Seneca | SCHOOL OF INFORMATION TECHNOLOGY ADMINISTRATION & SECURITY

Analysis Assignment

Group Nexus

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PMC130: Fundamentals of Systems Development

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Executive Summary

This document presents a detailed analysis and solution for the implementation of a comprehensive patient administration system for a dental clinic, developed by Nexus Technology Solutions. The clinic struggled with managing patient records, insurance processing, and billing due to outdated manual systems, leading to significant inefficiencies, errors, and delays. These issues not only hindered operational productivity but also negatively impacted patient satisfaction and billing accuracy. Our proposed solution aims to address these challenges by implementing a robust software system that enhances data accuracy, streamlines processes, and ensures compliance with industry standards and regulations.

The solution development follows an agile methodology, allowing for iterative construction and continuous improvement based on stakeholder feedback. Key features of the system include comprehensive management of patient records, household information, insurance details, staff coordination, and invoicing. The system's design ensures accurate, organized, and accessible information, significantly improving operational efficiency and reducing errors. The project also emphasizes rigorous quality assurance through various testing stages, including unit, integration, system, and user acceptance testing. Additionally, extensive training and support are provided to clinic staff to ensure a smooth transition and effective use of the new system. This solution aims to enhance the clinic's overall productivity, regulatory compliance, and patient care quality.

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INTRODUCTION

Nexus Technology Solutions provides custom software solutions to meet our clients' specific needs. Founded four years ago, we began with a small team of passionate technologists aiming to blend advanced technology with practical business solutions. Today, we've grown into a trusted partner for businesses looking to boost efficiency and productivity.

Our success is driven by a dedicated team of professionals—software architects, designers, developers, QA Analysts and project managers—who combine technical expertise with a deep understanding of industry needs. We work closely with clients to deliver solutions that not only meet but exceed expectations. Focused on innovation, reliability, and client satisfaction, Nexus Technology Solutions continues to lead in software development, helping businesses thrive in the digital age.

Our current project focuses on partnering with a dental clinic that operates with a team of multiple dental professionals. The clinic encounters substantial difficulties in handling patient records and simplifying billing procedures due to outdated systems. These systems are susceptible to errors, inefficiencies, and delays, significantly affecting the clinic's ability to deliver prompt and efficient patient care. Our objective is to overcome these challenges by introducing a robust software solution. This solution aims to enhance data accuracy, streamline operational processes, and ensure compliance with industry standards and regulations.

Custom software solutions for dental clinics are created by Nexus Technology Solutions using an organized methodology. We start by holding in-depth meetings to completely comprehend the unique operational difficulties and needs of the clinic regarding patient care and invoicing. Following this first stage, we carefully collect specific requirements through workshops, interviews, and a thorough assessment of all supporting material. Determining necessary data items, system functionalities, user responsibilities, integration specifications, and compliance needs are all part of this process. After that, our group concentrates on developing the system architecture, which comprises drawing a thorough schematic of the modules, interfaces, data flows, and structure of the system. Simultaneously, we carry out a thorough evaluation of the technical feasibility to guarantee smooth integration with the clinic's current IT infrastructure and scalability for expansion.

We use an agile methodology to construct and improve the software solution iteratively during the development period. We can confirm important features through prototype testing and swiftly adjust to changing requirements. We continue to actively collaborate with clinic stakeholders during this phase to

take their input into account and guarantee alignment with operational requirements.

Our procedure is not complete without quality assurance. We test the solution thoroughly using unit testing, integration testing, system testing, and user acceptability testing (UAT) to make sure it runs smoothly, is easy for users to understand, and works well in a variety of scenarios. We carefully supervise the deployment procedure to reduce any interference with clinic operations when testing is completed successfully, and clients provide their consent. To guarantee a seamless transition to the new system, we provide clinic staff with extensive training sessions. Following implementation, we keep a close eye on system performance and create a continuous feedback loop with clinic stakeholders so that we can keep improving the solution in response to their changing demands and market developments.

Business Summary

Problem Statement

The dental clinic currently struggles with managing patient administration efficiently due to the lack of a dedicated system. The current system falls short in dealing with the complexities of patient records, insurance processing, and the involvement of multiple staff members in procedures. The outdated methods may lead to errors, inefficiencies, and delays in handling patient records, household information, insurance details, staff coordination, invoice management and periodic operational reports. This inefficiency can affect patient satisfaction, billing accuracy, and overall clinic productivity.

Solution Vision

Develop a comprehensive patient administration system for the dental clinic to streamline the management of patient records, household information, insurance details, staff coordination, and invoicing. The system will ensure accurate, organized, and accessible information, improving operational efficiency, reducing errors, and enhancing patient satisfaction.

SWOT Analysis

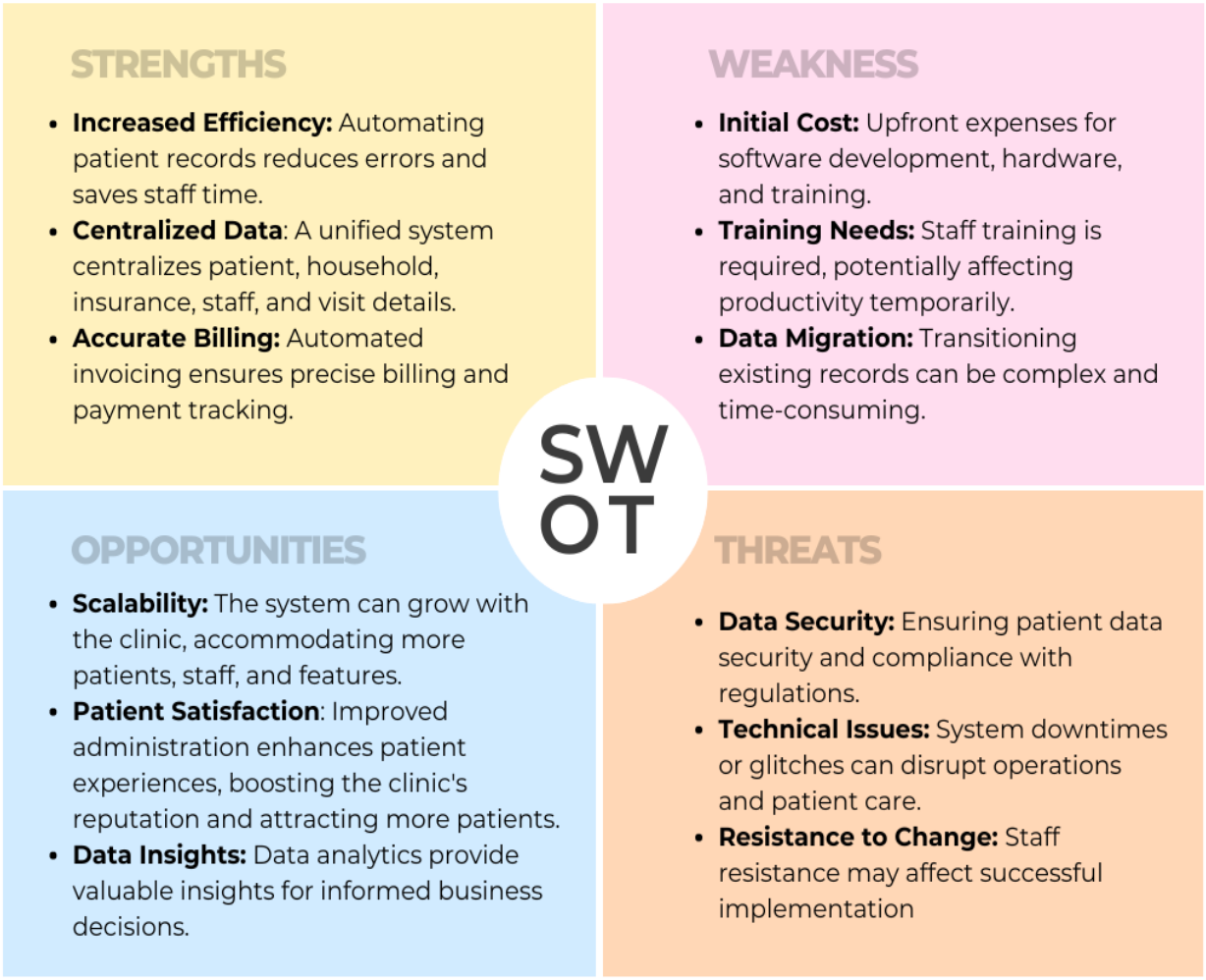

Figure 1: SWOT Analysis

Stakeholder Analysis

Stakeholder analysis is a critical component in the successful implementation and operation of the Dental Administration system developed as a cloud solution. This analysis aims to identify, prioritize, and engage key stakeholders who play vital roles in leveraging the system's capabilities to enhance clinic operations, patient care management, and regulatory compliance.

In this section, we will explore various stakeholders involved in the Dental Administration system. These stakeholders encompass internal users such as dentists and office administrators, external parties including patients and insurance providers, regulatory authorities ensuring compliance with healthcare standards.

By understanding the influence, interests, and priorities of each stakeholder group, we can strategically align communication, support, and implementation strategies to maximize the system's effectiveness and benefits across the clinic. Effective stakeholder engagement is key to achieving seamless integration, operational efficiency, and improved patient outcomes through the Dental Administration system.

Stakeholder	Influence	Interest	Details
Dentists	High	High	Primary users requiring efficient and reliable patient management tools.
Other Dental Staff	Medium	High	Includes dental hygienists, x-ray technicians, and specialist dentists, needing access to patient and procedure records.
Receptionist	Medium	High	Manages scheduling, patient records, and initial data entry.
Business Manager	High	High	Critical for managing patient records, oversees financial transactions, invoicing, and ensures data accuracy.
Heads of Household	Low	High	Receive and manage patient billing statements and insurance information.
Patients	Low	High	Require user-friendly access to appointment scheduling and health information.
Insurance Companies	Medium	High	Interface with the system for claims processing and billing inquiries.
Regulatory Authorities	High	High	Ensure compliance with healthcare regulations, data protection laws, and patient privacy standards.
Clinic Management	High	High	Drive strategic decisions and oversee the adoption of the system for operational efficiency.

Table 1: Stakeholder Analysis

Stakeholder Categorization

Categorizing stakeholders into internal or external, and operational or management, is essential for effective system implementation and operation. Internal stakeholders, such as dentists and staff, directly interact with the system in daily patient care and administrative tasks. External stakeholders, including patients and regulatory bodies, influence system requirements and compliance from outside the dental practice. Distinguishing between operational stakeholders involved in system use and management stakeholders overseeing strategic alignment ensures targeted engagement and efficient system integration.

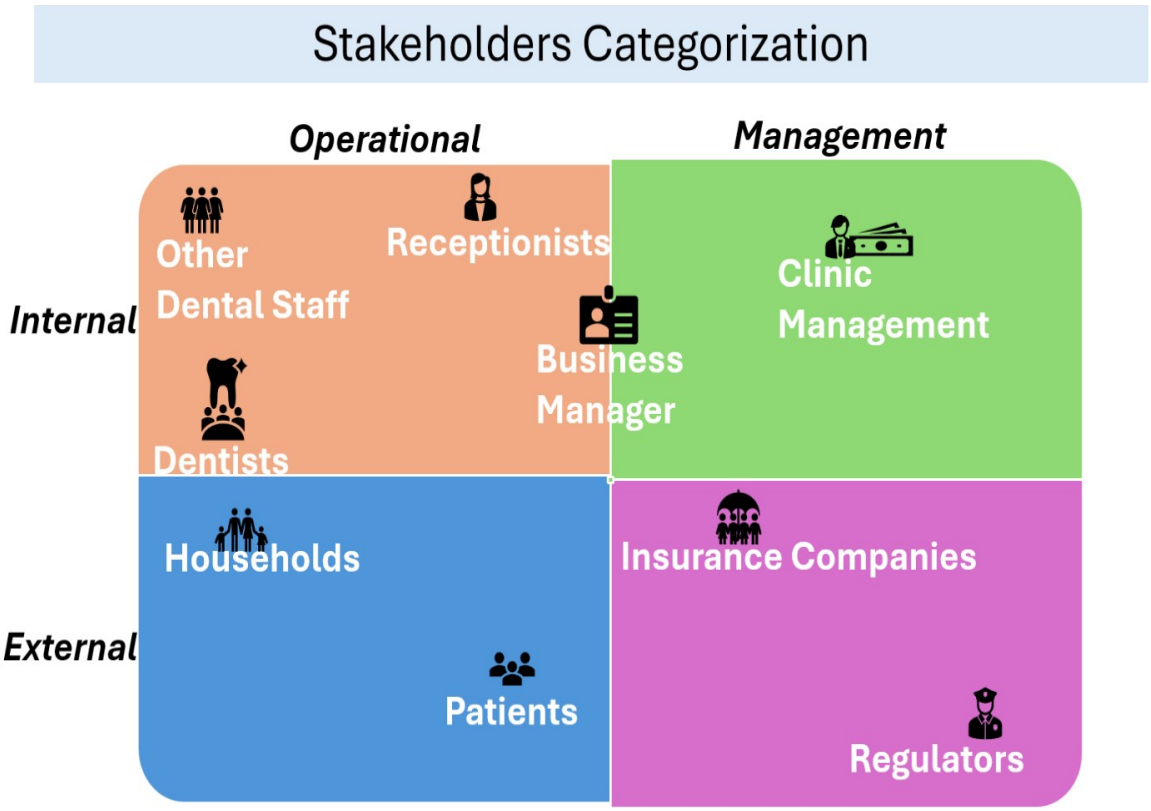

Figure 2: Stakeholders Categorization

Stakeholder Power and Interest Analysis

Stakeholder Power and Interest Analysis examines the influence and engagement levels of key stakeholders. Dentists and management hold high power due to their operational and strategic roles, impacting system decisions. Patients and regulatory authorities, with high interest in data security and service quality, are crucial for aligning system development with healthcare standards and patient satisfaction. This analysis guides effective stakeholder engagement strategies to ensure system effectiveness and regulatory compliance in dental practice management.

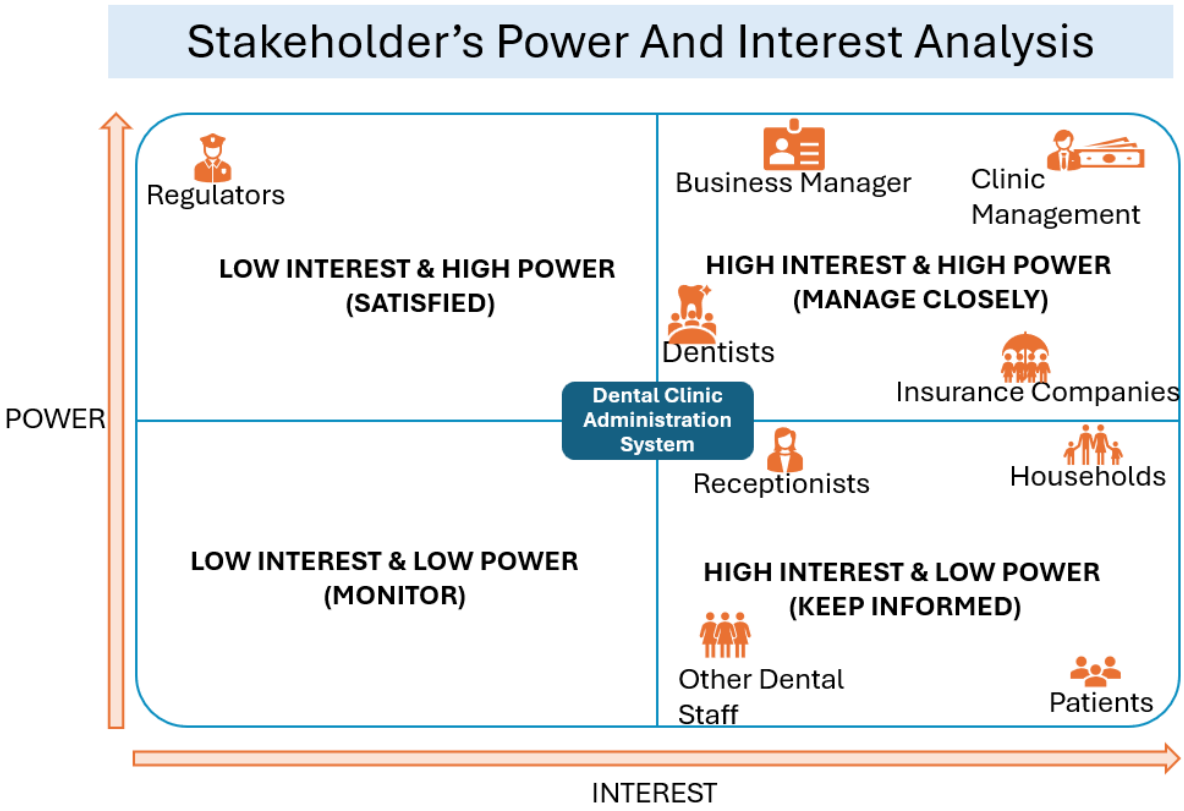

Figure 3 - Stakeholders Power and Interest Analysis

Detailed Requirements and Solution Features

1. Patient Records Management:
- Store patient details: name, date of birth, gender, date of first visit, and date of last visit.
- Link patients to household records for grouped management.

2. Household Records Management:
- Maintain household details: head of household name, address, and telephone number.
- Associate households with insurance carrier records.

3. Insurance Management:
- Keep insurance carrier records, such as contact and billing information.
- Link patient and household records to insurance carriers.

4. Staff Records Management:
- Maintain minimal staff details: name, address, and telephone number.
- Track staff involvement in patient visits and procedures.

5. Procedure Management:
- Store procedure specifics: type, description, tooth involved, copay amount, total charge, amount paid, and insurance denials.

6. Invoice Management:
- Generate invoices for insurance companies and heads of household.
- Invoice details tracking, including amounts due, paid, and denied.
- Print and send patient invoices monthly and insurance invoices weekly.

7. User Roles and Permissions:
- Define roles for receptionist and business manager with specific permissions.
- Receptionist: Enter and maintain patient and household information, track office visits.
- Business Manager: Maintain staff information, print and manage invoices, verify accuracy.

8. Reporting
- Reports on the procedures performed by dental staff.
- Generate overdue invoice reports.

Use Cases

Based on the above-mentioned functional requirements, the following use cases are identified for the dental management system.

Users/actors	Use cases
Business Manager	Create/Update Insurance Carrier Information
Business Manager	Create/Update Dental Staff Records
Receptionists	Create/Update Households
Receptionists/Business Manager	Create/Update Patients
Receptionists	Record Patient Visits

Dental Staff	Record Procedures
System	Generate Monthly Patients Invoices
System	Generate Weekly Insurance Invoices
Households	Make Payment
Insurance Companies	Disburse Copay/Claim Amount
System	Track Payments
System	Update Invoice Status
Business Manager	View Invoices
Business Manager	Send Overdue Invoices
Dental Staff	View Procedural Reports

Below is the diagrammatic representation of the above-mentioned use cases.

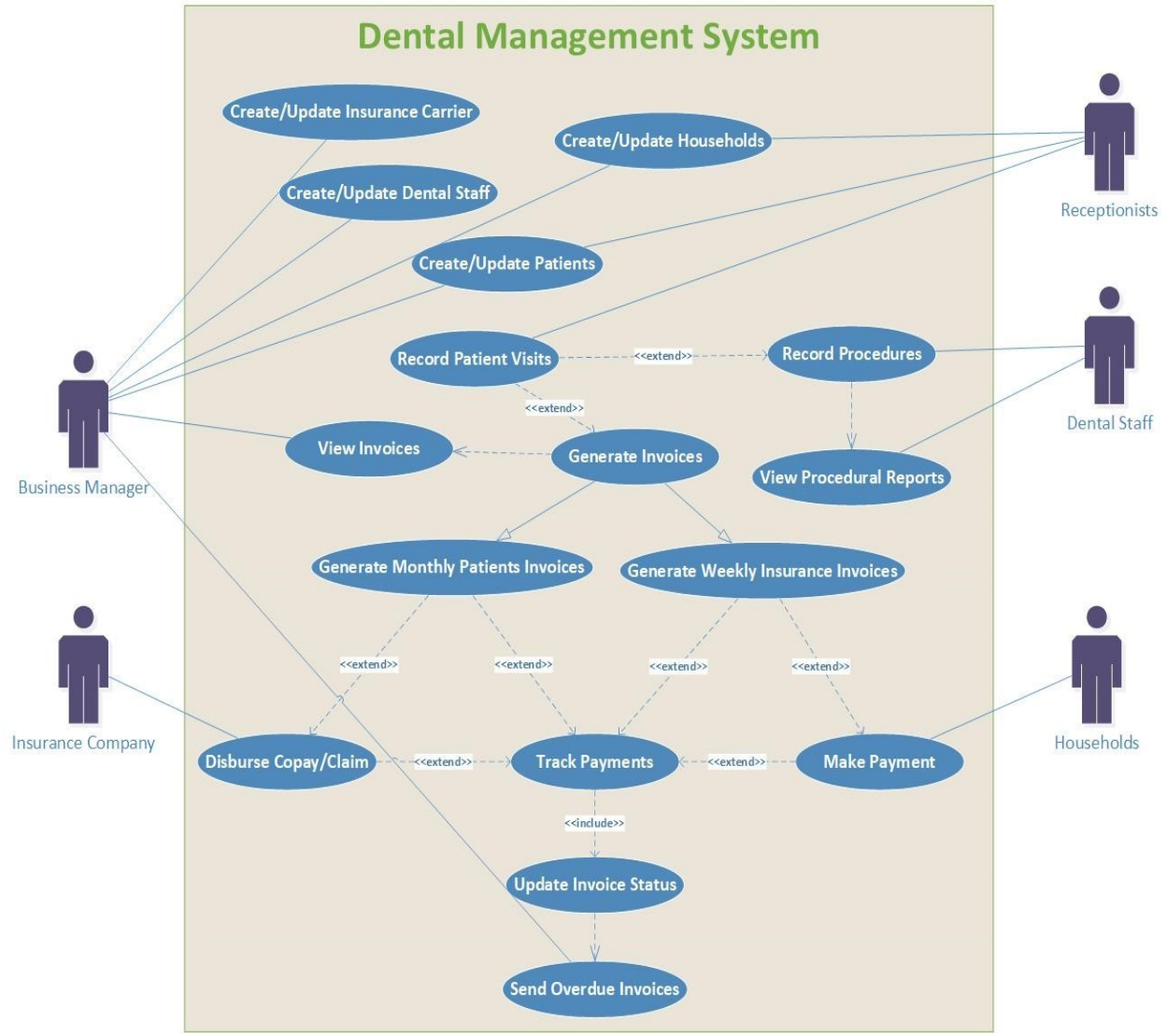

Figure 4: Use cases

USE CASE DESCRIPTIONS

From the case study we have identified 15 use cases which are given below with detailed use case descriptions.

1. Create/Update Insurance Carrier Information

Use Case	**Create/Update Insurance Carrier Information**
Scenario	Managing Insurance Carrier Information.
Triggering Event	A new insurance carrier identified, or existing information to be updated.
Actors	Business Manager
Related Use	N/A

Cases	
Preconditions	Valid insurance carrier information.
Postconditions	A record of the insurance carrier is created/updated in the system.
Flow of Activities	1. The Business Manager prepares to create/update an insurance carrier. 2. The system prompts for details about insurance. 3. The Business Manager adds/modifies information. 4. The system validates and saves the data.

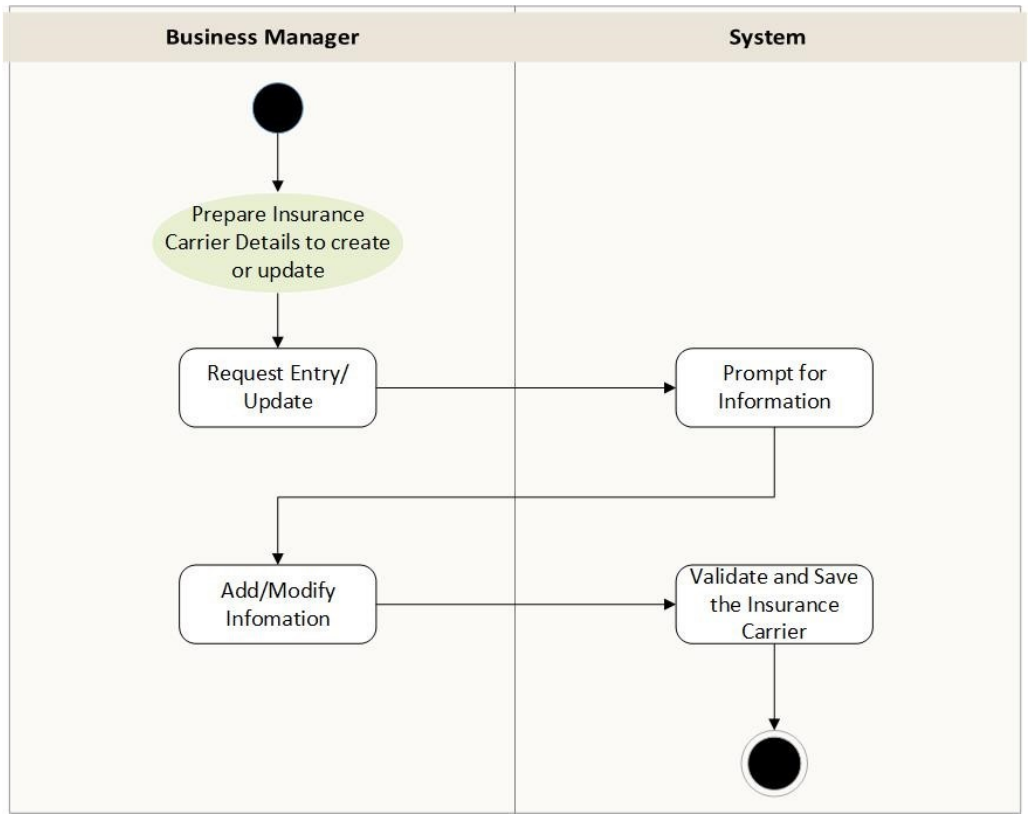

Figure 2 - Create/Update Insurance Carrier Information Activity Diagram

2. Create/Update Dental Staff Records

Use Case	**Create/Update Dental Staff Records**
Scenario	Dental Staff Information Management.
Triggering Event	New employee added or existing employee data updated.
Actors	Business Manager.
Related Use Cases	N/A
Preconditions	Valid Employee details.

Post-Condition	A staff record has been inserted/updated into the system.
Flow of Activities	1. Business Manager generates the new entry of employee 2. The system will prompt to enter details of the staff (name, address, et cetera). 3. The Business Manager would log/update details. 4. The system validates and stores the data.

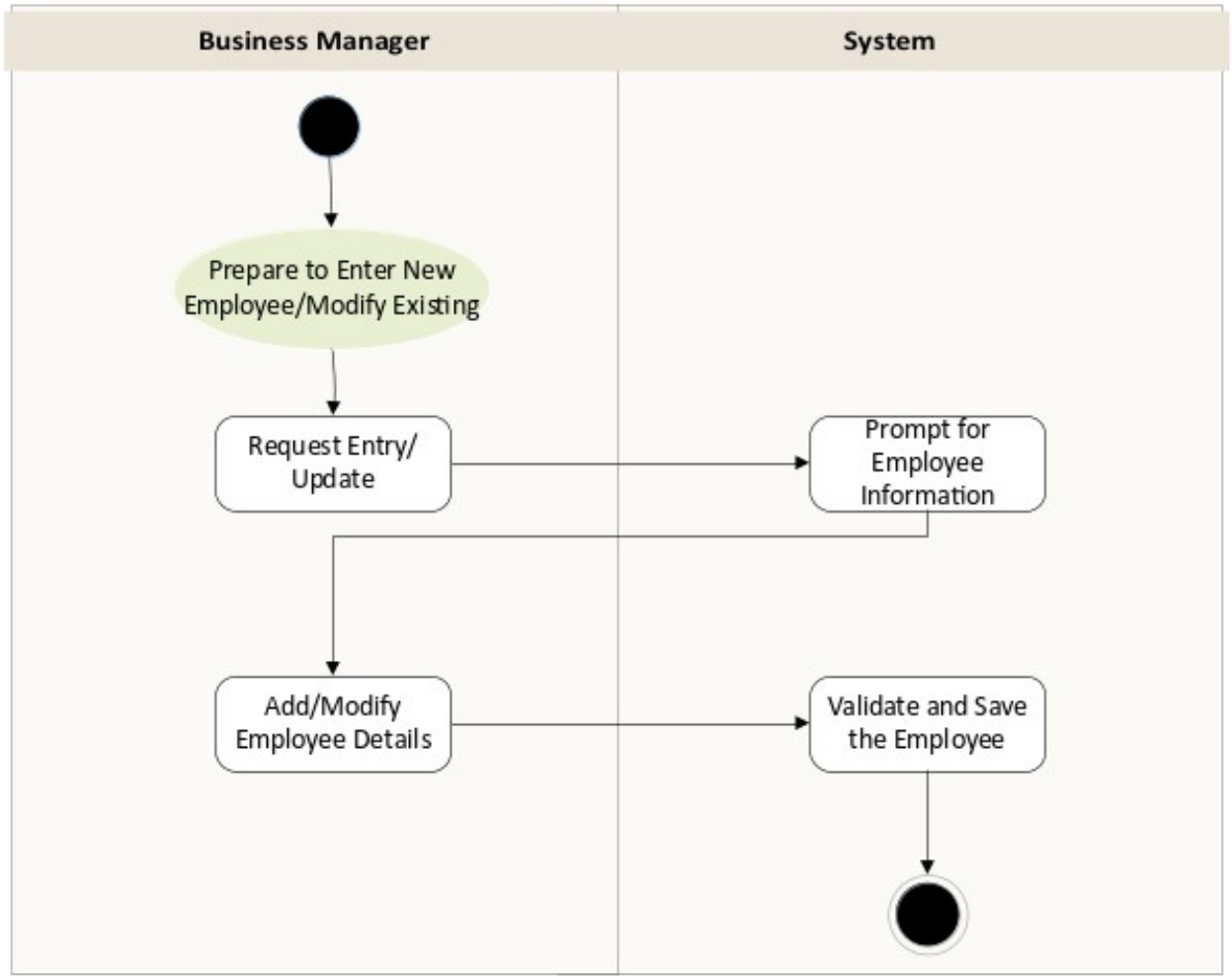

Figure 3 - Create/Update Dental Staff Activity Diagram

3. Create/Update Households

Use Case	**Create/Update Households**
Scenario	Managing Household Information.
Triggering	New household enrolls or existing information is

Event	updated.
Actors	Business Manager
Related use cases	N/A
Preconditions	Valid household information.
Postconditions	Household record saved/generated in the system.
Flow of Activities	1. Business Manager decides to create/update household. 2. System prompts for household details (Head of household, address, etc.). 3. The Business Manager enters or manipulates information. 4. System validates and saves the data.

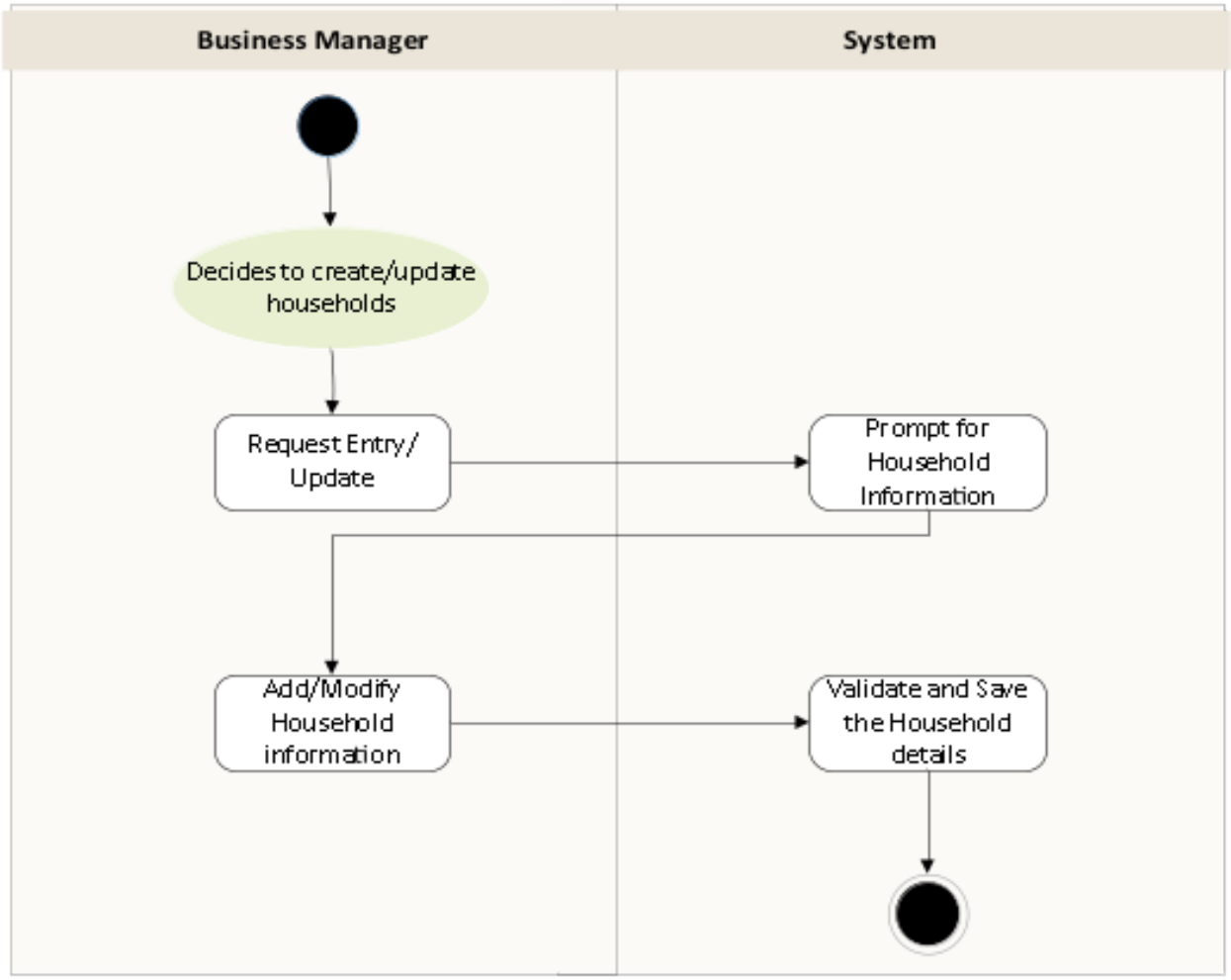

Figure 4: Create/Update Households Activity Diagram

4. Create/Update patients

Use case	**Create/Update patients**
Scenario	Receptionists or business manager create or update patient records.
Triggering event	New patient is registered, or existing information is updated.
Actor	Receptionists, Business Manager.
Related Use Cases	N/A
Preconditions	Valid household details.
Postconditions	Patient record is created/updated in the system.
Flow of Activities	1. Receptionists or Business managers realize that they are required to insert or update patient records. 2. The system provides prompts for all necessary details, such as personal information, medical history, insurance coverage, etc. 3. Receptionists or business manager enter or update the required information. 4. The system will save all the alterations.

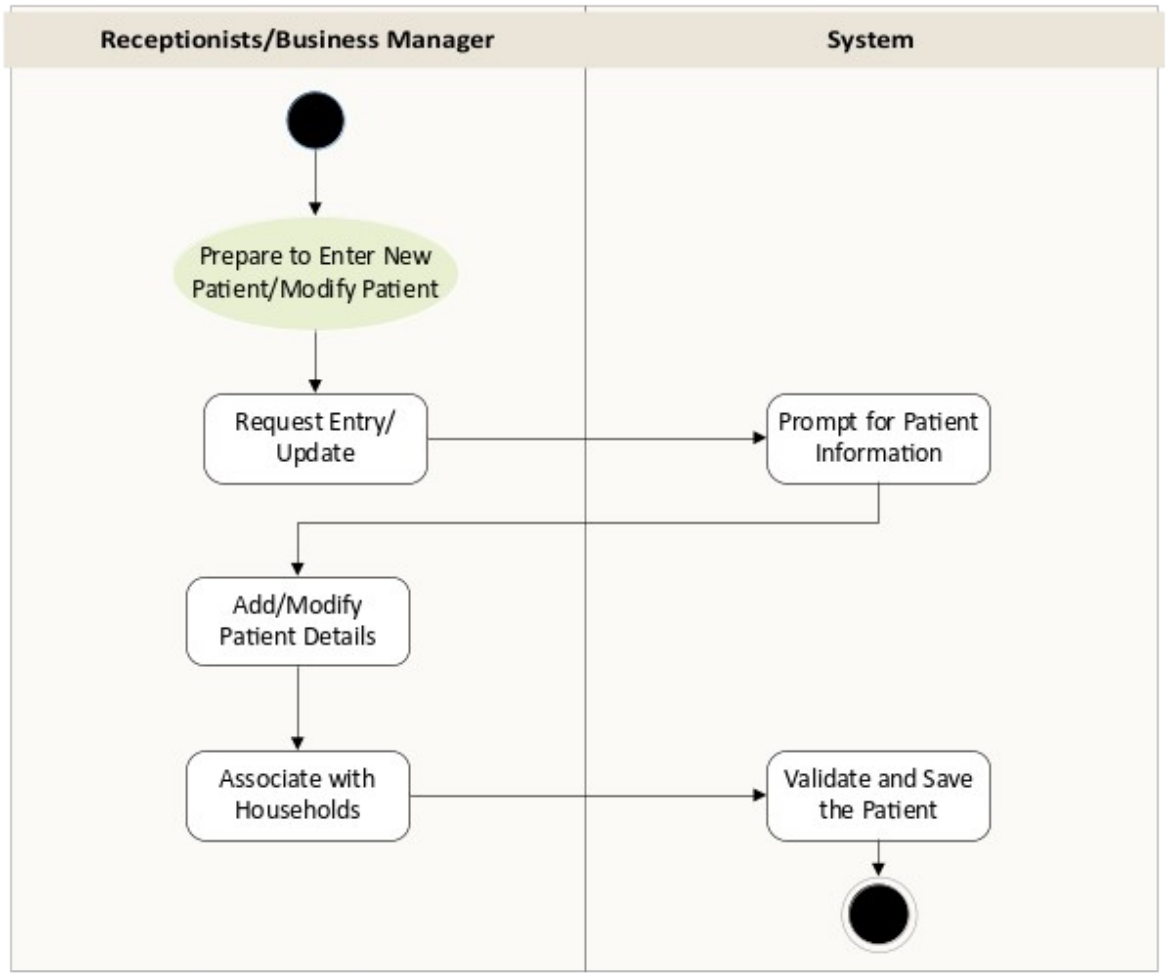

Figure 5 -Create/Update patients Activity Diagram

5. Record Patient Visits

Use Case	**Record Patient Visits**
Scenario	Documentation of all clinic patients that came for a visit.
Triggering Event	The patient shows up for a visit.
Actors	Receptionist.
Related Use Cases	N/A
Preconditions	There is a patient record in the database.
Postconditions	The details of the visiting would be recorded along with that of the patient.
Flow of Activities	1. Search for the Patient Details 2. Request a new Visit against the Patient

	3. System Prompts for Visit Details. 4. The Receptionist/Staff enters the date, the copay, and the services opted. 5. System revises the patient's visiting history.

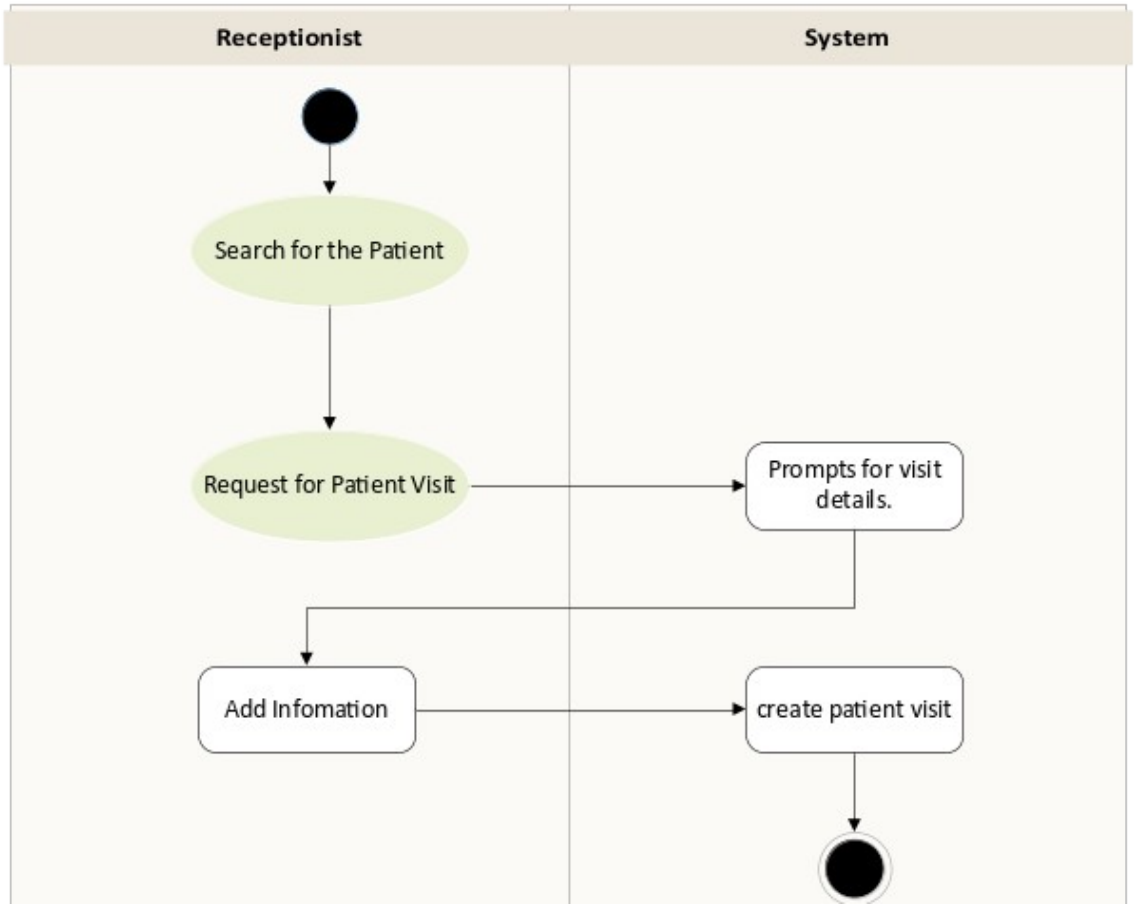

Figure 6: Record Patient Visits Activity Diagram

6. Record Procedures

Use Case	**Record Procedures**
Scenario	Record dental treatments performed during the visits.
Triggering event	A procedure is completed by the Dental staff.
Actors	Dental staff.
Related use cases	N/A
Preconditions	Information about the patient's visit exits in the Database.
Postconditions	Detailed information about the procedure is added to

	the visit.
Flow of Activities	1. The patient case is chosen by the Dental staff. 2. System prompts to fill details of the procedure such as, type, description, tooth involved, etc. 3. Staff adds the required details. 4. The system updates the procedures record.

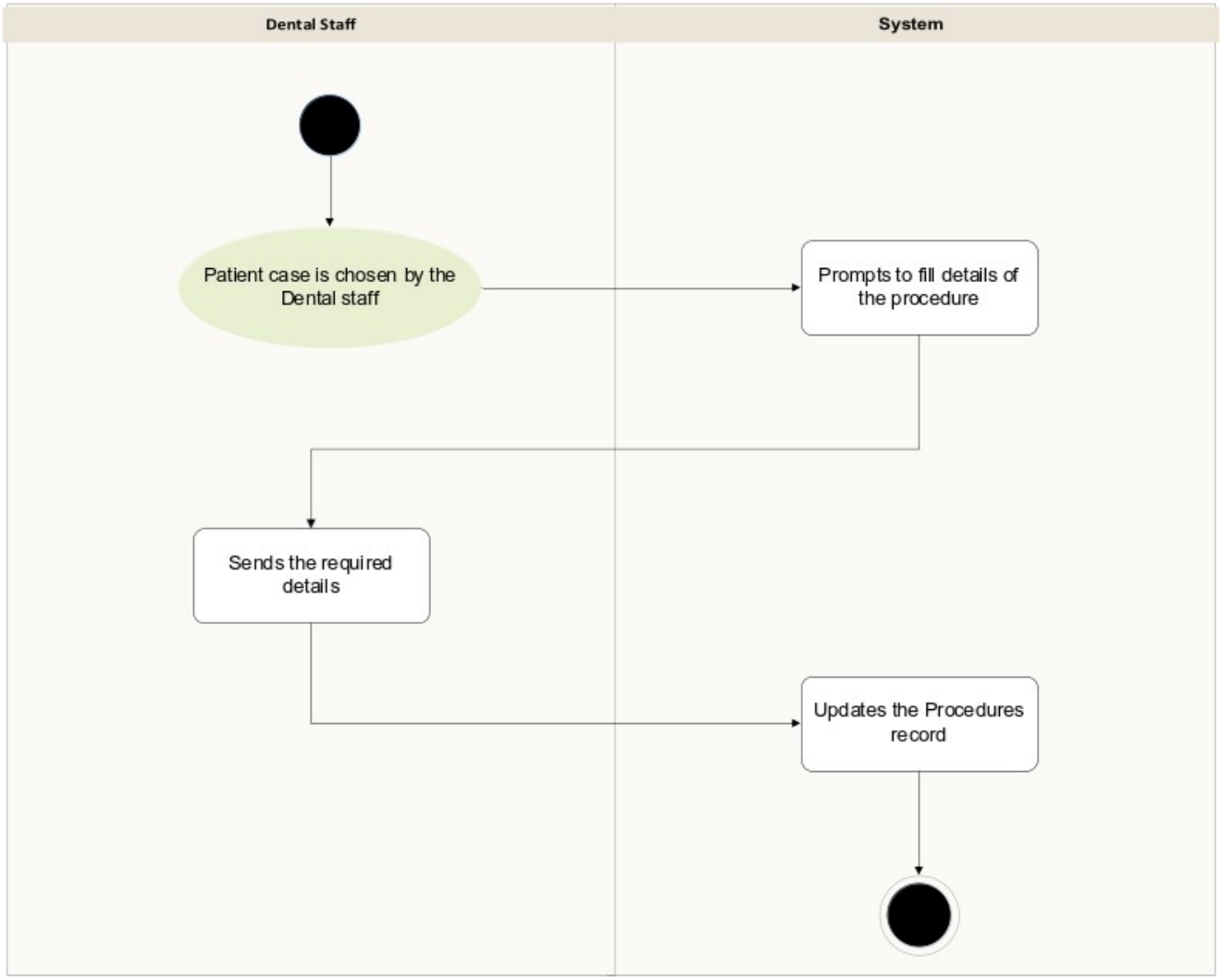

Figure 7: Record Procedures Activity Diagram

7. Generate Monthly Patients Invoices

Use Case	**Generate Monthly Patients Invoices**
Scenario	Creation of Invoices to Patients on a Monthly Basis.
Triggering Event	End of the month.

Actors	System.
Related Use Cases	Record Patient Visits
Preconditions	Patient visits and procedures for the month are documented.
Postcondition	Invoices created and Available for sharing.
Activities Flow	1. System Triggers Invoice Generation. 2. System compiles the visit and procedure data in the grid. 3. System evaluates draft invoices. 4. The System will then finalize and send invoices to the queue for completion.

8. Generate weekly insurance invoices

Use Case	**Generate weekly insurance invoices**
Scenario	System automatically generates the weekly invoices for the insurance companies.
Trigger	The last day of the week.
Actors	System
Related Use Cases	Record Patient Visits
Preconditions	End of the week.
Post-conditions	The system must be able to produce and save weekly invoices.
Flow of Activities	1. System recognizes the end of the week. 2. The system retrieves the appropriate patient visits and procedure details for that week. 3. The system recognizes all patients insured under the insurance plans. 4. System calculates charges for services provided to each patient. 5. The system generates invoices for every insurance company. 6. Consultation fees, procedure charges, etc. are included in the invoices. 7. Invoices generated get saved by the system.

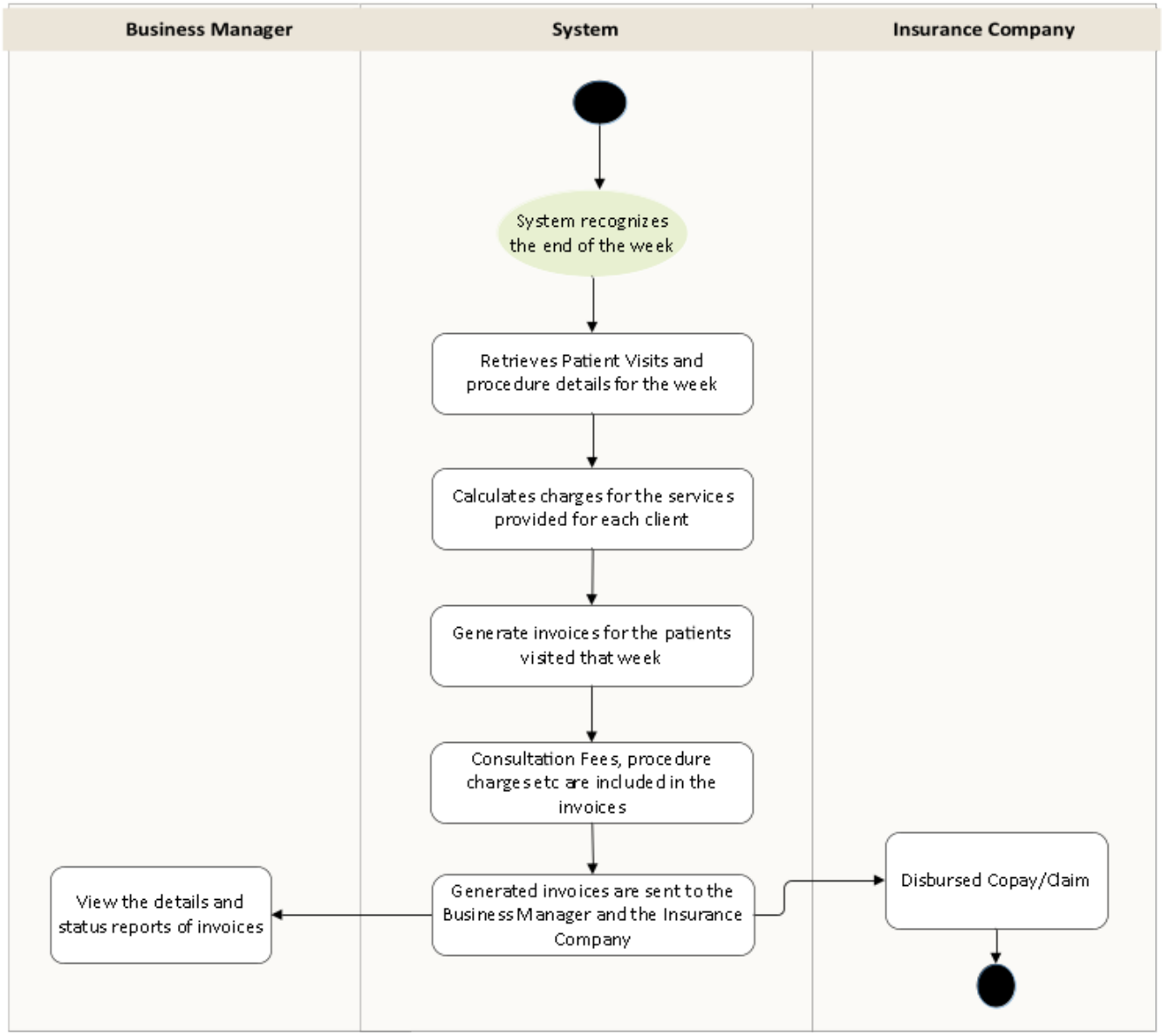

Figure 6: Generate weekly insurance invoices Activity Diagram

9. Make Payment

Use Case	**Make Payment**
Scenario	Payment initiated.
Triggering Event	The patient or insurance company submits the payment.
Actors	Household.
Related Use Cases	N/A
Preconditions	Valid payment details.

Postconditions	Payment is recorded and applied to the appropriate invoice.
Flow of Activities	1. The system prompts for the source of payment along with amount and date. 2. Household enters the information and pays the amount. 3. System updates the relevant invoice.

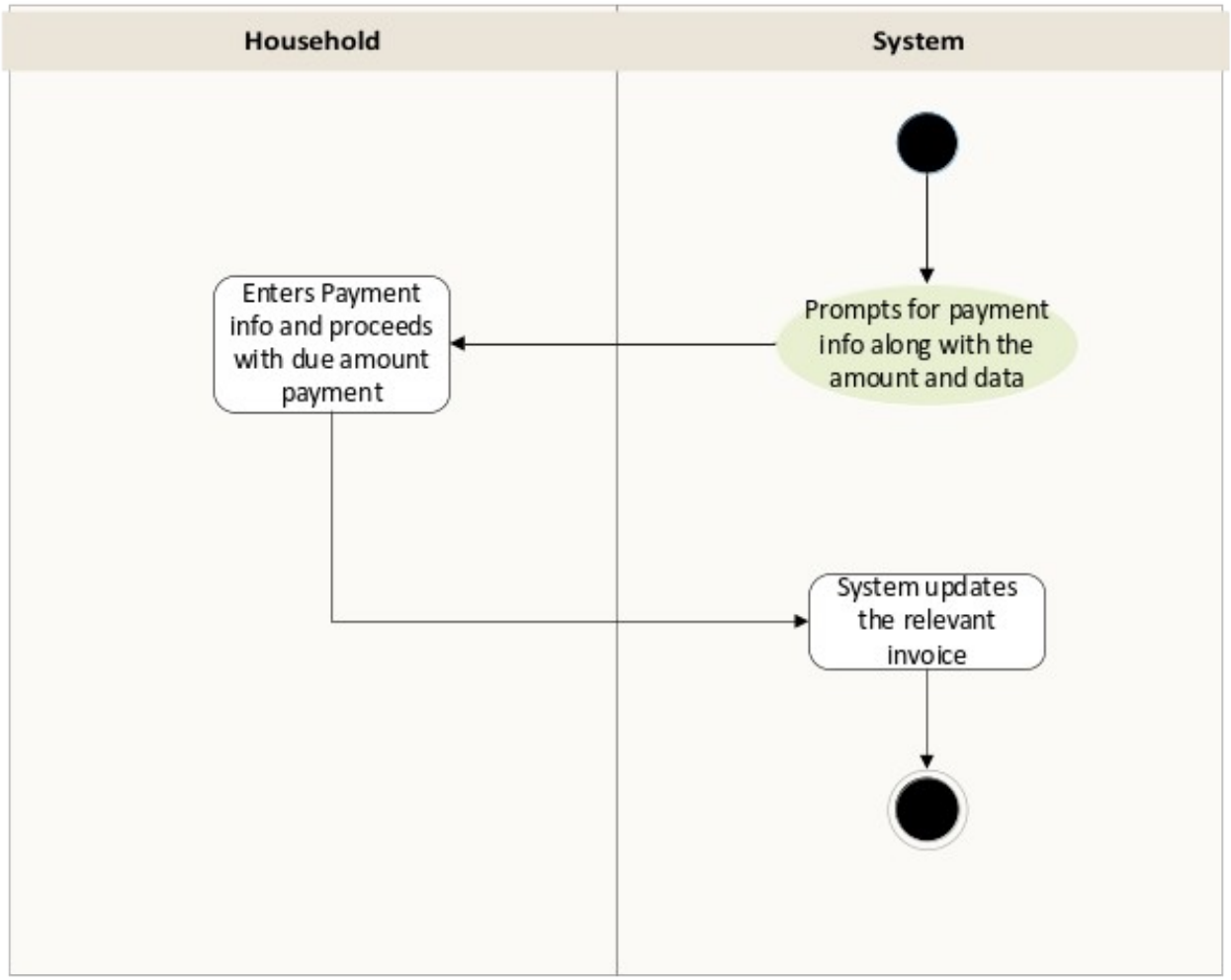

Figure 7: Make Payment Activity Diagram

10. Disburse Copay/Claim Amount

Use Case	**Disburse Copay/Claim Amount**
Scenario	To address payments about copays and other insurance claims.
Triggering	Payment received from the patient or the insurance

event	company.
Actors	Insurance companies.
Related Use Cases	Generate Monthly Patients Invoices
Preconditions	Valid details of payment.
Post-condition	Payment was posted and applied to the correct invoice.
Flow of Activities	1. Payment is received from the patient. 2. The system prompts for details of the amount, date, and payment source. 3. The Insurance company enters necessary information. 4. The system updates the corresponding invoice.

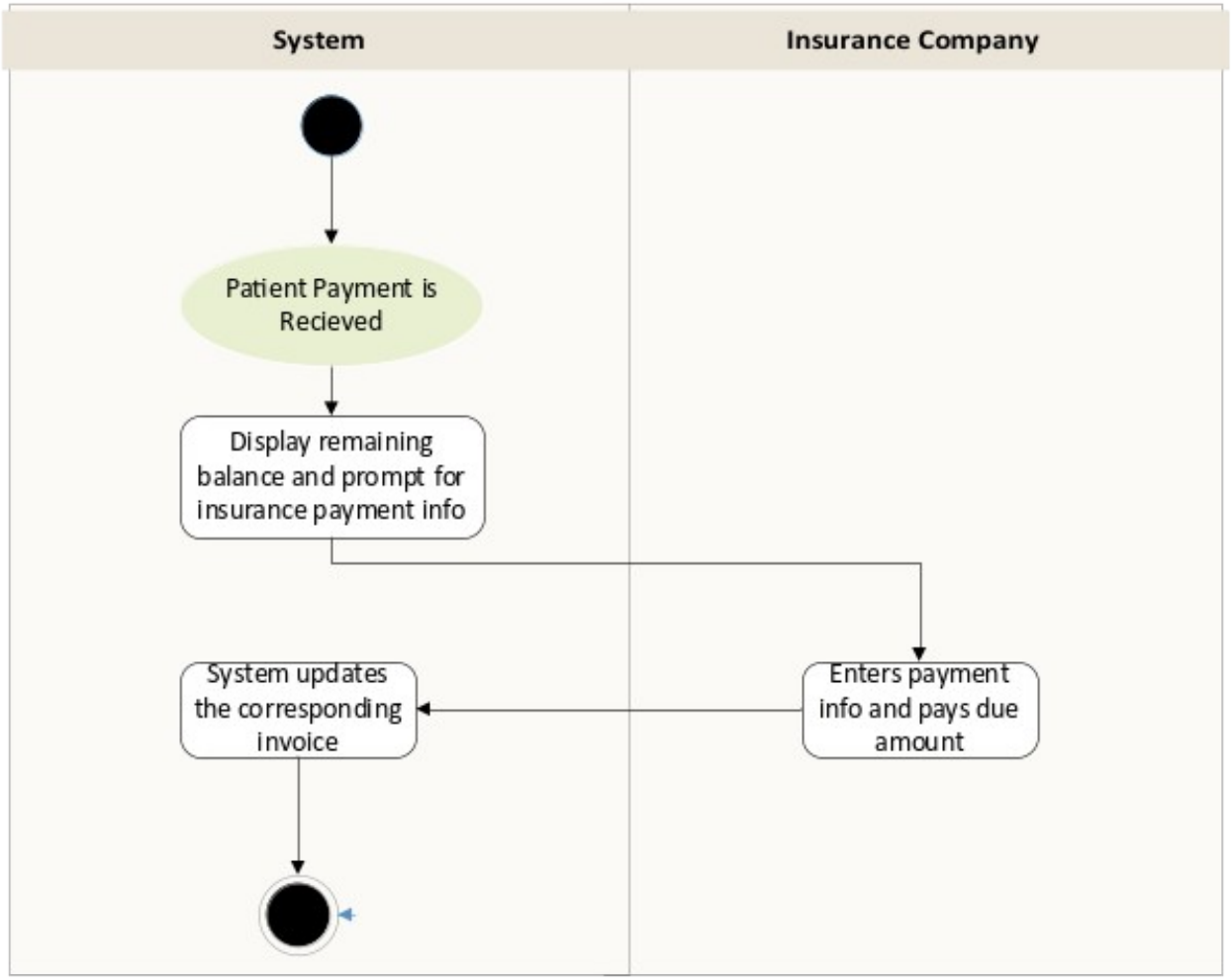

Figure 8: Disburse Copay/Claim Amount Activity Diagram

11. Track Payments

Use Case	**Track Payments**
Scenario	Monitoring payments received.
Triggering event	The payment is received from patient or insurance company.
Actor	System.
Related use cases	Disburse Copay/Claim Amount, Make Payment
Preconditions	Valid Payment details/procedure.
Postconditions	Payment is documented and associated with the correct invoice.
Flow of Activities	1. System receives payment. 2. Payment History in the System gets updated.

12. Update Invoice Status

Use Case	**Update Invoice Status**
Scenario	Managing the status of the Invoices.
Triggering Event	The payment is received or overdue.
Actors	System.
Related Use cases	Track payments.
Preconditions	Invoices exist.
Postconditions	Invoice status (paid, overdue) is updated.
Flow of Activities	1. The payment status updated in the system 2. System updates invoice the status depending on whether payment is received or overdue. 3. System displays current status like pending, paid, overdue.

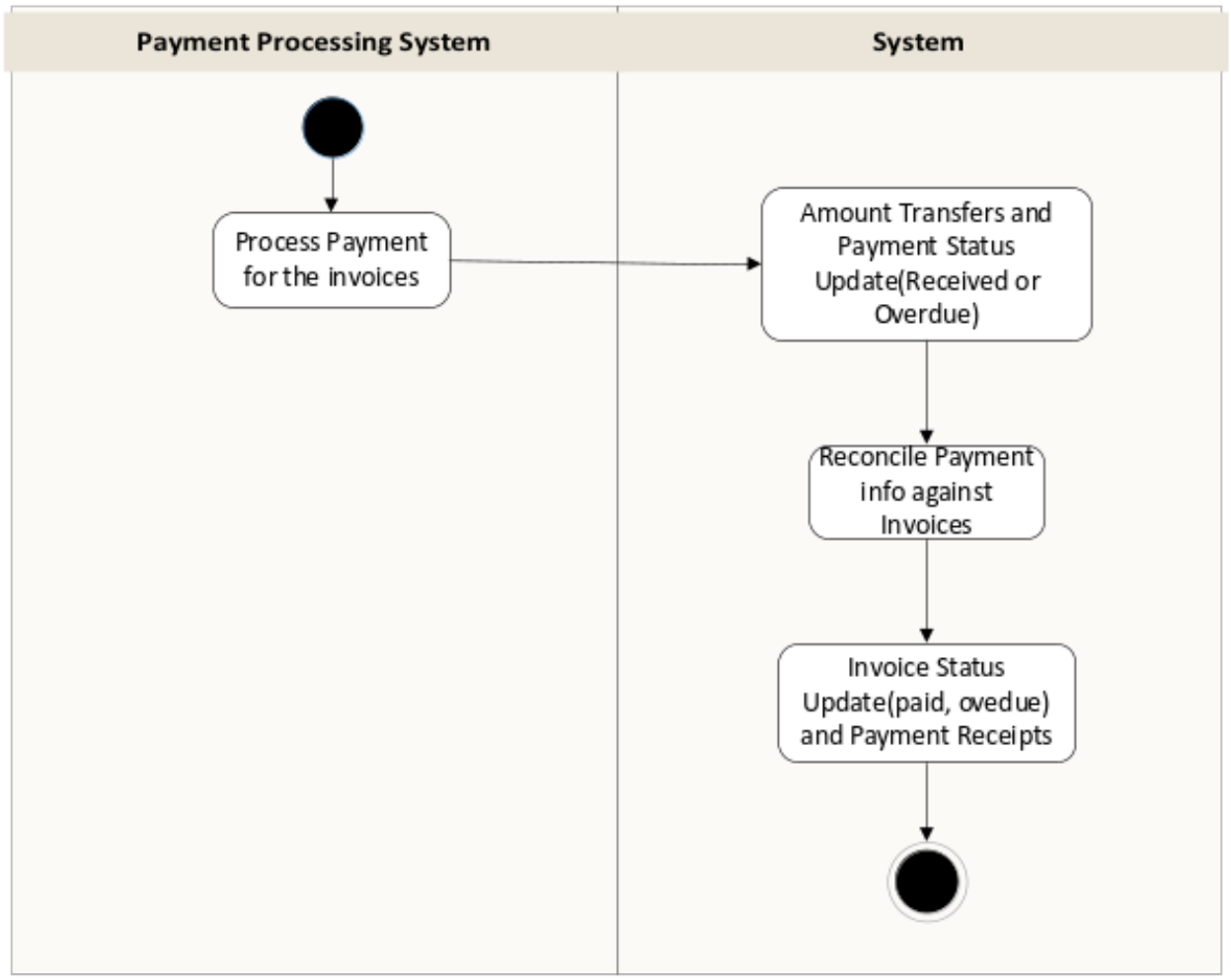

Figure 10: Track Payment & Update Invoice Status Activity Diagram

13. View invoices

Use Case	**View invoices**
Scenario	Accessing the patient and insurance invoices.
Triggering event	When User Request to view the invoice.
Actors	Business Manager.
Related Use Case	N/A
Preconditions	Invoices are generated.
Post-conditions	Invoices are accessible for the user to review.
Flow of Activities	1. The Business Manager proceeds to view invoices. 2. The relevant invoices are retrieved by the system and displayed.

	3. The Business Manager goes through the details.

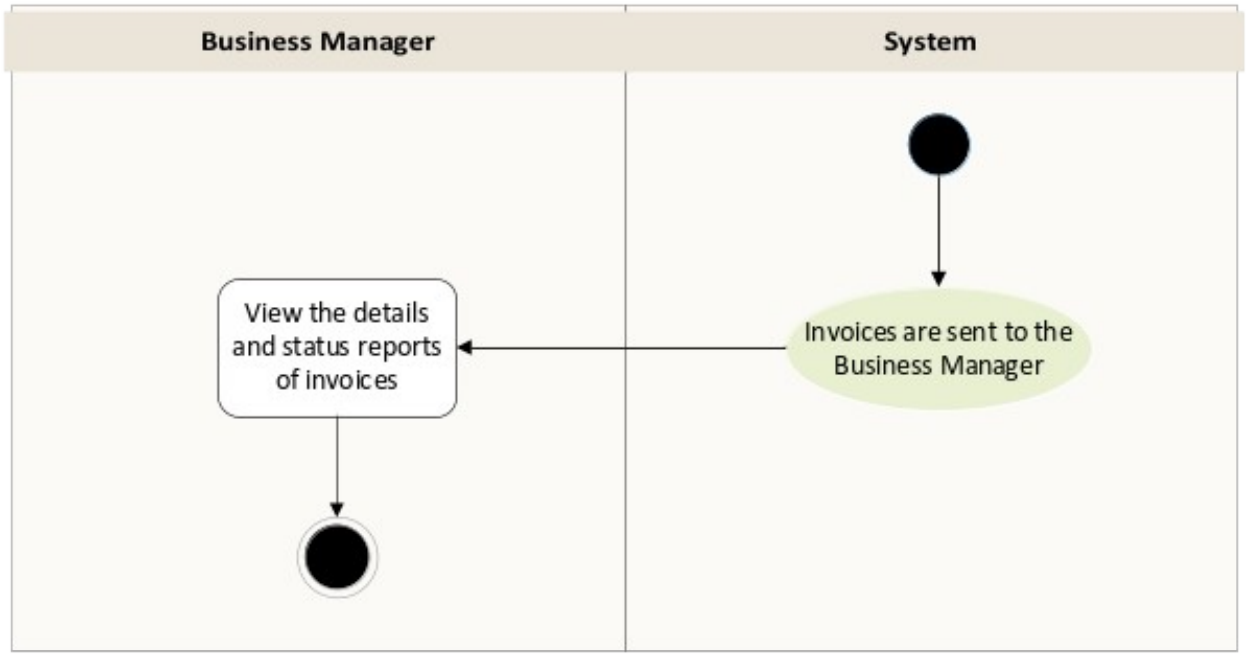

Figure 11: View Invoices Activity Diagram

14. Send Overdue Invoices

Use Case	**Send Overdue Invoices**
Scenario	Notification to the households regarding overdue payments.
Triggering Event	Last day of the month or a specified interval.
Actors	Business Manager.
Related Use cases	Update Invoice Status.
Preconditions	Overdue invoices exist.
Postconditions	Households are notified with the overdue notices.
Flow of Activities	1. The Business Manager requests for the overdue invoices' retrieval. 2. System provides overdue invoices. 3. The Business Manager reviews and approves the list System.

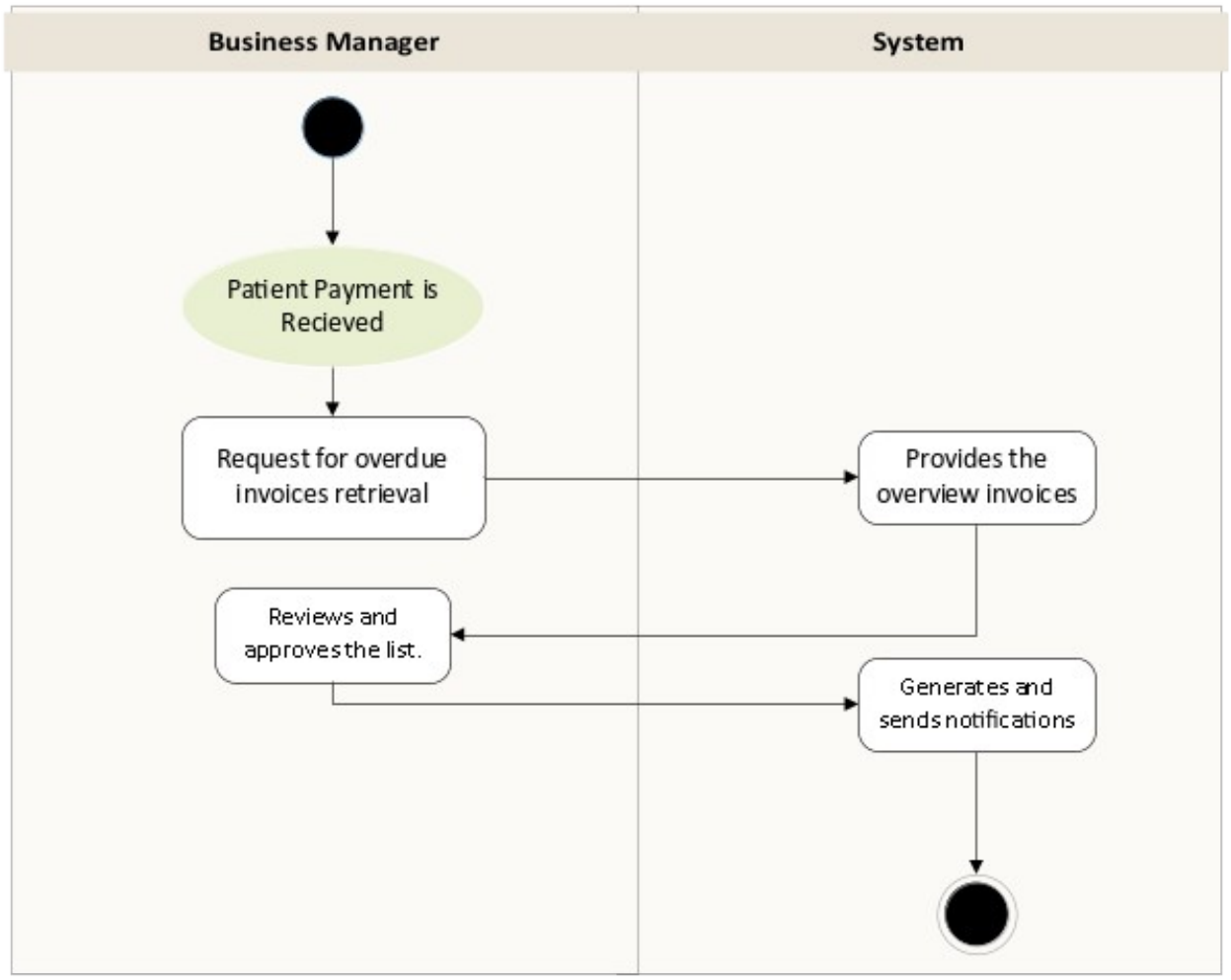

Figure 12: Send Overdue Invoices Activity Diagram

15. View Procedural Reports

Use Cases	**View Procedural Reports**
Scenario	Reports of procedures requested by dentists.
Triggering Event	The Dentist wants a summary of procedures performed.
Actors	Dental Staff.
Related Use Cases	Record Procedures
Preconditions	Procedures are documented.
Postconditions	The dentist receives the report requested.
Flow of	1. The dental staff requires a procedural report of

Activities	those done every week, month-to-month basis, etc. 2. The dental staff search the system data base 3. Dental staff views the required procedural report

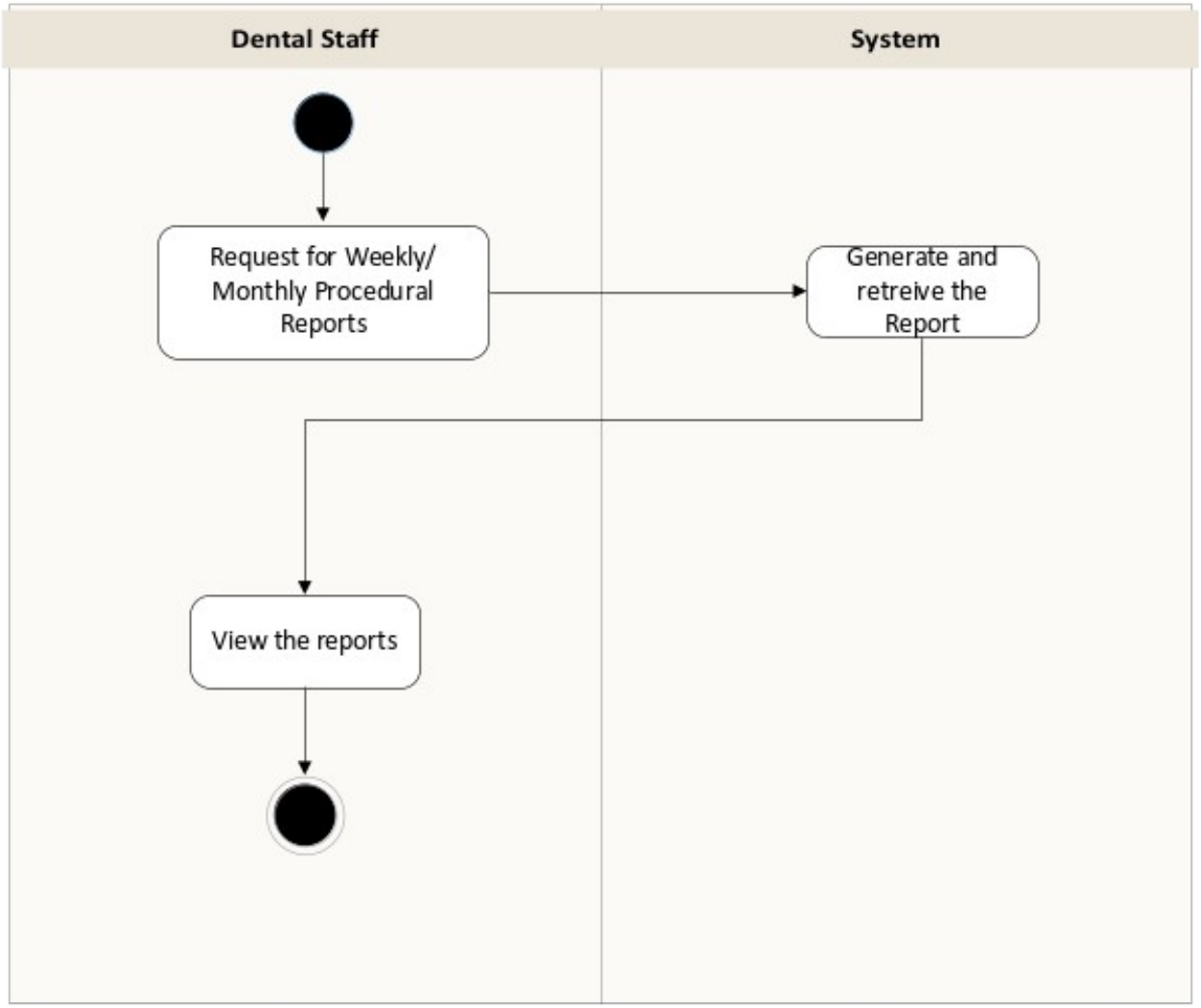

Figure 13: View Procedural Reports Activity Diagram

CLASS DIAGRAM

This process involves understanding the roles each entity plays within the system and categorizing them accordingly. Using the identified domain class and relationships, we constructed the class diagram. This involves defining classes, their attributes, and the relationships (associations) between them.

We identified the relationships between these entities:

- A Household can have multiple Patients.
- A Household is associated with one InsuranceCarrier.
- Each Patient can have multiple PatientVisits.
- A PatientVisit can involve multiple PatientProcedures.
- Each PatientProcedure can involve multiple VisitStaff.
- Invoices are related to PatientVisits and can be for either InsuranceCarrier or Household.

Using these identified attributes and relationships, we created a class diagram for the dental Clinic.

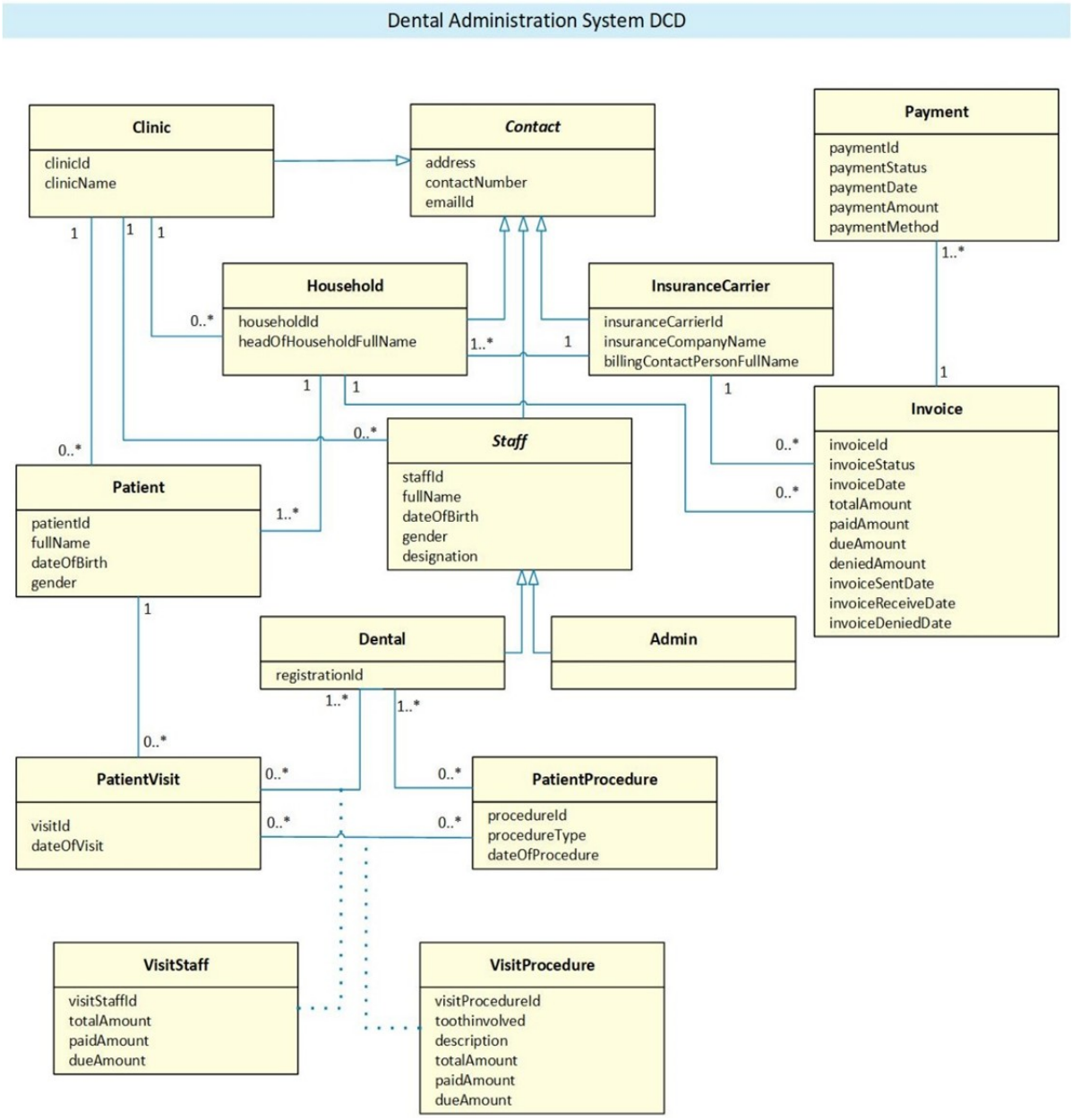

Figure 5: DCD Class diagram.

CONCLUSION

Nexus Technology Solutions proposes a comprehensive software solution to address the operational inefficiencies faced by the dental clinic due to outdated systems. Our proposed system will streamline patient records management, billing procedures, and staff coordination, thereby improving data accuracy, operational efficiency, and overall patient satisfaction. The project will involve detailed stakeholder analysis, requirement gathering, iterative development using agile methodology, and thorough quality assurance to ensure a seamless transition to the new system. This report outlines our understanding of the client's needs, the feasibility of the project, and the steps we will take to ensure successful implementation.

The next steps involve

1. Finalizing system requirements.
2. Developing the solution in iterative cycles.
3. Conducting rigorous testing.
4. Preparing for deployment.

We will work closely with clinic stakeholders to ensure the solution aligns with their operational needs and regulatory requirements, ultimately enhancing the clinic's efficiency and patient satisfaction.