SECD/SCSD 2613: System Analysis And Design

UTMSpaceKL

Semester 02, 2024/2025

Project Phase 2

LEGACY HEALTHCARE MANAGEMENT SYSTEM

KPJ Healthcare Berhad

Team Name: Group 5

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1.0 Overview of the Project

The aim of this project is to replace the Legacy Healthcare Management System (HMS) currently used by KPJ Healthcare Berhad. The existing system has served administrative and financial purposes for over two decades; however, it has become outdated, relying on legacy technologies such as Silverlight and a monolithic backend architecture.

A part of the multi-phase development strategy, this modernization effort is designed to improve user experience, scalability, and system integration through the use of modern frameworks, APIs, and secure architecture. The ultimate goal is to create a responsive, modular, and future-proof HMS that addresses current technology gaps without disrupting operations.

2.0 Problem Statement

KPJ Healthcare's current HMS possesses several critical shortcomings that render it less effective and adaptable. The system depends on extremely outdated technologies, which leads to compatibility issues with modern browsers, poor user experience, and exorbitant maintenance expenses. It lacks robust security controls and does not integrate with external systems such as mobile apps, payment gateways, or insurance portals.

In addition, the user interface is inflexible and is mostly structured with very little responsiveness. The inflexibility creates frustration for staff and increases the learning curve for new users. Lack of API support and modular architecture requires significant developer resources for even small changes. These challenges negatively impact operational agility and pose potential risks regarding data compliance and long-term viability.

3.0 Proposed Solutions

In accordance with the system modernization strategy defined in Phase 1, the suggested strategy tends to substitute the outdated Legacy Healthcare Management System (HMS) with a state-of-the-art, modular, and scalable solution. The existing system's deficiencies—in particular, aging technology, poor integration, and security vulnerabilities—will be resolved through the implementation of the following solutions:

1. Modern Frontend:

- Create a responsive, user-friendly user interface with the latest frontend frameworks such as React or Angular. This approach will make it accessible on all the popular browsers and devices, such as desktops, tablets, and smartphones.

2. Modular Backend Architecture:

- Rebuild the system using ASP.NET Core Web API, enabling separation of concerns through RESTful services. This enables maintainability, scalability, and integration with external platforms more easily.

3. Secure Authentication and Authorization:

- Implement role-based access control (RBAC) through OAuth2, IdentityServer, or Azure Active Directory (Azure AD) to secure patient and financial data.

4. Database Management:

- Use reliable and scalable relational database platforms such as SQL Server or PostgreSQL to effectively store healthcare data.

5. Reporting and Analytics:

- Integrate tools such as Power BI, SQL Server Reporting Services (SSRS), or Telerik to provide dynamic and visually enhanced reporting capabilities for informed decision-making.

6. Deployment Options:

- Deploy the system on the Microsoft Azure Cloud for high availability and scalability, or use Docker containers for on-premises installations, depending on organizational requirements.

7. Development Efficiency:

- Implement Continuous Integration and Continuous Deployment (CI/CD) pipelines to ensure rapid, reliable updates and maintain code quality throughout the development lifecycle.

Suggested solutions are based on the determination of feasibility and architectural design developed in Phase 1, and they form the base on which system requirements and user expectations are dissected in the current phase.

4.0 Information Gathering Process

To effectively modernize the Legacy Healthcare Management System (HMS) at KPJ Healthcare, it was essential to comprehensively understand both the limitations of the existing system and the specific needs of its users. This was particularly important in a high-paced healthcare environment where operational continuity and patient care are of utmost importance. Therefore, the information gathering process was designed to be thorough yet non-disruptive, ensuring that it would not interfere with daily workflows or impact patient care in any way.

Given the sensitivity of the hospital environment, the information gathering strategy focused on unobtrusive methods that would allow the project team to collect accurate data without disrupting staff operations. This approach ensured the system was assessed in its natural, real-world context, providing an honest reflection of its limitations. Two primary methods were used to gather data: Document Analysis and Passive Observation. These techniques provided valuable insights into the system's technical challenges, user experience issues, and operational inefficiencies.

Figure 1 : Login Page

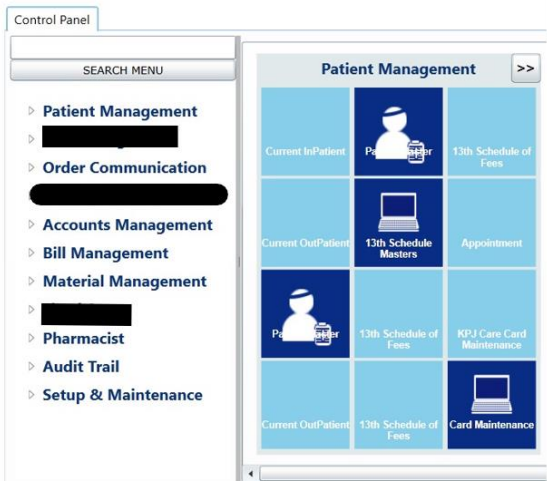

Figure 2 : Menu Page

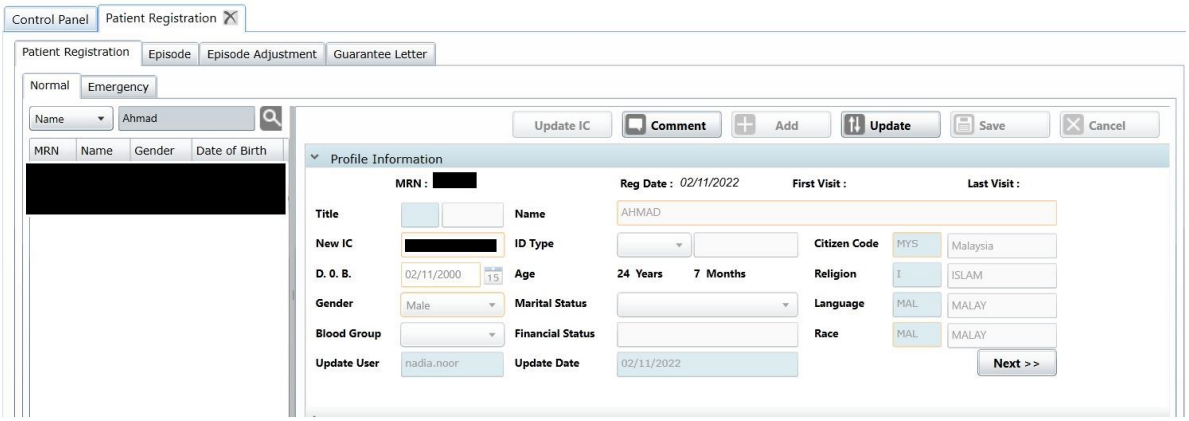

Figure 3 : Registration Page

4.1 Methodology Used

Document Analysis

Document Analysis involved a thorough review of all existing documentation related to the Legacy Healthcare Management System. This included examining user manuals, standard operating procedures (SOPs), system logs, technical specifications, and reporting templates. The purpose of this analysis was to identify recurring system limitations, outdated features, and operational bottlenecks that had developed over time.

By studying these documents, the project team was able to establish a baseline understanding of the system's intended functions and workflows. Key findings included outdated design structures, cumbersome reporting processes, and evidence of frequent technical failures during peak usage times. This method also helped in identifying areas where the system had been patched or minimally updated over time, offering insight into where deeper changes would be necessary for modernization.

Passive Observation

The second method of information gathering was passive observation, where the project team quietly observed hospital staff during their normal shifts. This approach was chosen to capture authentic user interactions with the system, without interrupting their workflows or creating bias through direct interviews or feedback requests. The focus was on observing staff in critical roles such as receptionists, finance officers, IT support staff, and department managers.

Key attention was given to how staff interacted with the HMS during high-volume tasks such as patient registration, billing, inventory management, and reporting. For example, receptionists were observed experiencing delays and slow loading times when managing patient appointments, especially when switching between modules. Finance officers often encountered difficulties when attempting to reconcile payments, as discrepancies arose due to lag times and the inability of the billing system to update in real-time. Observing these interactions helped the team gain a clear understanding of the system's technical limitations and inefficiencies that were not immediately apparent in documentation.

The observational approach also provided firsthand insights into specific issues such as the lack of compatibility with modern browsers. For example, IT support staff were frequently seen troubleshooting compatibility issues, particularly with newer browsers like Chrome and Firefox. This highlighted a critical technical gap—one of the core problems of the outdated browser-based front-end interface.

4.2 Summary from Method Used

The findings from both Document Analysis and Passive Observation revealed several critical limitations within the Legacy HMS that were directly impacting the hospital's operational efficiency and security. These insights provided valuable direction for the modernization project, ensuring that proposed solutions would be tailored to address the system's most pressing issues.

1. **Document Analysis Findings:**
    - **Reporting Limitations**: The reporting module lacked flexibility, requiring technical intervention to generate custom reports. Most reports were pre-programmed and difficult to adjust for specific needs, which slowed down administrative tasks like audits and month-end reporting.
    - **Performance Issues**: System logs revealed frequent timeouts and slow response times during peak hours. This was particularly noticeable when multiple users tried accessing the database simultaneously, highlighting performance bottlenecks that would need to be addressed in the new system.
    - **Lack of Integration**: The monolithic structure of the system made it difficult to integrate with external services such as insurance platforms or modern digital payment systems. This limitation posed a significant challenge in maintaining the hospital's competitive edge in the digital age.

2. **Observational Insights:**
    - **User Experience Challenges**: Receptionists were observed struggling with slow load times when switching between patient records and scheduling screens. This not only caused frustration but also contributed to longer waiting times for patients, affecting the overall service experience.
    - **System Compatibility Issues**: IT support staff were frequently addressing issues with the system's compatibility on modern browsers like Chrome and Firefox. The Legacy HMS was designed to work only on Internet Explorer, which had long been phased out. This resulted in users being forced to rely on outdated platforms, which increased security risks and decreased productivity.
    - **Operational Inefficiencies**: Finance officers were often confronted with inaccurate billing information due to the system's inability to update records in real-time, resulting in duplicate entries or missed transactions. This introduced significant risk into financial reporting and audit processes.

Conclusion

The combination of Document Analysis and Passive Observation provided a well-rounded understanding of the real-world challenges faced by KPJ Healthcare's HMS. The findings reinforced the need for a comprehensive modernization strategy that would not only improve technical performance but also enhance user experience, system security, and operational efficiency. By observing how hospital staff interacted with the system and analyzing key documentation, the project team was able to identify the core areas requiring improvement—areas that would be addressed through the proposed modernization plan.

In summary, the information gathering process confirmed that KPJ's current Legacy HMS is insufficient for the evolving needs of the organization. The system's outdated technology, poor user experience, and lack of scalability were key obstacles to operational efficiency and security. This insight forms the basis for the proposed modernization project, ensuring that the new system will be fully capable of supporting KPJ Healthcare's growing operational demands, enhancing security, and improving the overall user experience across all functional areas.

5.0 Requirement Analysis (AS-IS)

5.1 Current Business Process / Workflow

The current business process involves various departments using separate modules within a legacy monolithic system. Each process, such as patient registration, billing, or inventory, relies heavily on outdated forms and requires multiple manual entries.

These workflows are not integrated and require users to navigate through multiple screens to complete a task.

Below is a typical workflow for patient registration and billing:

1. **Patient arrives** and fills out paper-based forms.
2. **Registration staff** manually enters patient data into the HMS registration module.
3. The system generates a **temporary ID**, which must be copied manually into other modules.
4. The patient is sent to **consultation**, where the doctor retrieves information from a separate screen (non-integrated).
5. After consultation, the **billing department** re-enters patient information to generate invoices.
6. All information must be **stored separately** in the materials or general ledger modules if medications or services are used.
7. There is **no real-time data sharing** between departments.

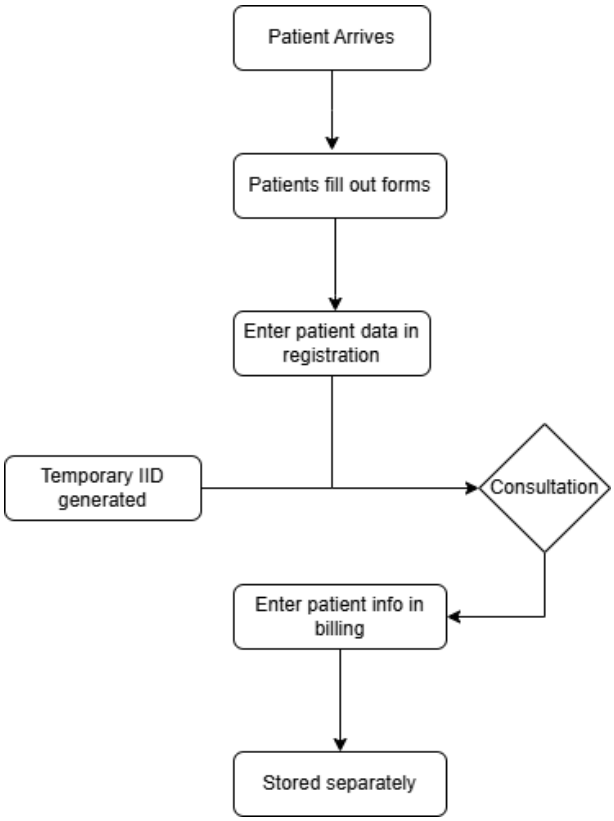

Figure 4 : Current workflow

5.2 Functional Requirements (AS-IS)

The current system meets the following functional requirements:

- Patient registration
- Billing and invoicing
- Inventory management
- Report generation for audits
- Staff scheduling and HR record keeping

Each function involves a sequence of inputs, processing, and outputs within a rigid interface. Here is **Table 1: Functional Requirements (AS-IS)**

Table 1: Functional Requirements (AS-IS)

FUNCTION	INPUT	PROCESS	OUTPUT
1. Patient Registration	Patient personal details, medical history	Manual entry into registration form	Patient ID, confirmation slip
2. Billing and Invoicing	Services used, medication details	Calculate total, generate invoice	Printed invoice, payment receipt
3. Inventory Management	Stock received, usage data	Update stock levels, generate alerts	Stock report, reorder notification
4. Report Generation	Daily/weekly/monthly activity logs	Aggregate and format data for audit	PDF/Excel audit reports
5. Staff Scheduling/HR	Staff availability, shift plans	Allocate shifts, update HR records	Duty rosters, attendance reports

5.3 Non-Functional Requirements (AS-IS)

Non-functional aspects of the current system include:

- Limited browser compatibility (requires outdated plugins)
- Low system response speed during peak hours
- Moderate security (basic authentication only)
- Poor accessibility on mobile devices
- Minimal usability due to outdated user interface

In addition to core functionalities, the system's non-functional characteristics were assessed. **Table 2 presents an overview:**

Table 2: Non-Functional Requirements (AS-IS)

CATEGORY	DESCRIPTION
1. Compatibility	Works only on outdated browsers with Silverlight plugin
2. Performance	Slow response times, especially during peak hours
3. Security	Basic username/password authentication; no encryption or role-based access
4. Accessibility	Not accessible on mobile or tablet devices
5. Usability	Outdated UI design with steep learning curve; no tooltips or guided features
6. Reliability	Occasional crashes and data loss due to lack of proper error handling
7. Scalability	Hardcoded limits; cannot handle growing user base or large data volumes

5.4 Logical Data Flow Diagram (DFD AS-IS)

To visualize the flow of data in the current system, a series of logical Data Flow Diagrams (DFDs) were constructed. These include the context diagram, Level 0 diagram, and detailed child diagrams for key processes. They collectively illustrate how data travels from external entities into the system and how it is processed and stored.

Context Diagram

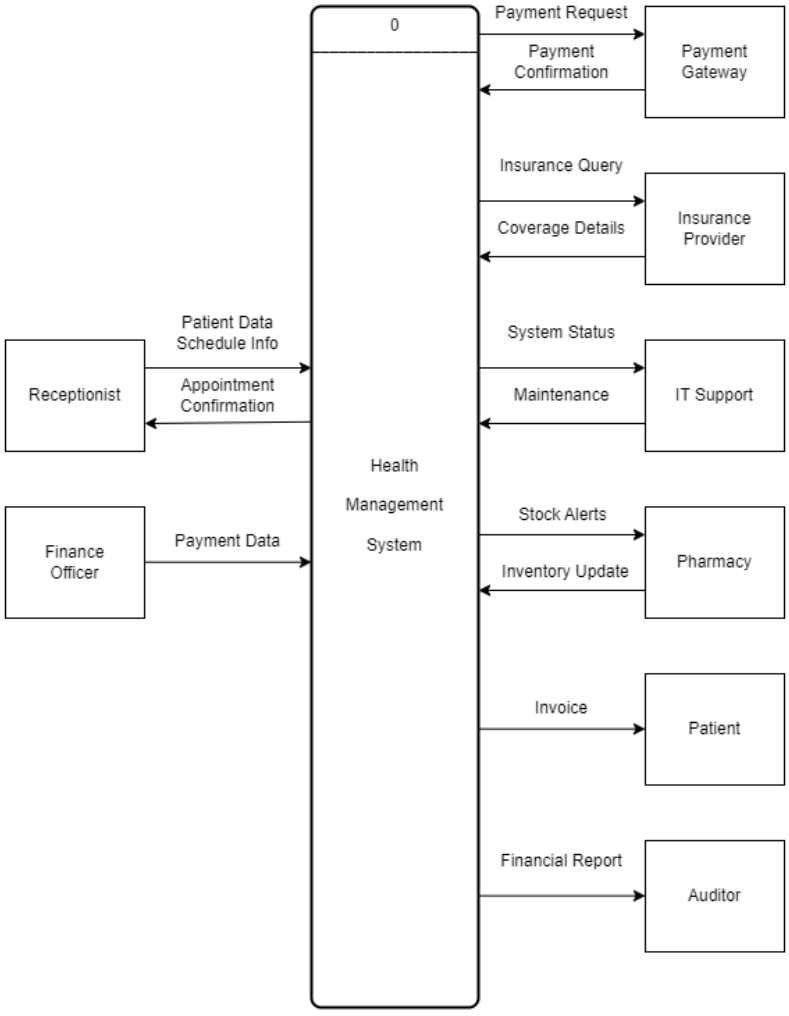

Figure 5 : Context Diagram

Diagram 0

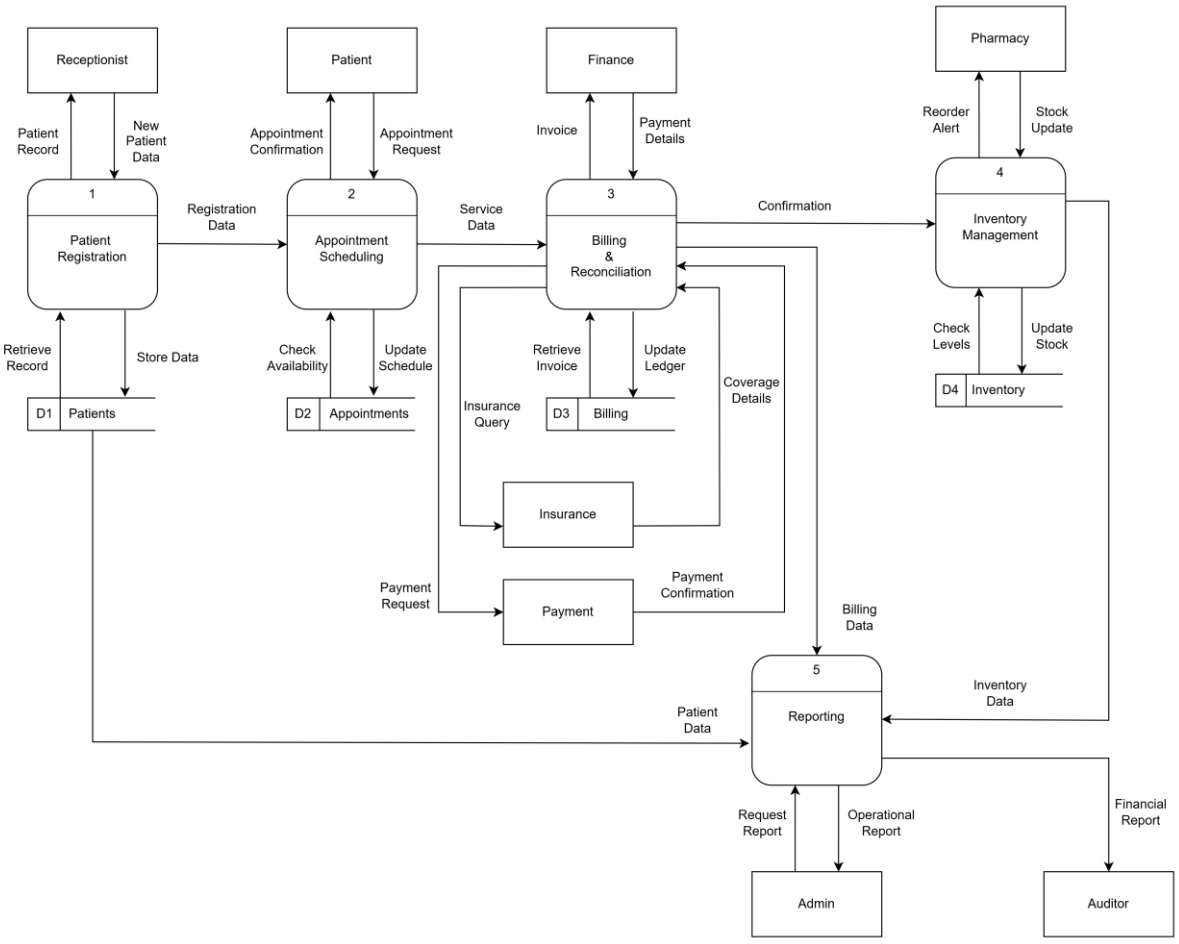

Figure 6 : Diagram 0

Child Diagram

1. Patient Registration (Process 1)

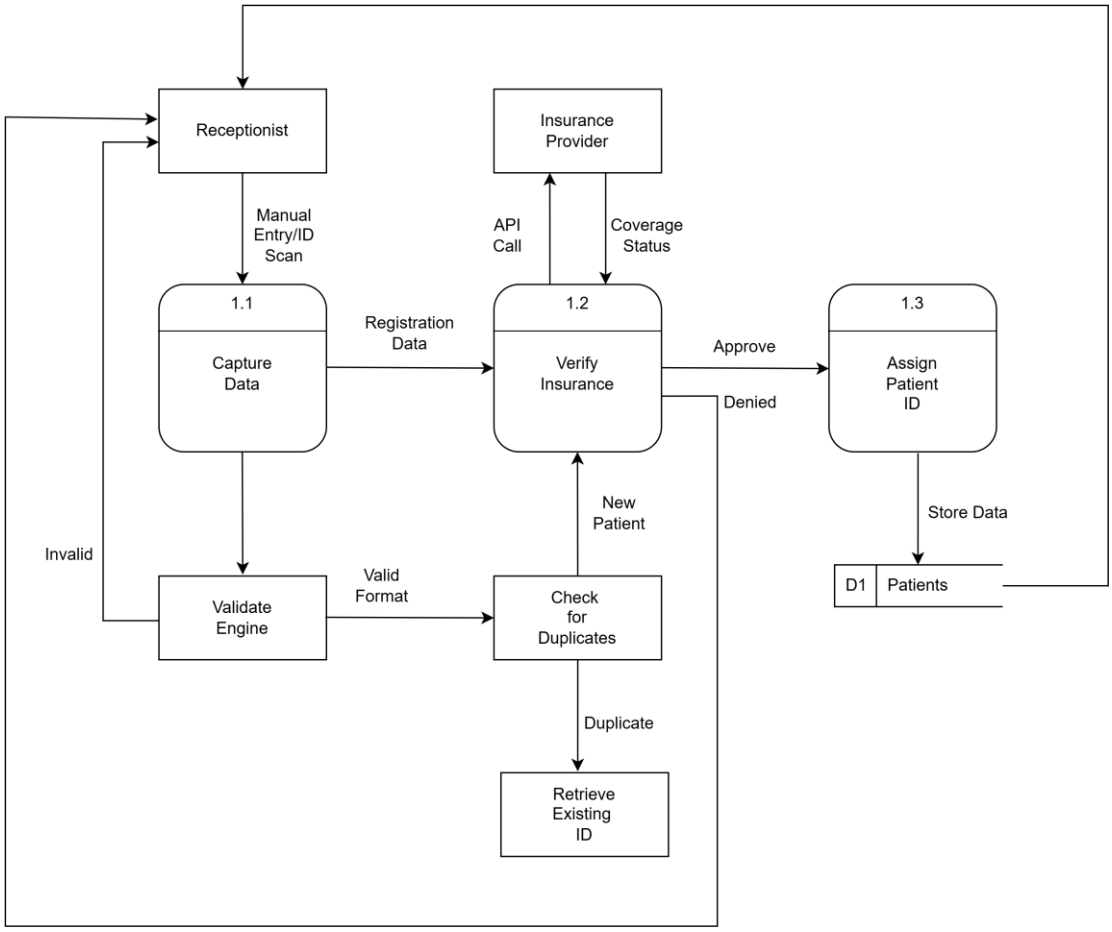

Figure 7 : Child Diagram Patient Registration (Process 1)

2. Appointment Scheduling (Process 2)

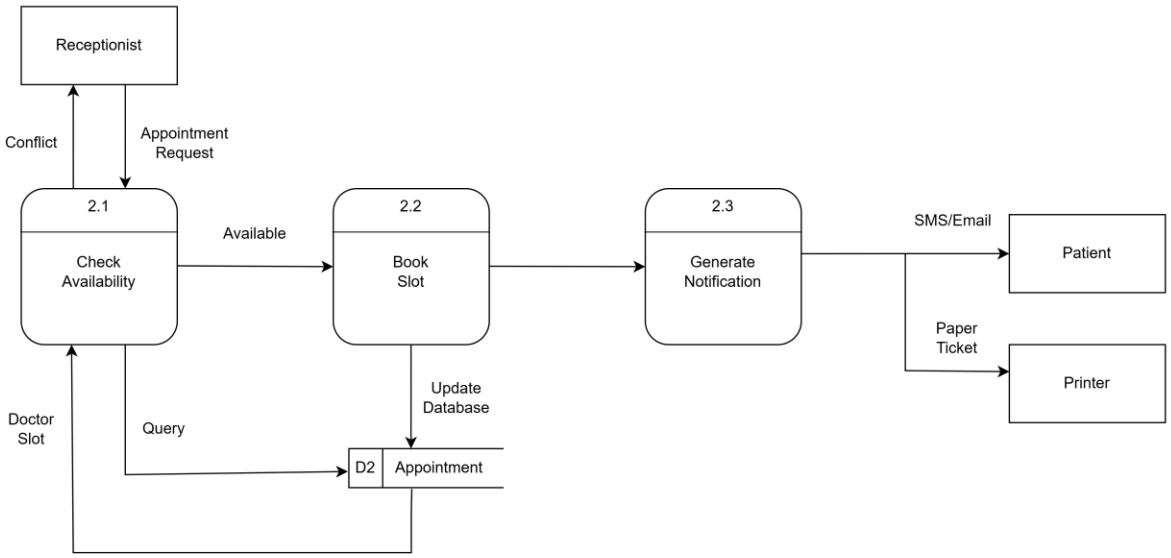

Figure 8 : Child Diagram Appointment Scheduling (Process 2)

3. Billing & Reconciliation (Process 3)

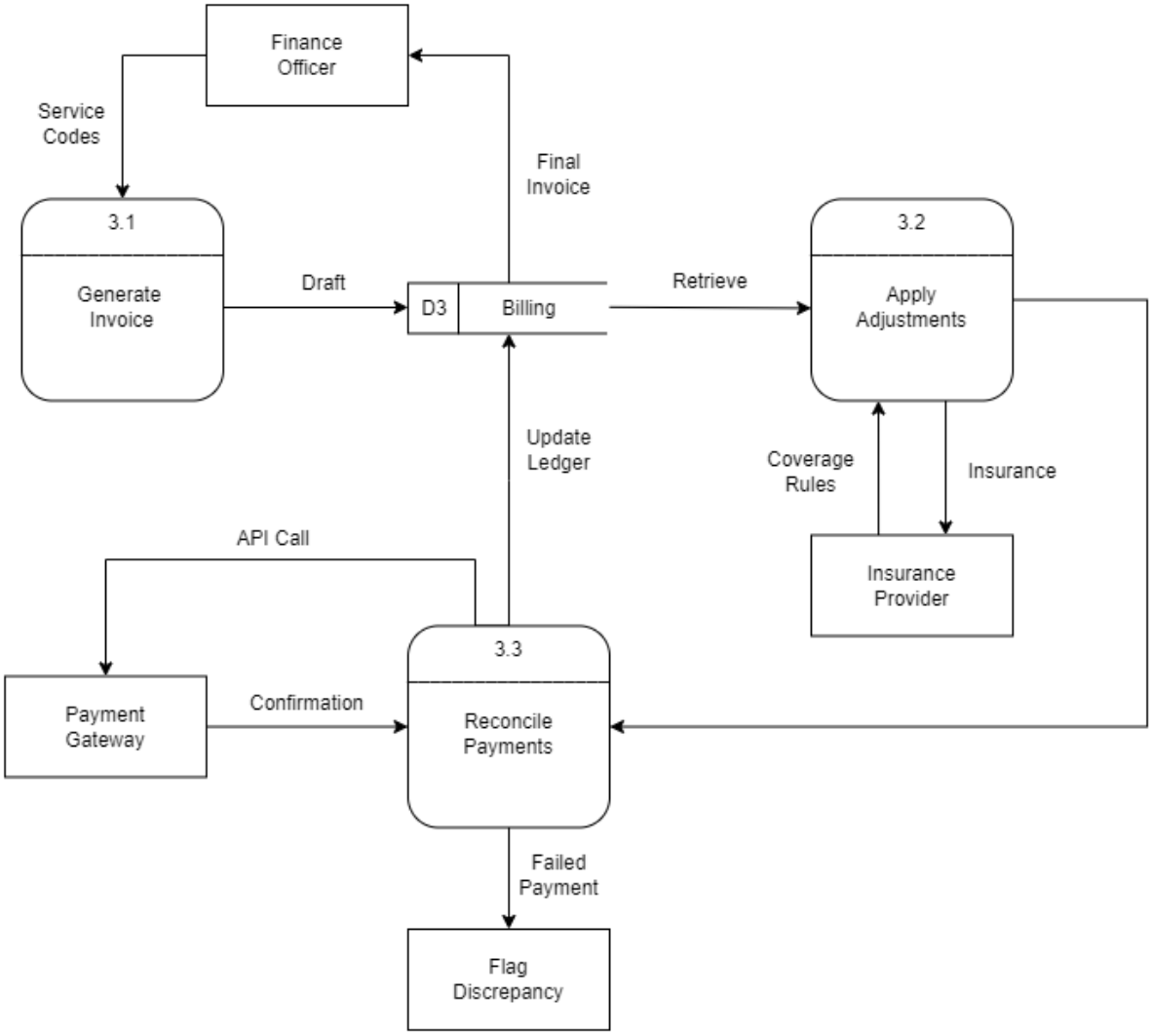

Figure 9 : Child Diagram Billing & Reconciliation (Process 3)

4. Inventory Management (Process 4)

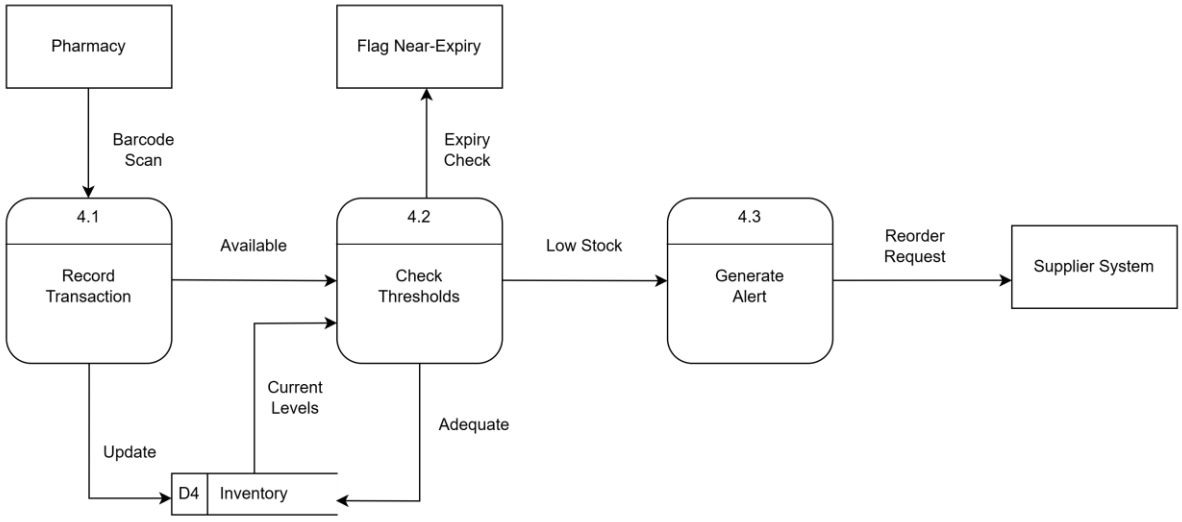

Figure 10 : Child Diagram Inventory Management (Process 4)

5. Reporting (Process 5)

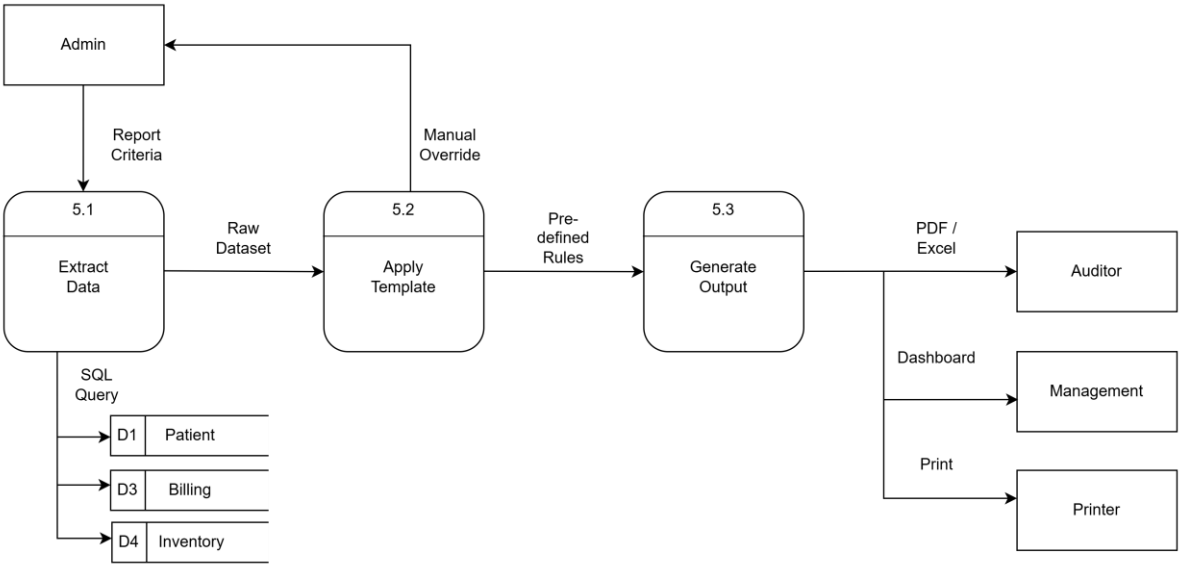

Figure 11 : Child Diagram Reporting (Process 5)

6.0 Summary of Requirement Analysis Process

The requirement analysis revealed that the legacy system used by KPJ Healthcare has several gaps in usability, integration, and scalability. Interviews and questionnaires showed high dissatisfaction among staff, particularly with system speed and navigation complexity.

Observation and document analysis confirmed redundancies and outdated workflows. These insights lay the groundwork for designing a modern system architecture that is more responsive, secure, and user-friendly.

Appendix A: Disclaimer

This academic report is prepared solely for educational purposes as part of a university assignment. The content, analysis, and system design presented herein are based on a Legacy system observed from a real-world environment within a healthcare context, including references to operational flows inspired by KPJ Healthcare Berhad.

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Appendix B: References

1.0 Sharina, N. I. (2025). 03 Topic III Part 1: Information Gathering – Interactive Method [PDF slides]. UTM, SECD2613 Systems Analysis and Design.

2.0 Sharina, N. I. (2025). 03 Topic III Part 2: Information Gathering – Unobtrusive Method [PDF slides]. UTM, SECD2613 Systems Analysis and Design.

3.0 Sharina, N. I. (2025). 04 Topic IV Part 1: Introduction to Data Flow Diagrams [PDF slides]. UTM, SECD2613 Systems Analysis and Design.

4.0 Kendall, K. E., & Kendall, J. E. (2019). Systems Analysis and Design (10th ed.). Pearson Education.