across care settings
- Encouraging patient-centered treatment methods and continuity of care

Hospital Operations and Facility Management includes the following:

- Controlling occupancy rates and bed allocations
- Planning surgical procedures and operations in the operating room (OR)
- Organizing routines for sanitation, cleaning, and facility maintenance
- Keeping an eye on environmental parameters like humidity, temperature, and air quality
- Ensuring adherence to safety rules and certification requirements

Human Resources and Staff Management includes the following

- Conducting performance reviews and training assessments.
- Keeping track of staff assignments, rotations, and on-call responsibilities.
- Monitoring employee schedules, shifts, and work hours.

- Processing leave requests, salary, and benefit claims. hiring and credentialing new healthcare workers

Quality Assurance and Performance Improvement includes the following

- Monitoring clinical outcomes, patient satisfaction, and operational efficiency through key performance indicators (KPIs) and conducting reviews, audits, and root cause analysis for adverse occurrences or medical errors
- Putting evidence-based procedures and quality improvement efforts into action
- Comparing performance to best practices and industry standards
- Ensuring adherence to regulatory regulations and accreditation requirements

Patient Engagement and Education includes the following:

- Providing tools and materials for patient education
- Personalized health reminders, alerts, and notifications. peer-to-peer networks and virtual support groups
- Interactive health portals and mobile applications for patient engagement
- Enabling patients to take part in shared decision-making and self-management techniques

Telemedicine and Remote Monitoring includes the following:

- Conducting virtual follow-up visits and telehealth assessments.
- Integrating wearable technology and home monitoring systems for health data collection.
- Providing remote monitoring solutions for chronic disease management and post-discharge care.
- Guaranteeing privacy, security, and interoperability of telemedicine platforms.

Emergency Response and Disaster Preparedness include the following:

- Implementing communication systems for emergency alerts and notifications.
- Coordinating mass casualty incidents and surge capacity planning.
- Creating emergency response protocols and disaster recovery plans.
- Holding drills, simulations, and training exercises for staff and first responders.
- Working with community stakeholders and emergency management agencies

Analytics and Business Intelligence includes the following :

- Predicting patient outcomes, resource utilization, and demand forecasting.
- Identifying trends, patterns, and opportunities for improvement.
- Producing reports, dashboards, and visualizations for performance monitoring and decision-making.

- Leveraging data analytics tools for clinical, operational, and financial insights.
- Supporting population health management and risk stratification initiatives

Patient Privacy and Data Security includes the following:

- Adopting strong security measures to guard patient data and stop illegal access.
- Encrypting private information while it's being transmitted or stored.
- Performing frequent security audits and vulnerability assessments.
- Enforcing user authentication, access limitations, and audit trails

Non-Functional Requirements:

1. **Performance:**
    - The system needs to support a few users without any major slowdowns.
    - Quick response times, for tasks like booking appointments and accessing records are essential for a smooth user experience.
    - It should be able to grow along with an increase in numbers and data storage needs.
2. **Reliability:**
    - The system must be highly available with interruptions for maintenance or updates.
    - It should be resilient to hardware failures, network issues and other unexpected

events without compromising data integrity.

- Backup and recovery procedures need to be in place to quickly restore operations during emergencies.

3. **Security:**

- It's crucial to have measures in place to protect data and adhere to privacy regulations like HIPAA.
- Access controls need to make sure that authorized individuals can access or make changes to information.
- Encryption plays a role in ensuring data security during both transmission and storage.
- Keeping audit trails is key for monitoring user activities and detecting access or malicious behavior.

4. **Scalability:**

- The system framework should be designed to handle an increase in the number of users, patient visits and data storage requirements over time.
- To achieve scalability, it is important to consider using a distributed computing design or cloud based infrastructure.
- Implementing load balancing mechanisms is crucial for distributing workloads, among servers or nodes.

5. Ease of Use:

- The user interface should be simple to grasp and navigate, with labels, layout and a design that adjusts smoothly.
- It is important to provide training materials and user guides to help staff members effectively learn how to utilize the system.

5. **Compatibility:**

- The system needs to be capable of sharing information, with other healthcare IT systems like health record (EHR) systems, laboratory information systems (LIS) and pharmacy systems.
- Data sharing should follow protocols and formats to ensure compatibility with these systems. Integration interfaces (APIs) should be in place to support interoperability with third party applications and services.

6. **Compliance.**

- Regarding compliance the system must meet the standards and requirements set by healthcare IT regulatory bodies such as HIPAA, HL7, DICOM and IHE.
- Regular audits and assessments need to be conducted to ensure adherence to mandates. Proper documentation demonstrating efforts, towards compliance and obtaining certifications is essential.

7. **Maintainability.**
    - The system should be structured with components and clear interfaces for maintenance and updates.
    - Code should be well documented and follow coding standards, for readability and maintainability.
    - Version control systems should monitor changes. Manage code revisions effectively.
    - Automated testing tools should be used to identify bugs and confirm system functionality post updates or modifications.

8. **Restoring and Workflow Management.**
    - To minimize the impact of disasters, cyber attacks it is crucial to plan for disaster recovery. To ensure the availability of data it is important to store the data backups.
    - Implementing business continuity tactics can help reduce interruptions, in hospital functions and patient care services.

9. **Monitoring System Performance and Tracking Progress.**
    - Use monitoring tools to keep an eye on system performance metrics such as CPU usage, memory consumption and network bandwidth.
    - Set up alerts to quickly address any issues or performance problems that arise.
    - Utilize analytical dashboards and reporting tools to analyze system usage trends identify patterns and make informed decisions on resource allocation and planning for capacity.

10. **Establishing Service Level Agreements (SLAs) Management.**
    - The system provider should offer support, for problem solving, software updates and maintenance services as part of the service level agreements.

Interfaces:

1. User Interfaces.

The system will have web-based user interfaces that can be accessed from web browsers, like Chrome or Firefox.

2. Hardware Interfaces.

- Our system is compatible with devices like laptops and computer desktops. So, it is designed primarily for these devices.
- Our application is compatible to connect with the devices like blood pressure monitors and glucose meters.

3. Software Interfaces.

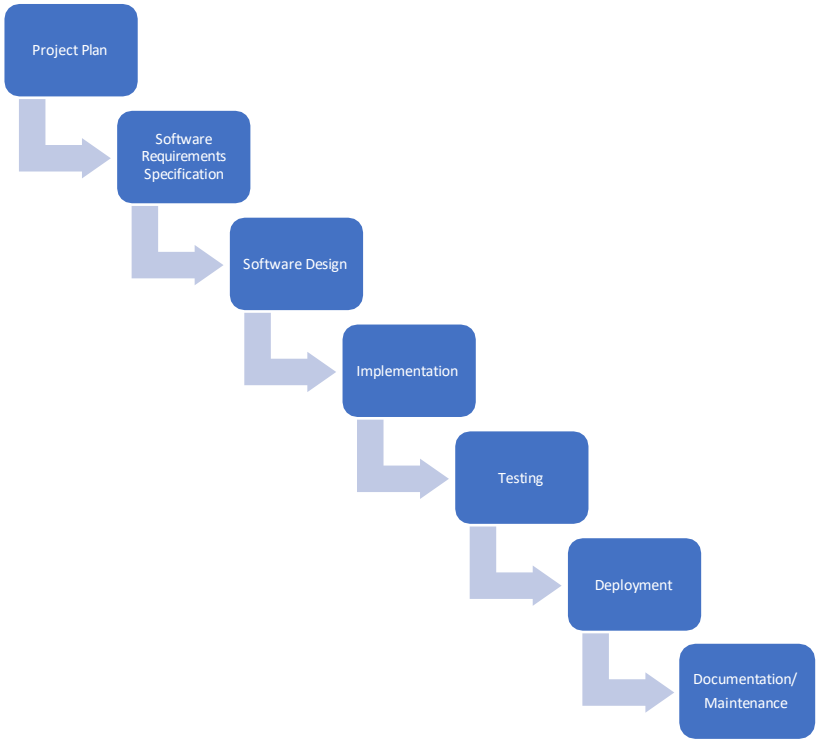
The system is set to integrate with third party software like insurance billing systems and laboratory equipment interfaces. Standard APIs will be available for data exchange with systems.

4. Communication Interfaces.

Secure information exchange protocols, including HTTPS for data transmission over the internet will be implemented in the system.

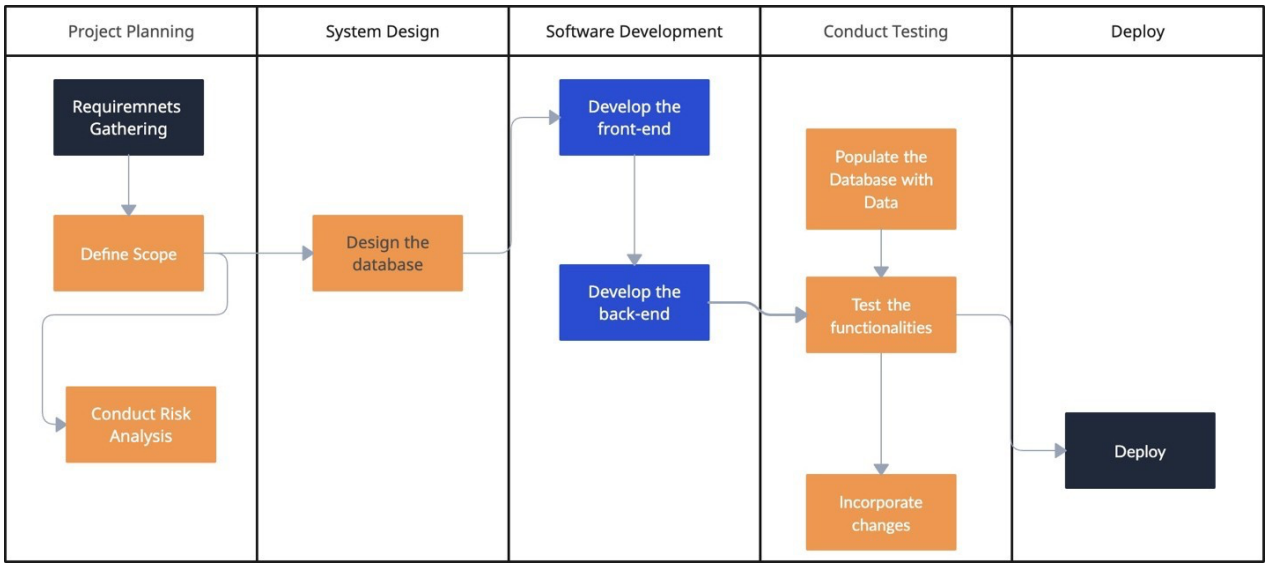
Development phases:

The project will use a Waterfall Model to ensure gradual and comprehensive development



Framework Activities	Task Set
Project planning	Create Project Plan
Project design	Software design
Risk analysis	Software Development
Coding/Programming	Testing
Testing and evaluation	Deployment

Task Network :



We will use a grant chart below to give three development phases

Development Phase 1: Implementation of Minimum Viable Product (MVP)

In first phase, our team aim is to focus on building the central part of HMS that has required features necessary to initiate necessary functionalities of HMS

Front End Requirements (Critical Features):

1. User Registration and Login.
2. Appointment Scheduling Interface.
3. Patient Profile Management.
4. Basic Dashboard for Patients and Healthcare Providers.
5. Basic Messaging System for Patient-Provider Communication.
6. Basic Search and Filter Functionality for Healthcare Services.
7. Emergency Contact Information.
8. Basic Reporting for Administrative Purposes.
9. User Feedback Submission.
10. Mobile Responsiveness for Access from Various Devices.

Back End Requirements (Critical Features):

1. User Authentication and Authorization.
2. Patient Appointment Management Logic.
3. Patient Profile Database.
4. Basic Messaging System Backend.
5. Appointment Database Management.
6. Database for Emergency Contact Information.
7. Security Measures (Data encryption, user authentication).
8. API Development for Front End-Back End Communication.
9. Basic Server Monitoring and Scalability Considerations.
10. Data Backup and Recovery Procedures.

Development Phase 2: Enhanced Functionality

In this phase, you'll enhance the hospital management system with more advanced features and improve the overall user experience.

Front End Requirements (Critical Features):

1. Advanced Search and Filters for Healthcare Services.
2. A system that allows patients and healthcare providers to communicate in time.
3. Reviews, from patients about healthcare providers.
4. An improved dashboard, for both patients and healthcare providers to use.Notification System for Appointment Reminders and Updates.
5. Categories and Subcategories Navigation for Healthcare Services.
6. Satisfaction Feedback Submission.
7. Admin Panel for Moderation and Administrative Tasks.
8. Mobile App Optimization (iOS and Android).
9. Advanced Security Measures (Data encryption, security audits).

Back End Requirements (Critical Features):

1. Advanced Search and Filter Functionality.
2. Real-time Messaging Backend.
3. Patient Review and Rating Management.
4. Notification System Backend.
5. Categories and Subcategories Database Management.
6. Admin Panel Backend (User management, administrative tasks).
7. Satisfaction Feedback Logic.
8. Advanced Security Measures.
9. Infrastructure Scaling (Load balancing, auto-scaling).
10. Advanced Reporting Data Handling.

Development Phase 3: Scalability and Optimization

In the final phase, we will focus on scaling the hospital management system for increased usage, improving performance, and ensuring long-term sustainability.

Front End Requirements (Critical Features):

1. Scalability Measures (Load balancing).
2. Mobile App Optimization.
3. Advanced Security Measures.
4. Marketing and SEO Enhancements.
5. Integration with Additional Third-Party Services (e.g., Telemedicine platforms).
6. Community Building Enhancements (Patient forums, support groups).
7. Continuous Performance Optimization.
8. Advanced Reporting for Administrators.
9. Accessibility Features for Users with Disabilities.
10. Cross-browser Compatibility Testing.

Back End Requirements (Critical Features):

1. Infrastructure Scaling (Load balancing, auto-scaling).
2. Performance Optimization (Caching, database tuning).
3. Advanced Security Measures (Regular audits, intrusion detection).
4. Integration with Additional Third-Party Services.
5. Community Data Handling.
6. Consistent Observation and Improvement.
7. Emergency Recovery and Proper Planning of Business positivity.
8. Compliance with Maintenance of Regulatory Standards (HIPAA, GDPR).
9. Documentation and Training Materials for Staff.
10. Vendor Support and Service Level Agreements (SLAs).

Member Contribution Table:

Member name	Contribution description	Overall Contribution (%)	Note (If applicable)
Vishwitha	Development Phase - 1	100%	
Anusha	Development Phase - 2	100%	
Pavan	System Structure	100%	
Dinesh	Development Phase - 3	100%	
Deepak	Project scope, Functional requirements	100%	
Divya Anusha	Non – functional requirements	100%	
Tejaswi	Task Network and Gantt chart	100%	
Jaswanth	Interfaces	100%	