System Analysis & Design Assignment: HarmonyCare Limited

Case Study Report

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Task 1: Business Environment Analysis and SDLC Model Recommendation

Business Environment Overview:

harmony Ltd is operating in the private health care area across its offices in the UK and Germany and failed to manage patient records, appointments and billing for its decentralized operations structure. HarmonyCare can accommodate up to 1000 employees in different branches, and the various inadequacies that they face affect their performance and also the patients.

Current Problems:

Lack of Centralized Patient Registration System:

- Multiple recordings or endlessly divergent data as the registration process is localized in each agency (Vincenzi *et al.,* 2021).
- Manual entry to handling functions will result in the slowing of workflows and potential mistakes in patient data management.

Manual Appointment Management:

- Overbooking, and lack of satisfaction among patients due to time wastage and messy scheduling workflow.
- Staff shortages (doctors, nurses etc.), and crises in resource allocation (rooms, instruments and stuff) negatively impact operational efficiency (Ebekozien *et al.,* 2023).

Challenges in Billing and Inventory Management:

- Incorrect billing and delays in invoicing are among the top challenges of manual billing.
- Problems with inventory tracking which can be abstract node/supply chain disruptions and forecasting demand.

This situation tends to bring forth the immediate need for a new system that will cover areas like automation of key processes, and data accuracy in addition to being made simple for information sharing across the HarmonyCare network.

Benefits of the New System: Benefits of the New System:

Implementing a new system tailored to HarmonyCare's needs will yield several benefits:

Automation of Key Processes:

Process automation leads to the elimination of manual data entry for patient registration, appointment scheduling, billing, and inventory management, which decreases errors in the management system overall and elevates organizational productivity (Mane, 2023).

Enhanced Data Accuracy:

A centralized data management will guarantee consistency and detail in the patient's records, helping to avoid duplicating entries or disputes.

Improved Patient Care:

Updated notifications and monitored resources will enhance patients' experience to the max, making them contented and satisfied.

Operational Efficiency:

This will help with the workflow which will result in better staff productivity and an evident reduced administrative work.

Compliance with Regulatory Standards:

This new system will make the process of compliance with the set legal requirements easier to enable proper patient security of their data as well as billing accuracy (Pacheco Baldó, 2020).

Recommended SDLC Model: Agile

Due to the fast-changing environment in which Harmonys Care operates and the necessity to come up with continued improvement strategies, the Agile SDLC approach would be the

most appropriate for system development. Agile methodology focuses on sprints, collaborative meetings, and adaptability that makes it possible to offer features on the go and produce as many functional typings of a computer program as needed.

Key Characteristics of Agile for HarmonyCare:

Iterative Development:

Ensures change is done only step by step after testing and after real user feedback is received and consideration is given to business transformation (Jon, 2024).

Collaboration and Communication:

Eases up communication process, enforcing strong collaboration among developers, stakeholders and users, thus business goals and user needs are aligned.

Flexibility and Adaptability:

Provides a platform for HarmonyCare through which it adapts promptly to fluctuations in market needs, regulatory standards or running operations specifications, that sustains the system's effectiveness and competitiveness.

Quicker Deliveries:

Accelerates the implementation of respective module functionality and enables the project to be able to address current operational challenges while providing the stakeholders with the value they need early in the development process (Morales-Gázquez *et al.,* 2020).

Task 2: Requirements Analysis

The requirements analysis of the new system that is meant to overcome the operational problems of HarmonyCare Limited cannot be overlooked; this is because it is a critical process that would enable us to define the functional characteristics as well as the non-functional ones that will make the system successful.

Core Functionalities of the Proposed System:

Patient Registration System:

Actors: Receptionist, Patient

Use Cases:

Register Patient: The new system's capability allows the receptionists to key in new patient data, like personal details, what time they are to come in, and pre-existing health conditions. It should just give out core info that these include:

Update Patient Details: This allows receptionists to add and remove information, and a wide array of changes to patient records to keep the information accurate and up-to-date (Spanish, 2020).

Appointment Scheduling:

Actors: Doctor, Receptionist, Patient

Use Cases:

Schedule Appointment: Receptionists or patients now can book an appointment by using this function, which may be based on the doctor's availability and of course the patient's preferences. Through the integration into the doctor's schedule, it not only informs those who will attend the appointment of the confirmed bookings but also notifies the relevant parties about the confirmed appointments.

Manage Appointment Changes: This feature allows the users to respace or cancel appointments; the rescheduling is adapted to the changes in patient needs and available time

slots (Boya, 2023). It ought to eliminate delays or disturbances in information gates by swiftly processing the notifications and updates.

Billing and Invoicing:

Actors: Billing Department, Patient

Use Cases:

Generate Invoice: The device abstraction of the service rendered means no physical invoicing to be done, but only assuring accuracy in billing patients. Such components should also be integrated into the system by the business office and generate bills that itemize procedure prices in detail.

Process Payment: Enables scheduling, payment processing, and record of payments made by the patients for services offered. This decreases the risk of late or wrong transferences at the same time.

Resource Allocation and Inventory Management:

Actors: Administrator, Inventory Manager

Use Cases:

Allocate Resources: Empower the administrators to allocate physicians, rooms, and apparatuses responsibly to each patient considering their needs and area of availability (Gautama Putra, 2021). It should opt for the least cost method of deployment to reduce the waiting times and improve the operational activities.

Manage Inventory Levels: Provide visibility in terms of managing the inventory of medical supplies and equipment that are crucial in replenishing at the right time. It should set up alerts whenever the inventory is at a low level and improve both the ordering and the inventory management activities.

Non-Functional Requirements:

Performance:

- The approach must be designed to optimize the network dynamics, avoiding overloading and hence ensuring timely response even at the peak moments.

- The critical response time for the medicine shop judicial functions of patient registration and appointment scheduling should have rate and consistency from a professional point of view (Kovalenko, 2022).

Security:

- Personal data need to be processed according to the rules and regulations (for instance, GDPR, and HIPAA). Obfuscation and authorization control to secure the sensitive details shall be applied to this end.\

- A safety system should be built to protect finance data in all transactions and offer secure payment processing.

Usability:

- The backend user interface should be intuitive and user-friendly to those across the branches with different tech savviness levels.

- The training and support resources that will ensure the proper and successful adoption and usage of the system must be made available (Valacich *et al.,* 2022).

This kind, of careful requirements analysis is required by HarmonyCare Limited to design and carry out the system that improves the operation and treatment of the patients. According to the feature of core functionalities and non-functional requirements, it is possible to develop a customized solution which is designed to optimize the existing workflows, improve data accuracy, and management of compliance with regulatory standards, in the end, this ensures the healthcare services in a better quality level.

Core Non-Functional Requirements:

The need for including non-functional requirements into the proposed system is understood by HarmonyCare as they aim to achieve the success of their system. These core non-functional requirements are essential to enhancing operational efficiency, improving patient care, and ensuring compliance with regulatory standards:

Performance:

The system should demonstrate strong stability, which is transparent and able to withstand high load during peak time while running steadily without experiencing a significant performance drop (Seppänen and Nurmi, 2024). Operations critical for timeliness such as patient registration and appointment scheduling should remain flowed through to yield the best user experience and continuity of operations.

Security:

The mainline privacy of the patients is a rust. The system has to meet the requirements of jurisdiction laws such as GDPR and HIPAA with strict policies for data access and encryption to protect personal details and data. Data integrity and confidentiality are two aspects with a non-compromising nature which should be guaranteed in the design and implementation of the system.

Usability:

The system interface thus should be intuitive-seeming along with being user-friendly with «bridging the gap» of all levels of technical knowledge of the staff across the branches (Redaud *et al.,* 2024). The necessary training and support resources will be in place so that the new system is learned by users and accepted seamlessly thus leading to greater levels of satisfaction and operational efficiency.

Impacts of Proposed System Implementation Incorporation:

Implementing the proposed system at HarmonyCare will yield substantial benefits across various aspects of healthcare service delivery:

Improved Data Accuracy:

Data centralization and data entry automation will make sure to reduce the number of human errors that all manual input brings. In such a way all the related data will be complete and without flaws over the entire system.

Enhanced Operational Efficiency:

Streamline scheduling of appointments, resource distribution and billing processes shifting workflows to be more optimum which ultimately results in the reduction of administrative burden and increase in staff productivity (Miller, 2021). This leads to higher efficiency in the service delivery and better patient experience, thus, making the medical institution user-friendly.

Enhanced Patient Care:

Instant [alerts], precise billing, and prompt resource allocation will result in improved patient care and satisfaction with the services offered by our health institutions. The process of care will be made more effective by the implementation of standardization based on the need and time criticality of healthcare services provision.

Task 3: System Design with Data Flow Diagrams (DFD)

Level 0 DFD (Context Diagram):

External Entities:

Patients: The patients who are seeking medical services and coming in contact with the system to determine the time and other resources needed for their treatment and health recovery (scheduling appointments and accessing the healthcare facilities and resources).

Medical Staff: Among them are doctors, nurses and other medical workers who perform most of the services and deal with the care of the individual under their operation (Islam and Uddin, 2023).

Administrators: The staff involved in resource allocation, inventory management, and technical support system maintenance.

Processes:

Patient Registration: Includes taking the information that is in the patient records of the system and making sure that all of the information is true, recent, and in the right format.

Appointment Scheduling: Offers convenient booking and monitoring of patient appointments, maintaining the availability of both patients and the staff (Amrane *et al.,* 2020).

Billing and Invoicing: carrying out the financial transactions prompted by the patient services such as creating invoices and payment processing.

Resource Allocation Management: It distributes resources like the doctors, rooms and the necessary medical equipment to patients according to their necessity and operational needs.

Data Stores:

Data stores represent repositories where crucial information is stored and accessed within the system:

Patient Records Database: Data that is distributed throughout the chain process is simplified allowing patients' health information to be maintained with the help of a unique ID, along with their medical history, contact information and appointment details (Kim, 2022,).

Appointment Database: This system takes a lead role in scheduling data, so that you may see appointment dates and openings in your appointment calendar. It serves the purpose of scheduling.

Billing System: Captures or generates billing information, bills a good or service, and reflects the financial transaction related to patient services.

Inventory Management System: The track is used for the control of medical supplies and equipment, the work eases the conventional care with supply and distribution of supplies.

Data Flows:

Data flows illustrate the movement of information within HarmonyCare's system:

Patient Information Flow: Generates transfer of patient data from registration, appointment scheduling, etc. onto the medical staff.

Appointment Details: Communicates the schedule of appointments with various stakeholders responding to any time delay or availability issues arising (Dantas *et al.,* 2021).

Billing Data: Transfers billing information to the billing system and critical participants in financial operations.

Resource Allocation Updates: Delivers resource allocation and operational management reports and instructs them on ways to optimize patient care processes.

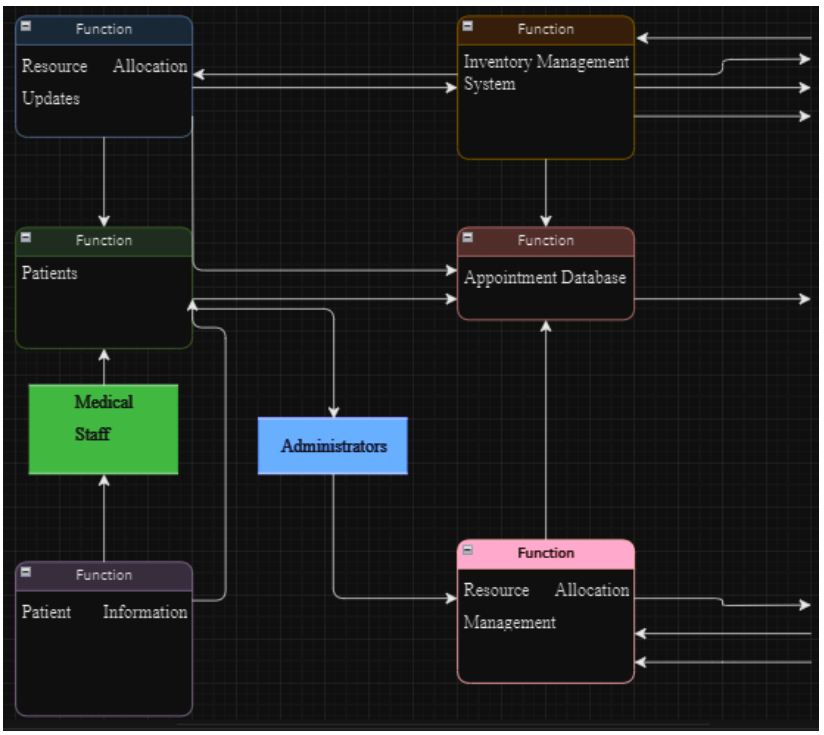

Figure 1: Level 0 DFD

(Source: Srlf-created in draw.io)

Level 1 Data Flow Diagram (Main Process Diagram):

Components of Level 1 DFD:

Patient Registration System:

Inputs: Patient data: (Example: self-clarifying details, medical history)

Processes:

Register Patient: In the course of interviewing new patients and imputing data from personal information, catchphrase: "Receptionists create patient records), receptionists enter new patient data into the system.

Update Patient Details: The era of updating changed and provided opportunities to record the patient's data.

Outputs: Updated Patient Records with acknowledgement of any alterations that had occurred (Kao *et al.,* 2020).

Appointment Scheduling:

Inputs: Availability of Doctors, Patient Demands (such as preferred time pickers).

Processes:

Schedule Appointment: Reightering depends on the receptionist or any patients who input scheduling requests, check doctor availability, and make appointments.

Manage Appointment Changes: Provides the option of changing or cancelling the appointments, thus updating the system immediately (Bhatta *et al.,* 2022). For further practice, explore our previous sessions:

Outputs: Appointments placed in the reliable calendar with the exact timetable assigned.

Billing and Invoicing:

Inputs: Customer Engagement (for example, consultants and interventions), Patient Education.

Processes:

Generate Invoice: LAMS automatically generates invoices based on services rendered to patients in their records.

Process Payment: Enables transaction processing and payment entry, updates the patient account, the bills the patient must pay, and the payroll records (Liu *et al.,* 2023).

Outputs: The patient bills and the payments recorded in the system will be confirmed respectively.

Resource Allocation/Inventory Management:

Inputs: Demand Forecast, Inventory Levels foreseeably, the equipment and supply are required to be accounted for.

Processes:

Allocate Resources: Doctors are placed in certain departments with rooms and equipment distributed among them by the number of released beds and the availability of the equipment.

Manage Inventory: The inventory managers track the stocked-up levels and update the records on the inventory as time progresses and they also estimate their future sales (Kühlen *et al.,* 2023).

Outputs: By keeping the information about the Resource Allocation (e.g., assigned resources) and its accurate inventory reports (e.g., stock, reorder recommendation) in the same place.

Interactions within Level 1 DFD:

Our Patient Registration System is directly linked with Appointment Scheduling and Billing and Invoicing processes to give patient information for appointment scheduling and generating invoices. In the Appointment Scheduling process, the Resource Allocation represents the inventories, which are the doctors and rooms that are allocated to patients based on the availability and the quantities (Pavić and Džapo, 2020).

Our Billing and invoicing processes depend on detailed patient data (from the Patient Registration module) and service details (from the Appointment Scheduling module) offered during situations (Yousefi Nejad Attari *et al.,* 2020). Resource Allocation/Inventory Management is one of the factors that drive efficient operations since it is necessary to have enough resources and inventory that are available at the scheduled appointments and services.

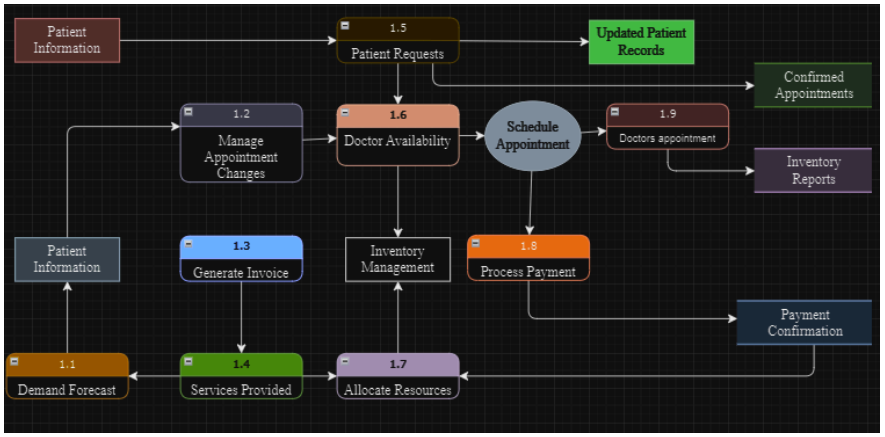

Figure 2: Level 1 DFD

(Source: Self-created in draw.io)

Level 2 DFD (Detailed Process Diagrams):

Subprocesses:

Validate Doctor Availability:

The receptionist adduces the names of doctors who are on call based on their routine schedules.

Data flow: Data about the clinical availability of the day was entered by the receptionist into the system.

Process: The system cross-references the worked-out day schedules of doctors with the patient's appointment request time and date (Getchell and Pachamanova, 2022).

Confirm Patient Details:

The receptionist confirms the patient's name and manipulates the medical information stored in the system.

Data flow: Patient-specific information accessible from a centralized patient records database.

Process: The Receptionist is responsible for confirming the patient's identity, and medical requirements, and follows the protocols to pass on the message from the patient to the doctor on time.

Schedule Appointment Slot:

Further, the secretary picks up the time slot that is convenient to both the doctors and the patient's availability.

Data flow: Appointment time and slot details were transferred to the appointments timetable module as well.

Process: The system uses the selected date for scheduling the planned appointment.

Data Flows:

Doctor Availability Data:

- Data transfer from the doctor's availability database to the appointment scheduling component is conducted through the system.

- Information consists of the working days of the doctor, specific medical service, and the hours usable for the appointment.

Patient Appointment Requests:

- The flow of data began with the patients making a specific request for an appointment at a particular time or for a specific service.
- Information is pulled by the system from the database and processed for further assigning.

Confirmed Appointment Details:

- Data path which delivers a complete list of bookings, for example, the doctor's name, the patient's name, schedules, and all other necessary information.
- We will convey particular information to stakeholders including doctors, patients, and the frontline staff.

Interactions and Processes:

User Input and Validation:

- The receptionist enters the therapist's availability as well as the patient's surname and appointment date, confirming it all through the system (Aktas and Yilmaz, 2020).
- Synchronizes and verifies the information in the operational engine to sustain the schedule accuracy.

Automated Scheduling Algorithms:

- The system uses algorithms to determine the most suitable appointment schedules by considering chaos and chaos rules initially.
- Algorithms essentially determine factors such as availability of doctors, choice of clients and the seriousness of the medical situation.

Real-time Notifications and Updates:

- After patients and doctors make appointments, the system sends real-time notifications to their devices.

- Informing relevant stakeholders who will participate in the meetings about changes that may affect their schedules is essential for ensuring an efficacious schedule and limiting scheduling conflicts (Leng *et al.,* 2021).

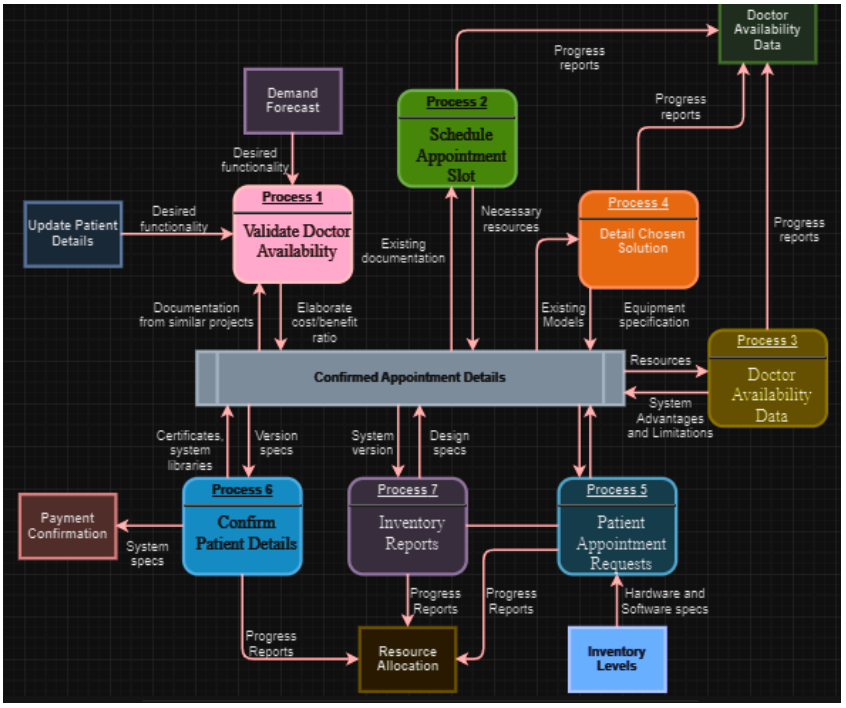

Figure 3: Level 2 DFD

(Source: Self-created in draw.io)

Task 4: Implementation Plan and Stakeholder Communication

In the implementation phase of the new system development for HarmonyCare Limited, a comprehensive plan is essential to ensure successful deployment and adoption across the organization. This plan encompasses system testing and training initiatives, accompanied by strategic stakeholder communication strategies tailored to varying roles and needs.

System Testing:

To test out the functional efficiency, effectiveness and proper of the new system, HarmonyCare will apply the closed testing strategy.

Unit Testing: The system of system-level integration will be tested to see if the components are operating as the design intended.

Integration Testing: The integrated modules' operativeness will be tested to ensure optimum data flow without errors and bugs (Hu *et al.,* 2021).

Acceptance Testing: Testing that is conducted from end-to-end will be used to ensure that the system can fulfil business requirements and user expectations.

HarmonyCare intends to do it by enforcing strictly the testing procedures which will be used for identifying and solving any problems that might appear before the system is deployed which will so to reduce the disruptions of operations.

Training:

Training is also one of the most critical components which allows for an efficient and smooth transition into the new system. Employment at HarmonyCare will involve getting the staff starting with training sessions differentiated according to certain positions, covering system functionalities and best practices. Training programs will be designed to:

- Tailor your communication based on audience needs that vary according to the department or function within the organization.
- Giving the practical experience to all the users for the better operation of such a system would be important (Batubara *et al.,* 2022).

- The wrap-up phase entails support and ongoing resources for the employees as they seek to improvise on the outcomes.

- The new system implementation will be more successful if HarmonyCare invests in different types of training to increase people's adoption and realization of the advantages of the system.

Stakeholder Communication:

The HarmonyCare project understands the significance of using open and adapted communication tools to grab the attention of both the current stakeholders as well as the general population involved in the project implementation process. Communication strategies will include:

Channels: We use different media for communication such as meetings, email reports, intranet announcements and others to be effective in providing information.

Tailored Methods: Adjusting communication strategies according to stakeholder position titles, background, and the role that the environment has in their lives to ensure their full participation and understanding.

Regular Updates: Keeping up with providing regular information on project deadlines, issues encountered and succession points; will encourage the participation of stakeholders and immediate resolution of their issues (Teklit, 2023).

Through the delivery of robust stakeholder communication strategies, HarmonyCare intends to develop a collaborative environment and cope with the different levels of expectations of its various stakeholders.

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