Team №6 (CareTech)

GOODMEAD HOSPITAL MANAGEMENT SYSTEM (HMS)

A Cloud-Based Solution for Modern Healthcare Operations

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EXECUTIVE SUMMARY

- **Project:** HMS to modernize GoodMead Hospital.
- **Goals:**
  - Improve operational efficiency.
  - Ensure regulatory compliance.
  - Enhance patient care.
  - Support collaboration with external healthcare entities and service providers
- **Scope:** Covers clinical, administrative, and support operations.
- **Stakeholders:** Hospital staff, external labs, pharmacies, patients.

PROJECT OVERVIEW

MISSION

GoodMead Hospital is a leading multidisciplinary hospital located in Sydney, Australia. It offers a wide range of healthcare services including pediatrics, gynecology, orthopedics, radiology, dentistry, and sports medicine. The hospital aims to modernize operations by transitioning from manual to digital systems for better efficiency.

VALUES

- Efficiency in hospital operations.
- Integration and collaboration across departments.
- Innovation through cloud-based solutions.
- Commitment to patient-centered healthcare.
- Security and compliance in all data processes.

CHALLENGES
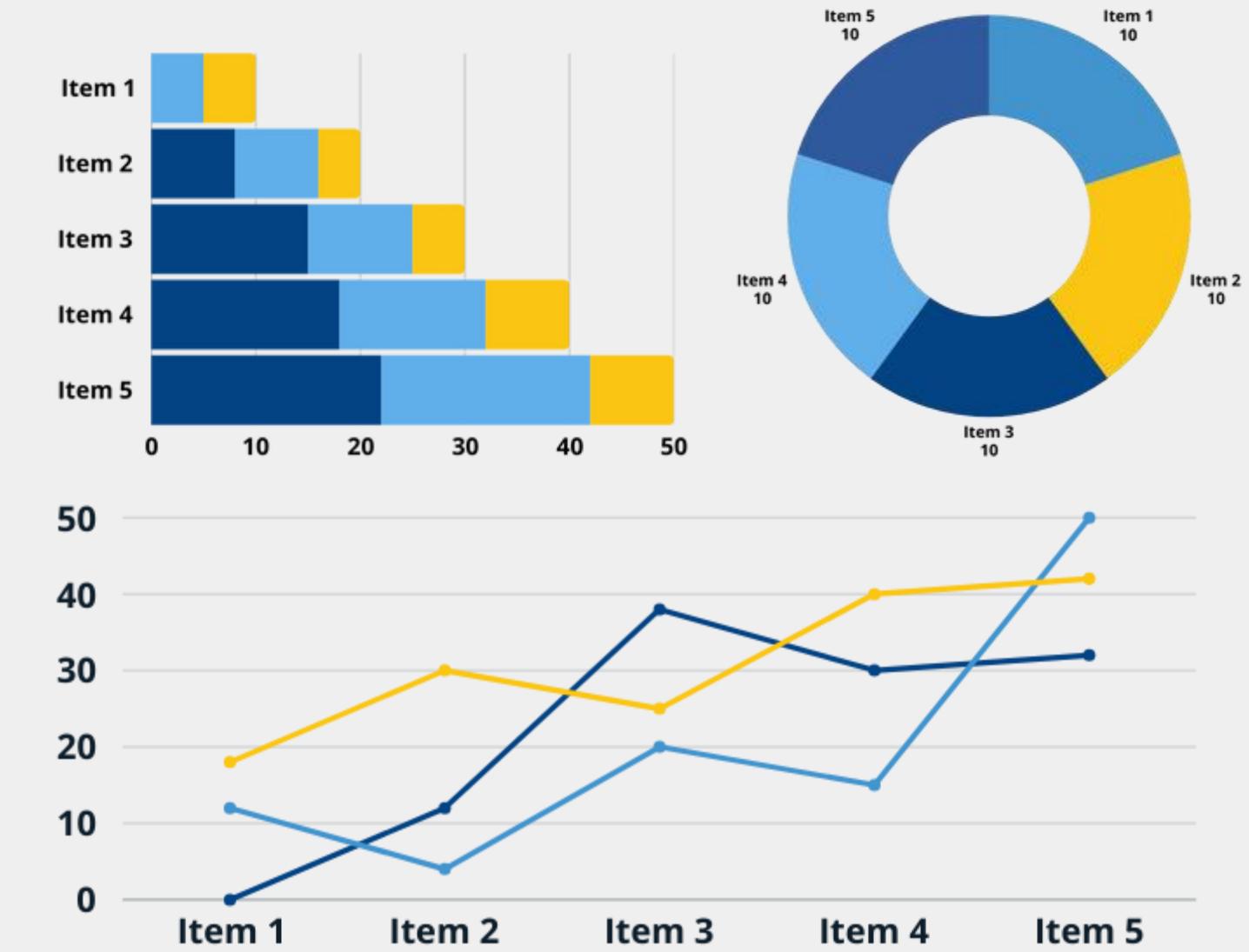
- Reliance on manual, paper-based systems causing delays.
- Fragmented and outdated digital tools across departments.
- Inefficient workflows leading to reduced productivity.
- Limited integration with external labs and pharmacies.
- Difficulty in tracking and managing patient data securely.

PURPOSE OF THE PROJECT

KEY PURPOSE:
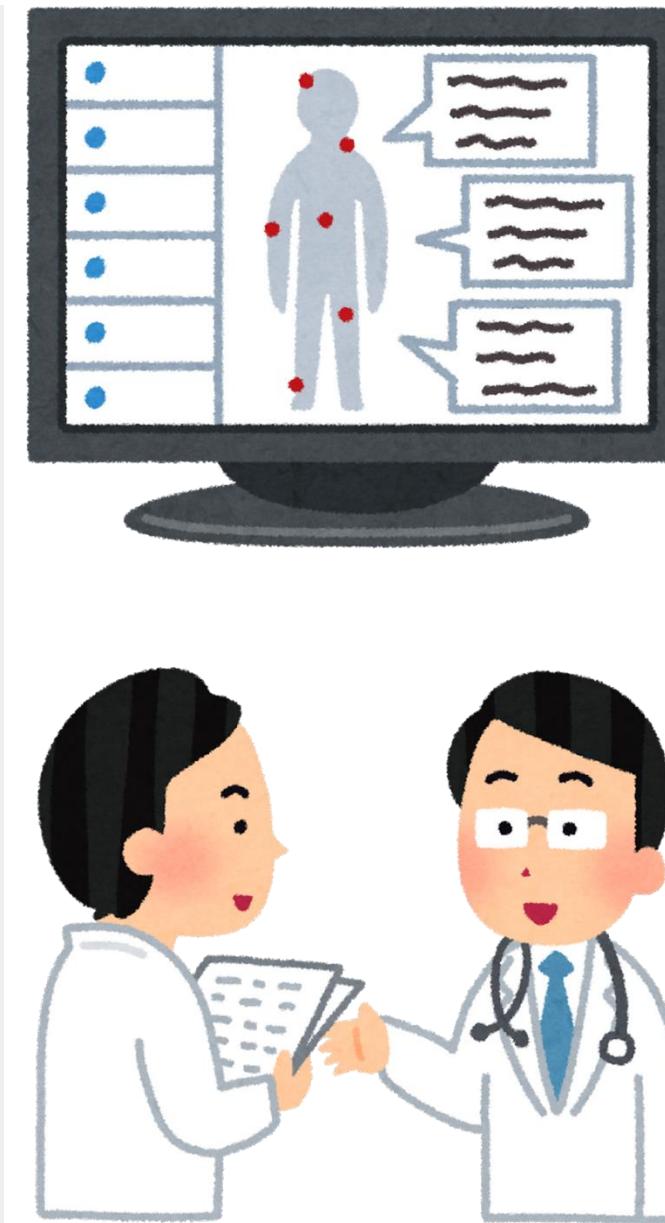
- **DEVELOP A CLOUD-BASED, INTEGRATED HMS.**
  - TO REPLACE FRAGMENTED MANUAL SYSTEMS WITH A UNIFIED, INTERNET-ACCESSIBLE PLATFORM.
- **STREAMLINE OPERATIONS AND COMPLIANCE.**
  - ENHANCE WORKFLOW EFFICIENCY WHILE ENSURING ALIGNMENT WITH HEALTHCARE REGULATIONS.
- **SUPPORT COLLABORATION WITH EXTERNAL HEALTHCARE PROVIDERS.**
  - FACILITATE SEAMLESS DATA SHARING AND PARTNERSHIPS WITH LABS, PHARMACIES, AND OTHER FACILITIES.

PROJECT SCOPE

The HMS initiative encompasses the following key functional areas:

- Patient services include registration, medical records management, diagnostics, outpatient scheduling, and emergency services.
- Clinical operations involving surgical scheduling, pre- and post-operative workflows, legal documentation, and integration with external labs.
- Administrative systems include staff scheduling, resource allocation, facilities management, and financial oversight.

- Interoperability with external laboratories, pharmacies, government services, and research institutions.
- Compliance and security, especially regarding patient data privacy under EMR (Electronic Medical Records) regulations.
- Multimedia support through the integration of a NoSQL database to manage unstructured data such as videos, emails, audio consultations, and medical journals.

Strategic Objectives

- Optimize hospital operations.
- Accessible and user-friendly platform.
- Remote consultations and multimedia capabilities.
- Performance dashboards and operational transparency.
- Improve patient and staff experience through unified digital services.

Technology and Methodology

- Developed with an object-oriented approach using UML 2.5 standards.
- Tools: StarUML, Visio.
- Platform: .NET or J2EE (TBD).
- Cloud-based with NoSQL for multimedia data.
- Follows CAMS for iterative development and feedback.
- Includes alpha and beta testing stages.

SWOT ANALYSIS

Strengths:
GoodMead Hospital has strong backing from its leadership and a solid partnership with MethodScience. The project benefits from a scalable cloud-based design, structured governance, and the use of standardized modeling tools like UML 2.5. Clear goals focus on improving patient care, resource efficiency, and regulatory compliance.

Weaknesses:
There is no existing software infrastructure, and many administrative tasks rely on manual processes. Undocumented clinical workflows and an undecided technology stack may lead to delays. Additionally, some staff may resist adopting new IT systems.

Opportunities:
GoodMead can position itself as a leader in hospital digital transformation. The system will enhance collaboration with external labs and pharmacies, enable remote consultations, and support innovative research using multimedia data and NoSQL analytics. Community engagement will also grow through health outreach features.

Threats:
High legal risks exist regarding patient data privacy and EMR compliance. Cybersecurity threats, integration complexities with third parties, and funding uncertainties pose significant challenges. There is also a risk of scope creep due to pursuing multiple goals simultaneously.

PESTLE ANALYSIS

- **Political:** EMR system support.
- **Economic:** Cost savings from cloud solutions.
- **Social:** Patient demand for digital access.
- **Technological:** Cloud, NoSQL, IoT.
- **Legal:** Health data laws.
- **Environmental:** Reduced paper use, eco-friendly vendors.
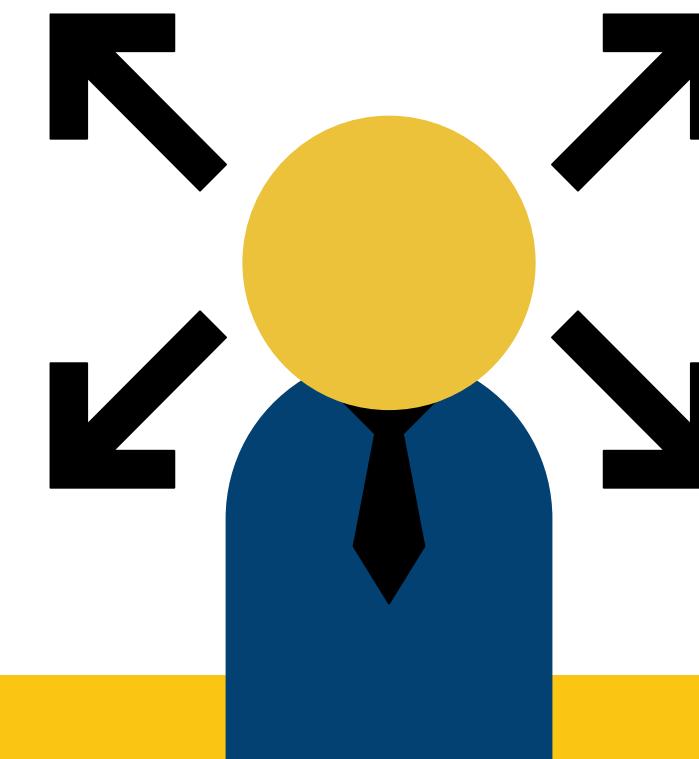
KEY STAKEHOLDERS

EXTERNAL STAKEHOLDERS

Lisa Morante	**Principal Consultant, Method Science**	Advises on methodology, best practices, compliance, and oversees collaboration with IT teams.
Prof. David Sinclair	**Government EMR Compliance Officer, Health NSW**	Ensures patient data privacy and compliance with national EMR regulations
Dr. Meera Kapoor	**Head of Radiology, GoodMead Hospital**	Provides insights for diagnostic systems and ensures integration with third-party labs.
James McAllister	**Director, Swift Labs Diagnostics**	Collaborates for seamless data sharing between hospital and independent diagnostic labs.
Sarah Finnigan	**Senior Advisor, HealthTech Pharma**	Facilitates pharmaceutical data flow, integration of drug information and research.
Constable Rajiv Patel	**Liaison Officer, NSW Emergency Services**	Supports HMS integration with police and ambulance emergency systems.
Mark Reynolds	**Representative, GoodMead Patient Council**	Advocates for patient needs contribute to usability and accessibility requirements
Olivia Chen	**CEO, Cloud Med Hosting Solutions**	Oversees cloud infrastructure, scalability, and uptime commitments.
Karen Beckett	**Public Relations & Donor Liaison, GoodMead**	Monitors and reports community engagement via HMS social responsibility features.

INTERNAL STAKEHOLDERS

Benjamin Brown	**Project Director**	Oversees the HMS project, ensures alignment with hospital goals, manages overall direction.
Ayana Bojokoeva	**Lead Business Analyst**	Captures business processes, gathers user requirements, and ensures accurate system modeling.
Austin Clark	**Senior Solutions Architect**	Leads the technical design and system architecture; evaluates cloud platforms and technologies.

PROJECT TIMELINE & BUDGET

Time - Total: 18 months

Phase	Duration
Requirements Gathering	2 months
System Design & Architecture	2 months
Development Phase I	4 months
Development Phase II	4 months
Integration & Interfacing	2 months
Testing	2 months
Deployment & Training	1 month
Contingency	1 month
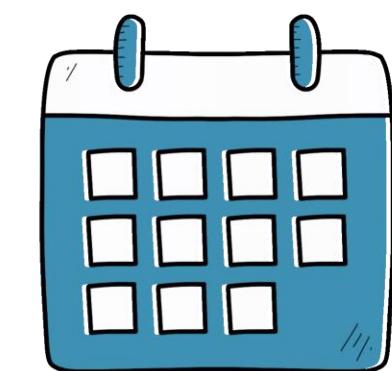
Budget - Total: $7.5 millions

Category	Cost (USD)
Consulting (MethodScience)	1.2 million
Software Design & Development	2.5 million
Hardware & Cloud Infrastructure	1.1 million
Testing & QA	500,000
Training & Change Management	400,000
Legal, Compliance, & Security Audit	300,000
Contingency Reserve	850,000
Miscellaneous	650,000

QUALITY EXPECTATIONS & KEY FEATURES

Key System Capabilities:
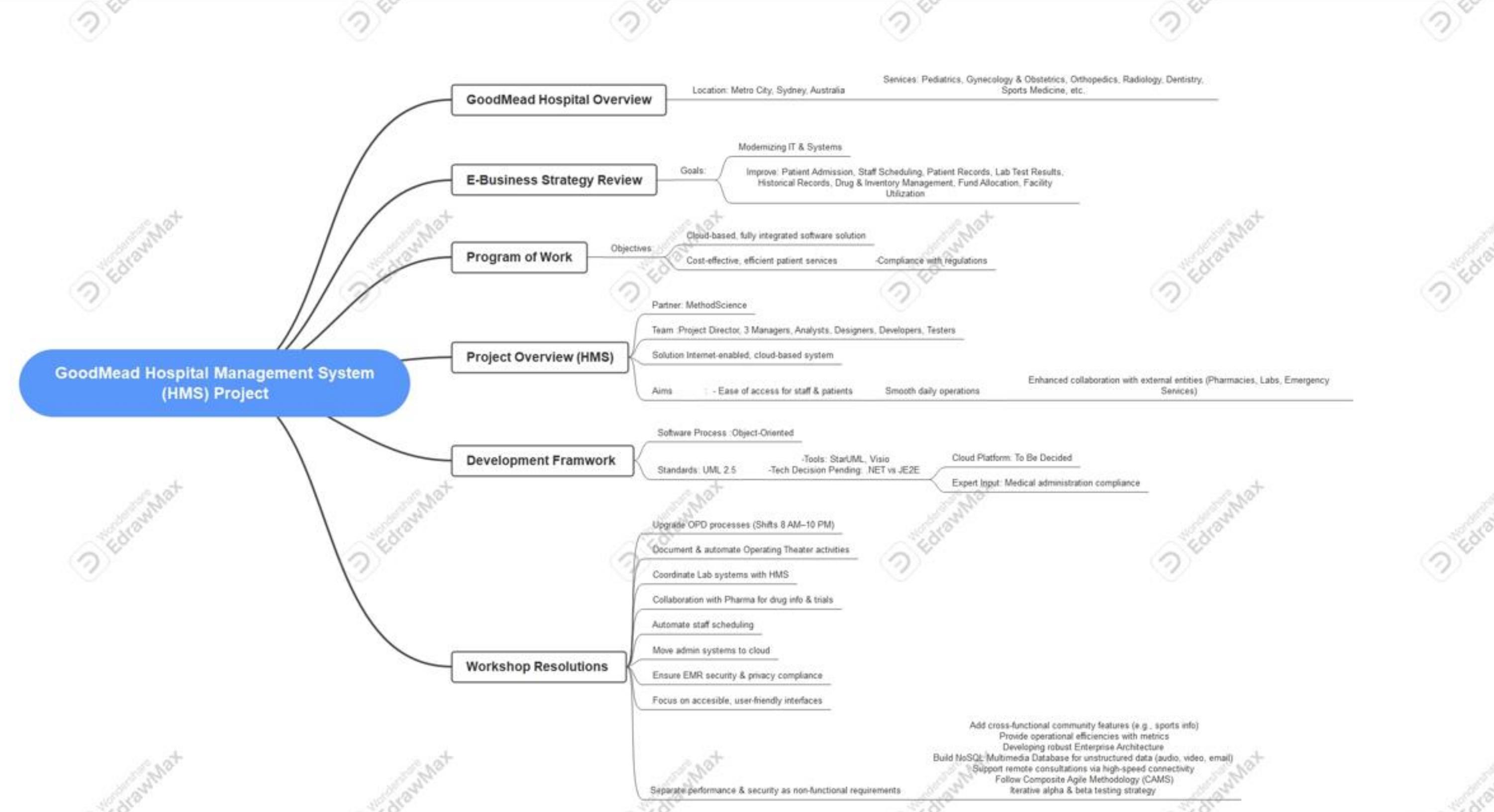
- Manages patient registration, records, and admissions.
- Scheduling for staff, surgeries, and appointments.
- Integration with labs, pharmacies, emergency services.
- Operating theatre management and surgical workflows.
- Drug inventory and pharmaceutical collaboration.
- Multimedia support for consultations and research.
- Accessibility-compliant interfaces.
- Cloud-based, scalable architecture with NoSQL support.
- Real-time telehealth and remote consultations.
- Operational dashboards and real-time analytics.

Quality Expectations:

- 99.9% uptime, <2s response time.
- EMR compliance, WCAG 2.1 accessibility.
- Secure, role-based access with audit trails.
- High user satisfaction (85%+ target).

MIND MAP OVERVIEW

GoodMead Hospital Management System (HMS) Project

GoodMead Hospital Overview
- Location: Metro City, Sydney, Australia
- Services: Pediatrics, Gynecology & Obstetrics, Orthopedics, Radiology, Dentistry, Sports Medicine, etc.

E-Business Strategy Review
- Goals:
  - Modernizing IT & Systems
  - Improve: Patient Admission, Staff Scheduling, Patient Records, Lab Test Results, Historical Records, Drug & Inventory Management, Fund Allocation, Facility Utilization

Program of Work
- Objectives:
  - Cloud-based, fully integrated software solution
  - Cost-effective, efficient patient services
  - -Compliance with regulations

Project Overview (HMS)
- Partner: MethodScience
- Team :Project Director, 3 Managers, Analysts, Designers, Developers, Testers
- Solution Internet-enabled, cloud-based system
- Aims:
  - - Ease of access for staff & patients
  - Smooth daily operations
  - Enhanced collaboration with external entities (Pharmacies, Labs, Emergency Services)

Development Framwork
- Software Process :Object-Oriented
- Standards: UML 2.5
  - -Tools: StarUML, Visio
  - -Tech Decision Pending: .NET vs JE2E
- Cloud Platform: To Be Decided
- Expert Input: Medical administration compliance

Workshop Resolutions
- Upgrade OPD processes (Shifts 8 AM–10 PM)
- Document & automate Operating Theater activities
- Coordinate Lab systems with HMS
- Collaboration with Pharma for drug info & trials
- Automate staff scheduling
- Move admin systems to cloud
- Ensure EMR security & privacy compliance
- Focus on accesible, user-friendly interfaces
- Separate performance & security as non-functional requirements
  - Add cross-functional community features (e.g., sports info)
  - Provide operational efficiencies with metrics
  - Developing robust Enterprise Architecture
  - Build NoSQL Multimedia Database for unstructured data (audio, video, email)
  - Support remote consultations via high-speed connectivity
  - Follow Composite Agile Methodology (CAMS)
  - Iterative alpha & beta testing strategy

OVERALL USE CASE DIAGRAM

Hospital Management System

Actors: Patient, Receptionist, Doctor, Nurse, Admin Staff, Lab Technician, Pharmacist, External System (Labs/Pharmacy/EMR)

Use cases: Register Patient, Schedule Appointment, Access Patient Records, Record Lab Results, Prescribe Medication, Manage Staff Schedules, Update EMR, Request Remote Consultation, Generate Reports

This diagram shows all the key interactions between hospital staff, external systems, and the HMS. It shows how different stakeholders like patients, receptionists, doctors, admin staff, etc., interact with the system to perform core hospital tasks. Each oval is a system function, and each stick figure represents an actor that interacts with those functions. This diagram enables stakeholders to see immediately who is doing what in the system.

USE CASE #1 - SCHEDULE APPOINTMENT

Use Case Name: Schedule Appointment

Actor: Receptionist

Goal: To book an appointment for a registered patient with an available doctor.

Preconditions:

Patients must be registered in the system.

Receptionist must be logged in and have access to scheduling features.

Postconditions:

Appointment is saved in the system.

Patient receives notification (email/SMS).

Main Flow:
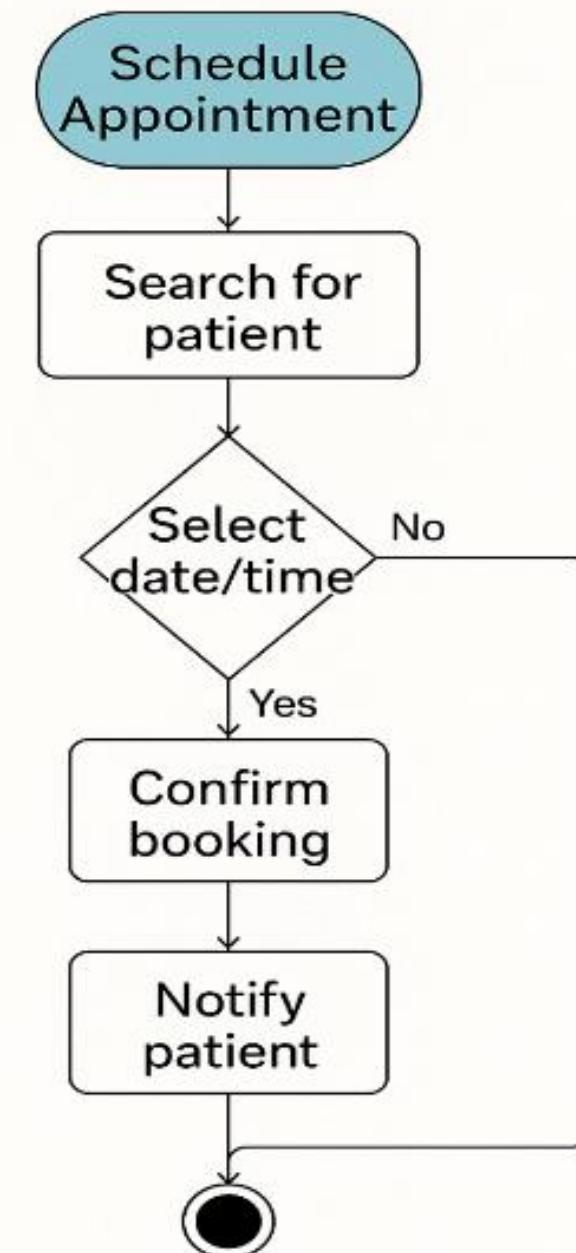
Receptionist logs into HMS.

Searches for the patient by name or ID.

Views list of available doctors and schedules.

Selects preferred date and time.

Confirms the booking.

USE CASE #2- ACCESS PATIENT RECORDS

Use Case Name: Access Patient Records

Actor: Doctor

Goal: To view and update the medical records of a patient.

Preconditions:

Doctor must be authenticated and authorized.

Patient records must exist in the system.

Postconditions:

Records viewed and possibly updated with new notes or prescriptions.

Main Flow:
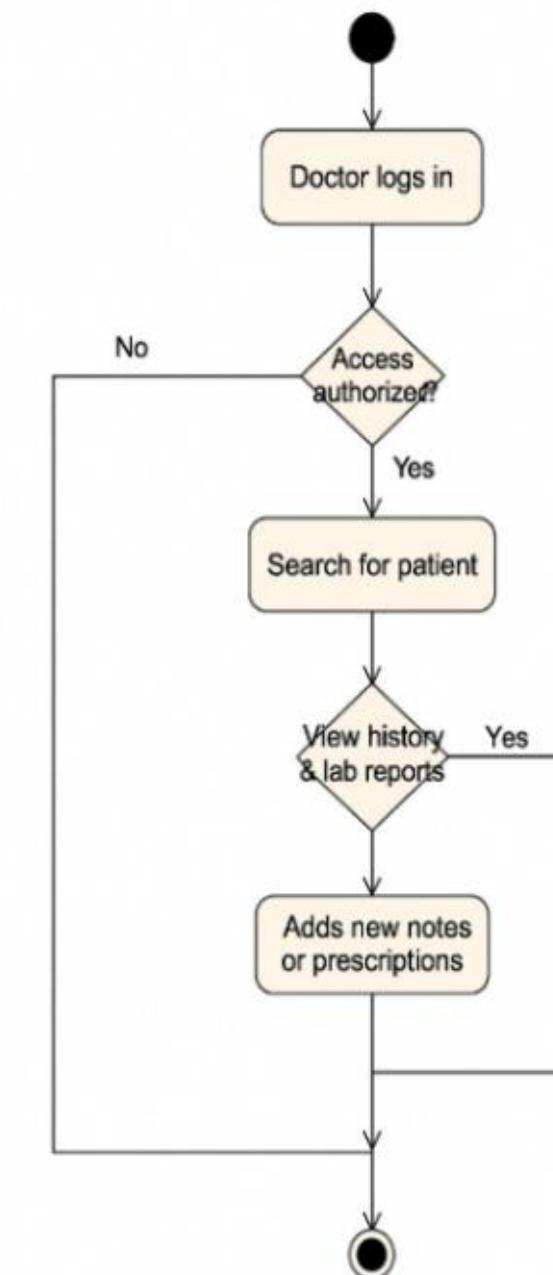
Doctor logs into HMS securely.

Searches for the patient's record using patient ID or name.

Views medical history, lab reports, and previous prescriptions.

Adds new consultation notes, prescriptions, or updates.

Saves changes to the EMR system.

USE CASE #3 - UPDATE EMR

Use Case Name: Update Electronic Medical Records (EMR)

Actor: Admin Staff

Goal: To ensure that EMRs are updated, accurate, and compliant with regulations.

Preconditions:

Admin staff must have authorization to access EMR.

EMR entries requiring updates are identified.

Postconditions:

Data securely stored and synchronized in the cloud.

Compliance checks are completed.

Main Flow:

Admin logs into the HMS system.

Accesses the EMR system interface.

Validates the data entry for correctness.

   - If invalid, data must be corrected.
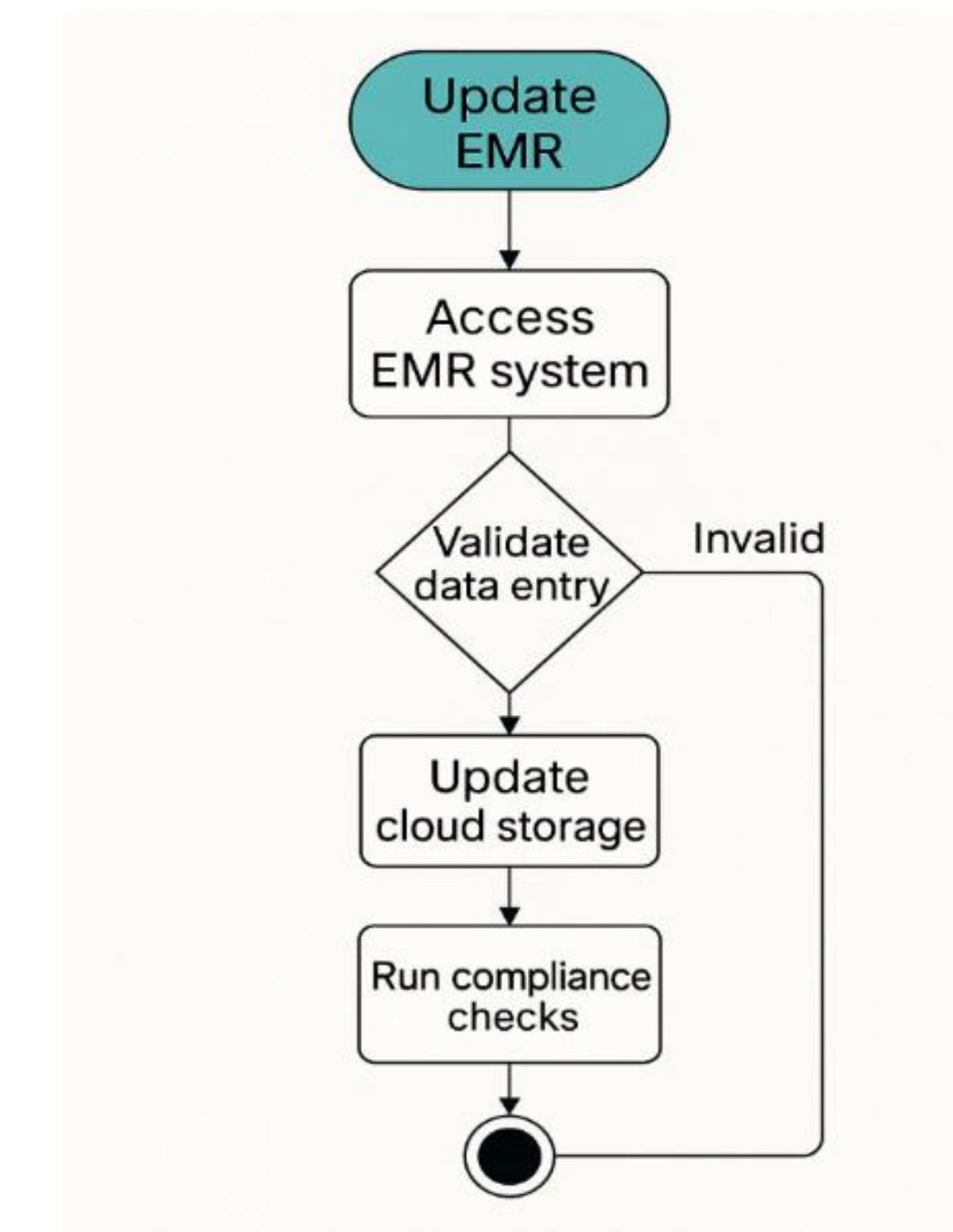
Updates the EMR and syncs it with cloud storage.

Runs compliance checks to ensure data meets legal standards.
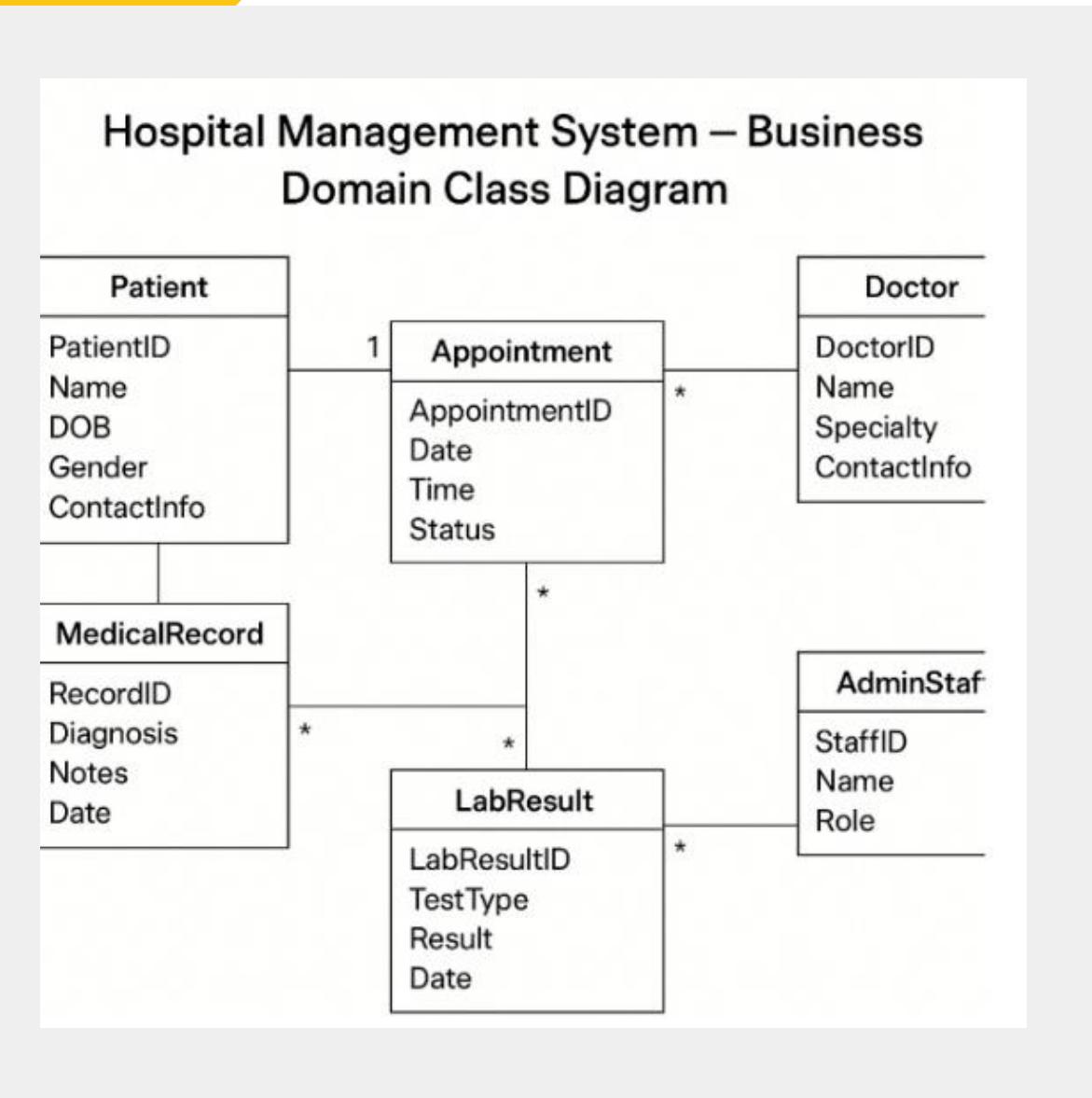
The session ends after a successful update and validation.

Alternative Flow:

   If data entry is invalid, the system prompts correction before proceeding.
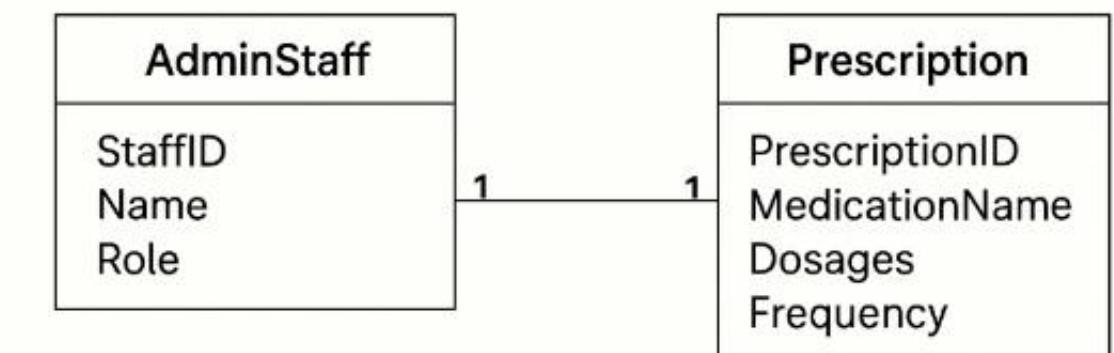
BUSINESS DOMAIN MODEL - MEDICAL

Hospital Management System – Business Domain Class Diagram

This diagram represents the core medical workflow within the Hospital Management System. It shows how patients interact with doctors through appointments, and how their medical records and lab results are managed.

This diagram focuses on the administrative and prescription management part of the system, involving AdminStaff and the process of managing Prescriptions issued after appointments.
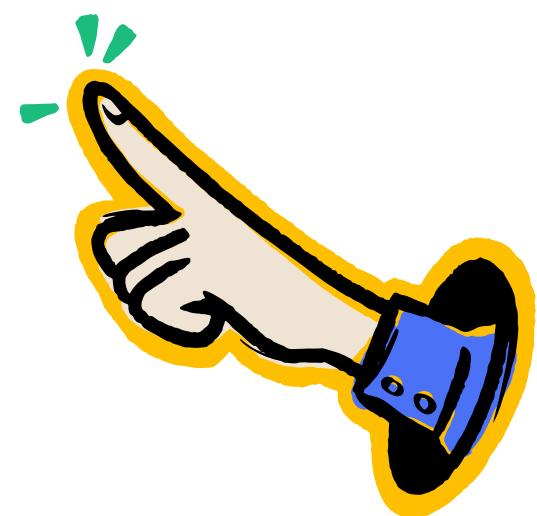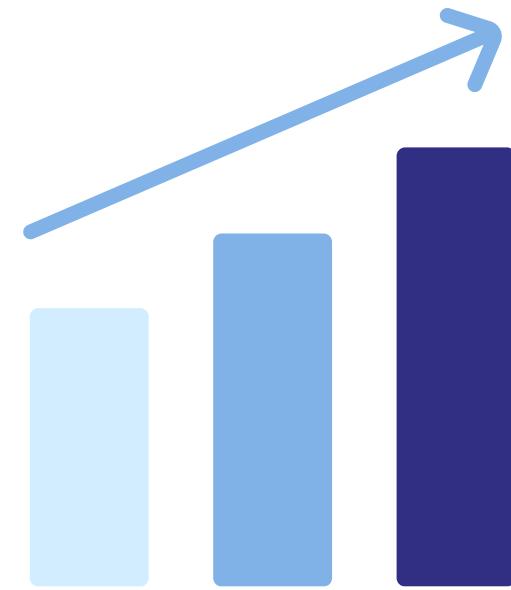

Hospital Management System – Business Domain Class Diagram

NON-FUNCTIONAL REQUIREMENTS (NFRS)

Performance

The system is required to support at least 200 concurrent users, including doctors, nurses, administrative staff, and patients, without any degradation in performance. It must ensure that 95% of user actions, such as booking appointments or retrieving records, are completed within two seconds. Additionally, the HMS should handle up to 10,000 daily transactions efficiently, providing lab results and prescriptions to authorized users within five seconds of submission.
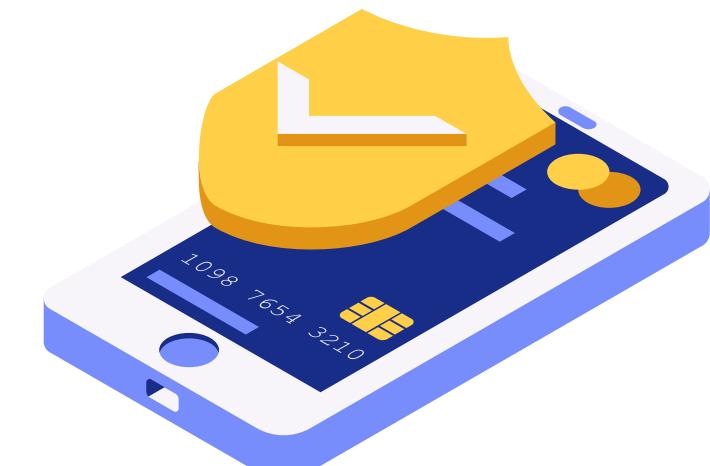
Usability

HMS will offer a user-friendly, intuitive interface designed for both technical and non-technical staff, ensuring ease of use across all hospital departments. It will meet WCAG 2.1 Level AA standards to support accessibility for users with disabilities and will require no more than two hours of training for new users to become proficient. The system will be responsive across desktops, tablets, and mobile devices, with initial support in English and the capability to add multiple languages.

Cybersecurity

All data within the system, whether stored or transmitted, will be protected using AES-256 encryption. Role-based access control (RBAC) will restrict sensitive data access to authorized personnel only, with Two-Factor Authentication (2FA) required for staff handling patient data. HMS will comply with relevant healthcare data laws, maintaining audit logs of all sensitive actions for at least six months. It will actively monitor for unauthorized access attempts, automatically blocking threats and alerting security teams within one minute.

PROJECT KANBAN BOARD

GOODMEAD HOSPITAL (HMS)

ITERATION 1: FOUNDATION AND PLANNING

To-Do	Doing	Done
As a Project manager, I want to evaluate different implementation platforms so that the most suitable technology stack is selected.	As a technical team lead, I want to set up the development environment so that the team can begin iteration work.	As a board member, I want a comprehensive review of existing systems completed so we can identify areas of improvement.
As a system architect, I want to define the overall enterprise architecture so that all hospital systems can be integrated effectively.	As a developer, I want to design the NoSQL multimedia database schema so that the system supports unstructured data storage.	As the board, we approved the HMS project scope, funding, and delivery timeline.
As a security specialist, I want to identify privacy regulations so that the HMS system ensures EMR compliance.	As a designer, I want to create use case diagrams using UML 2.5 so that the development process aligns with modeling standards.	As a consultant, I partnered with the GoodMead team to define transformation objectives and methodology (CAMS).
As a business analyst, I want to gather requirements from departments to capture all current and future system needs.		

PROJECT KANBAN BOARD

GOODMEAD HOSPITAL (HMS)

ITERATION 2: CORE FEATURE DEVELOPMENT

To-Do	Doing	Done
As a receptionist, I want a patient registration system so that I can efficiently onboard patients into the hospital database.	As a developer, I am integrating external lab systems via APIs so that test results are updated automatically in the HMS.	As a designer, I completed modeling of key activity diagrams for patient care and diagnostics workflows.
As a doctor, I want access to digital medical records so that I can provide faster and more accurate diagnoses.	As a nurse, I am reviewing UI mockups for accessibility so the system accommodates all users, including those with disabilities.	As a product owner, I validated requirements with department heads and aligned the backlog with hospital priorities.
As an HR officer, I want to develop a staff scheduling module so that I can plan shifts effectively.	As a tester, I am conducting alpha testing on patient records and scheduling modules to validate core functionality.	As a developer, I completed the core database integration for patient profiles and staff details.
As a compliance officer, I want to create a logging mechanism to monitor access to sensitive data for legal auditing.		
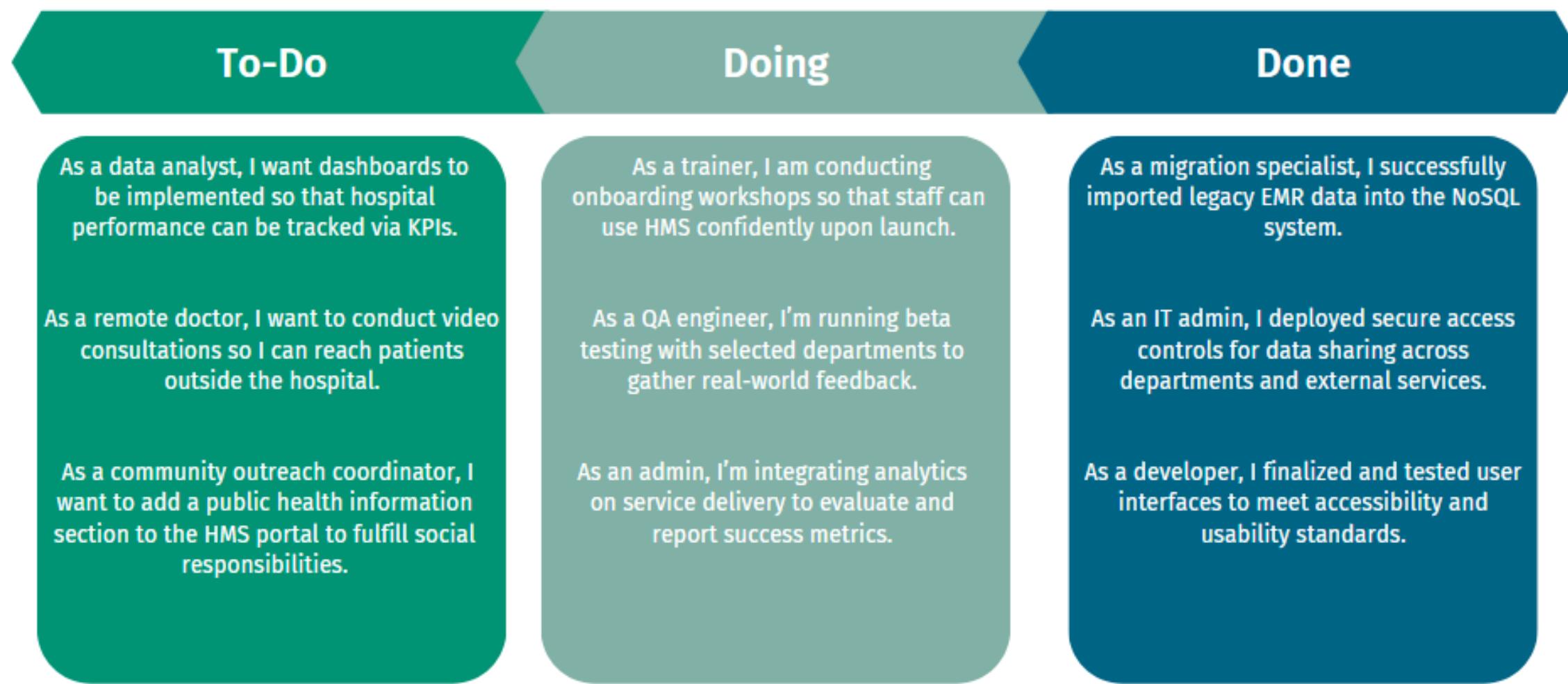
PROJECT KANBAN BOARD

GOODMEAD HOSPITAL (HMS)

ITERATION 3: ADVANCED FEATURES

To-Do	Doing	Done
As a data analyst, I want dashboards to be implemented so that hospital performance can be tracked via KPIs.	As a trainer, I am conducting onboarding workshops so that staff can use HMS confidently upon launch.	As a migration specialist, I successfully imported legacy EMR data into the NoSQL system.
As a remote doctor, I want to conduct video consultations so I can reach patients outside the hospital.	As a QA engineer, I'm running beta testing with selected departments to gather real-world feedback.	As an IT admin, I deployed secure access controls for data sharing across departments and external services.
As a community outreach coordinator, I want to add a public health information section to the HMS portal to fulfill social responsibilities.	As an admin, I'm integrating analytics on service delivery to evaluate and report success metrics.	As a developer, I finalized and tested user interfaces to meet accessibility and usability standards.

AGILE PROJECT APPROACH

The Agile methodology is ideal for the HMS project due to its ability to handle complex, evolving requirements in a dynamic hospital environment. By using the Composite Agile Methodology Stack (CAMS), our team ensures iterative development, early delivery of key features like outpatient scheduling and EMR, and continuous stakeholder feedback. Regular Agile practices such as daily stand-ups and sprint reviews support flexibility, strong communication, and rapid issue resolution. Agile's focus on collaboration, compliance, and adaptability allows us to deliver a scalable, accessible system that evolves with the hospital's future needs.

RISK MANAGEMENT

RISK REGISTER					
Risk Name	**Risk Description**	**Quadrant**	**Likelihood**	**Consequences**	**Mitigation**
Security & Privacy	Patient data breach or unauthorized access to EMR records, violating strict government privacy regulations.	Operational	2	11	• Implement end-to-end encryption and role-based access controls. • Use multi-factor authentication (MFA) for staff and service providers. • Regular security audits and penetration testing.
Clinical Operations & Process	Failure to properly model undocumented clinical workflows (e.g., pre/post-op, legal documentation).	Operational	3	9	• Collaborate with medical domain experts to document implicit workflows. • Conduct on-site observations and interviews with clinical staff. • Use iterative feedback loops to update workflows
Budget & Resource	Project cost overruns due to scope creep or unforeseen technical complexities.	Operational	6	3	• Define and enforce a change management protocol. • Use Agile sprints to monitor budget burn-down rate. • Maintain a contingency reserve for unexpected costs.
Schedule	Delays in rollout due to dependencies across departments or delayed feedback from clinicians.	Operational	8	1	• Use CAMS methodology to break down work into smaller deliverables. • Maintain strict sprint retrospectives and planning reviews. • Identify and resolve blockers daily via stand-up meetings.
Stakeholder & Communication	Misalignment of priorities among hospital board, project team, and consultants.	Strategic	4	5	• Schedule bi-weekly steering committee reviews. • Use project dashboards for transparent progress tracking. • Maintain stakeholder engagement through regular updates and demo sessions.
Compliance & Legal	HMS fails to meet compliance standards for digital health services and EMR frameworks.	Operational	1	10	• Engage regulatory experts in the design and review phases. • Align documentation with government e-health frameworks. • Conduct legal compliance verification before each major release.
Innovation & Multimedia Data	No SQL-based unstructured data storage (emails, videos) fails to deliver performance or analytics benefits.	Operational	5	4	• Use proven NoSQL platforms. • Employ metadata tagging for searchability and analytics integration. • Pilot multimedia services with limited departments first.
Integration	Incompatibility or communication failures with external labs, pharmacies, and ambulance systems.	Strategic	7	8	• Adopt HL7/FHIR standards for health information exchange. • Build APIs to support secure and asynchronous communication. • Test all integrations in sandbox environments with external partners.
User Adoption & Training	Resistance from staff used to manual or legacy systems.	Operational	11	2	• Conduct hands-on training sessions before rollout. • Appoint department "change" to assist adoption. • Provide easy-to-access documentation and helpdesk support.
Technology & Platform	Delay in selecting or switching between implementation platforms (.NET vs J2EE), affecting architecture decisions.	Operational	9	7	• Conduct technical feasibility study early in the project • Involve cloud architects in parallel during platform selection. • Choose modular design to minimize platform lock-in.
Performance & Scalability	HMS may not handle peak usage or multimedia data traffic (e.g., video consultations, NoSQL workloads).	Operational	10	6	• Perform load and stress testing using real hospital scenarios. • Use cloud autoscaling and caching mechanisms. • Optimize multimedia storage with CDN and data lifecycle policies.

To safeguard against **security risks**, the HMS will employ end-to-end encryption, role-based access, and multi-factor authentication, supported by regular audits. For **clinical operations**, collaboration with medical experts will ensure undocumented workflows are accurately modeled and refined through iterative feedback. To manage i**ntegration risks**, standardized HL7/FHIR protocols and secure APIs will be tested extensively with partners. **User adoption** is addressed through training, departmental change agents, and accessible support. Delays in choosing a **technology platform** are mitigated by early feasibility studies and modular design. **Performance risks** are managed with load testing, cloud autoscaling, and CDN optimization. Budget overruns are controlled by Agile-based monitoring and a contingency reserve, while **schedule risks** are minimized using CAMS for iterative delivery and daily stand-ups. **Stakeholder alignment** is maintained via bi-weekly reviews and transparent dashboards. **Compliance risks** are reduced through expert involvement and legal checks, and **multimedia data risks** are mitigated by piloting NoSQL solutions with advanced tagging and analytics support.

CHANGE MANAGEMENT

The implementation of HMS will shift GoodMead from manual, paper-based operations to a modern, cloud-based system, impacting outpatient care, surgery scheduling, labs, inventory, and patient records. Staff will adapt to new digital workflows, which may initially face resistance.

To manage this, we will engage stakeholders early, communicate the project's vision clearly, and involve users in design and testing. Comprehensive, role-specific training will support adoption, alongside departmental change agents. Regular feedback through surveys and workshops will guide adjustments. Phased rollouts, strong leadership backing, and a proactive support structure will ensure a smooth, inclusive transition and minimize disruption.

BUSINESS & ENTERPRISE ARCHITECTURE (MOAS)

Mission:
To modernize and integrate GoodMead Hospital's healthcare services through a secure, cloud-based HMS, improving patient care, efficiency, compliance, and collaboration.

Key Objectives:
Enhance patient experience with faster digital workflows and seamless communication. Optimize resource use in staff scheduling, inventory, and facilities. Ensure compliance with EMR standards and privacy laws, while promoting data exchange with external partners. Support multimedia and NoSQL data for unstructured content. Adopt Agile practices (CAMS) for iterative development and drive organizational efficiency through automation and real-time decision-making analytics.

Architecture Overview:
- **Business Architecture:** Defines core healthcare services and role-based workflows aligned with policies.
- **Application Architecture:** Cloud-based modules for patient care, labs, billing, compliance, unified via a secure portal.
- **Data Architecture:** Hybrid data store supporting structured EMRs and multimedia content (audio/video, tests).
- Technology Architecture: Cloud-first, microservices, telehealth-ready, IoT-enabled platform.
- **Security & Compliance:** End-to-end encryption, role-based access, and EMR compliance standards.

Scope & Users:
The HMS supports patient intake, diagnostics, surgeries, HR, finance, and drug management, integrating with labs, pharmacies, emergency services, and regulators. Key users include doctors, nurses, administrators, patients, and external partners.

BUSINESS INTELLIGENCE & DATA SCIENCE

CLINICAL INSIGHTS & PREDICTIVE HEALTH ANALYTICS

By analyzing patient history, lab results, and treatment outcomes, the HMS will enable predictive models to identify high-risk patients and support clinical decision-making. These insights will allow early detection of complications, anticipate emergency room admissions, and enhance triage accuracy through AI-driven support. Personalized care plans will be generated to improve health outcomes and patient safety.

OPERATIONAL EFFICIENCY & RESOURCE OPTIMIZATION

Data science will be applied to hospital operations to streamline workflows and optimize resource use. Predictive models will forecast patient volumes, helping to improve staff scheduling and reduce wait times. Additionally, the system will enhance utilization of operating rooms and beds while monitoring and predicting the use of drugs and medical equipment, ensuring efficient inventory management.

STRATEGIC & REGULATORY INTELLIGENCE

Business Intelligence (BI) tools within HMS will provide real-time performance dashboards, enabling hospital leadership to track KPIs and maintain regulatory compliance. These analytics will support data-driven funding decisions, measure return on investment, and facilitate automated compliance reporting. Visual summaries will aid in strategic planning and transparent governance.

CONCLUSION & CALL TO ACTION

The GoodMead Hospital Management System will transform hospital operations by streamlining processes, enhancing patient care, and ensuring regulatory compliance. Through a unified, cloud-based platform, HMS will improve efficiency, enable real-time clinical insights, and support better decision-making across departments. This transformation requires committed support from all stakeholders to ensure a successful launch, setting the foundation for continuous innovation and excellence in healthcare delivery.

THANK YOU!

Team №6 (CareTech)