Faculty of Engineering and Technology

Computer Science Department

COMP433 – Project

<<Ramallah Dental Clinic's PROJECT >>

Prepared by: Jana Herzallah 1201139

Nirmeen AlSheikh 1200200

Lana Badwan 1200071

Noor Rahib 1202853

Roaa Ghannam 1200353

Instructor: Dr. Samer Zain

Date: 30th Jan 2024

Contents

1. Phase 1

Introduction

We're beyond excited to present our proposal for your new software system that will hopefully improve the smoothness and integrity in the working system for Ramallah Dental Inc., a dental clinic that works hard to give top-notch care to patients.We have read your request for proposal and since Ramallah Dental Inc. is a leading dental clinic in the city of Ramallah, we would love to be a part of this transformative journey. By focusing on delivering the best state-of-the-art dental services to your patients and their families. And since the clinic employs approximately 16 dedicated staff members and works 7 days. It is essential for us to present a strong establishment for a system that can hold intelligent connections among these team members, ensuring effective mechanism for the clinic to work by.

We fully understand the challenges you are facing in the clinic. The current system that manages all the information related to employees, patients, inventory, and purchases is outdated in which the information is neither synchronized between all employees nor integrated since its divided between various employees and not stored in one place but in multiple formats and relies mainly on manual processes such as the use of Excel and Google Sheets, which increases the effort needed to query information and increases the likelihood of having duplications and errors. To solve this problem, our vision is to design a mobile application for your clinic using database management Systems so that it combines all data and processes into one integrated place and not having all processes automated.

The clinic's current system suffers from great difficulties that we will address one by one and present our solutions in the next section in details, such as the weak mechanism of generating and querying important reports related to patients, doctors, nurses, appointments, inventor. So, we emphasize that an urgent need occurs for a new software system that can easily outputs needed reports automatically based on logical and reasonable steps. Thus, doctors can basically request any type of their patient’s information with just a click of a button.

It is also inevitable to mention a solution of the problem related to the clinic’s inventory, since the verbal and oral communication between doctors and other related employees is surely not effective. Our presented solution hopes to allow tracking inventory on a daily basis by making a list that can be accessed by involved people and giving alerts in case any of the supplies gets closer to being empty.

And for the most important problems which are the patients need to call to book an appointment through the receptionists, we see that developing the app with some space for the patients to interact by booking their own appointments without the need of calling ensures a smoother and faster experience for them especially when peek times hit and all patients starts calling and the system getting down a lot within these times.

For the second important problem which is the doctors and employees making their schedules manually and handing them to the receptionist in order to book appointments according to them, also when any emergency happens within an employee, the need of cancelling all appointments and calling all involved patients takes so much time and effort. So, we thought of making an APIs for each doctor to upload his free slots that will be directly linked with the patients to book in, also to give alerts to all involved.

Lastly, for each patients visit the doctor has to record all data , including diagnoses ,medications, performed operations, X-rays and blood works on the patients part on the app to solve the problem of having to search for the data in huge folders which is vulnerable to loss and corruption.

We see that the need of linking patients' bank accounts and insurance policies to the proposed system is very crucial since many customers pays in instalments, others having insurance policies, and it’s very hard to keep track of their payments manually. We will also provide a discount for families through the system so it can be done easily without the need of doing complex calculations on your own.

We understood your clinic's challenges and we would like to bring a fresh and powerful mechanism. We're enthusiastic to compete for this project and create a new level of professionalism to the dental care services.

System Features

1. Employee Registration:

• The system allows all employees in the clinic (doctors, workers, recipients, secretaries, Sales representatives) to create their individual accounts and register in the system, providing their essential information such as name, ID, contact details, role, qualifications, family members, bank accounts, insurance, etc. Each employee has his own account and can log into it with his credentials to ensure his data security and privacy.

• The software creates a profile page for each employee that contains their general personal and professional information (including roles, responsibilities, and qualifications). Also, it gives the employee the option to update his data as needed.

• The employee enters his start time to work, attendance, and leaving time, and the system records the work hours, attendance, absence, and leaving requests for each employee. Also reporting employee performance, attendance, and salary history. Thus the system will calculate the salary for each employee according to his attendance report.

• Create and manage employee schedules with the ability to set shifts and assign tasks. Also, the system provides notifications for schedule changes or shift swaps to all employees and a secure messaging system for staff communication and announcements.

2. Patient Registration:

Patients have a user-friendly platform to manage their healthcare information. The system allows all patients attending the clinic to register by creating an account, providing essential personal information such as name, date of birth, gender, contact details, and emergency contacts, and uploading a photograph for identification purposes. They are prompted to provide their full medical history, including chronic diseases, allergies to medications and foods, and any genetically inherited conditions.

Patients can schedule appointments with their preferred healthcare providers through the system, and it provides real-time availability checks and confirms the appointment slot.

Prescriptions and medications prescribed during clinic visits are stored in the system, ensuring an accurate record of past treatments.

Patients can upload X-rays, blood work reports, and other diagnostic images or documents to their profiles. These documents can be securely stored, reviewed, and shared with healthcare providers as needed.

The system is equipped with an AI-driven feature that can analyze uploaded blood work reports and diagnostic data. The AI can identify health trends and provide advice or recommendations based on the data, such as dietary suggestions in cases of deficiencies (e.g., lack of calcium).

Patients can access detailed reports related to their clinic visits, including diagnoses, treatments, and progress over time. Reports are stored securely and can be easily shared with other healthcare providers. The system ensures the highest standards of data security and privacy compliance, following all relevant regulations and encryption protocols.

The system allows patients to associate with family members within the system. When a specified number of family members attend the clinic, the system can automatically apply discounts and awards as per the family plan according to what your preferences are.

3. Dental Clinic Services

With a user-friendly UI-UX design, the system displays all dental care services, including tooth loss treatment, tooth repairs, tooth implants, dental cosmetics, and emergency services. It describes each dental treatment in depth so that people understand the procedures and their advantages. It also shows the expected expenses for each dental service to assist people in making educated selections. The system may compute costs depending on variables such as service type, materials consumed, and any further procedures necessary.

Patients may arrange dental appointments straight from their profiles using the technology.

With the help of AI, dental professionals can generate tailored treatment plans for patients, describing recommended operations, anticipated prices, and timescales. The system allows patients to examine and accept these plans.

4. Supply Inventory and Device Maintenance:

The software streamlines the procurement and maintenance of essential supplies and devices used in the clinic to ensure the availability of necessary items while also planning and tracking the maintenance of medical devices throughout the month and year as needed. The system maintains a comprehensive inventory of medical supplies, equipment, and other items required for daily clinic operations. The items are categorized for easy organization, and their quantities are monitored in real time.

When the quantity of a particular supply falls below a set threshold, the system generates automatic alerts for the designated staff that can place orders for restocking directly through the system with approved suppliers. Also, for device maintenance planning, the system allows for the scheduling of annual maintenance for medical devices and equipment; the schedules are pre-planned for the entire year, including dates and details of each maintenance session.

The designated staff receives automated reminders and notifications about upcoming device maintenance tasks. Detailed records of device maintenance, including service reports, technician information, and any necessary repairs, are stored within the system.

This historical data can help in tracking the performance and lifespan of the devices.

5. Additional features:

The system is directly linked with public services to provide patients with an easy and comfortable experience with clinic services, such as:

· **Integration with insurance companies:** Patients can link their insurance information to the system, enabling real-time verification of coverage and eligibility during the appointment scheduling process. The system can automatically generate insurance claims and submit them to the relevant insurance companies on behalf of the patients. Also, real-time status updates on claims and reimbursements can be provided to patients.

· **Integration with Medical Laboratories**: The system can directly send diagnostic test orders to partnered medical laboratories. Test results are automatically received and added to the patient's record, streamlining the diagnostic process. Patients can view their lab results securely within their profiles and share them with healthcare providers as needed.

· **Financial Integration with Banks:** Patients can make payments for clinic services and co-pays directly through the system, securely linked to their bank accounts or credit cards. The system can facilitate flexible payment plans and payment reminders.

· **Appointment reminders and notifications:** The software has an automated appointment reminder through SMS, email, or in-app notifications. Patients can receive notifications for upcoming appointments, test results, and payment due dates. Also, the system provides post-treatment care instructions and reminders to help patients recover and maintain oral health after dental procedures.

· **Customer Support Chatbot:** Implement a chatbot to provide immediate assistance to patients, helping with appointment scheduling, general inquiries, and assistance with the system.

- O**nline Store dedicated with the clinic:** we suggest adding all products that the clinic believe its good for their patients such as toothbrushes , toothpastes , flossers and any other product you think it will help patients get the best quality with. It is an efficient way of adding some profits to your business and ensuring that patients will get the highest quality of products since doctors pick them according to their standards.

- **Emergency interfaces in the app:** calling numbers provided in this section will connect patients to specialized doctors with emergencies handling doctors.

- **Fixing the website**: by adding all doctors information, inspirational before and after pictures of their work, phone numbers and emails, a link for the facebook ,a link to the application and short tutorials on how to be used and some areas that have advertisement to increase profits.

- **Disabled people help :** doing a version that helps blind people by interacting with the software through voicenotes

- Mappings to how can you reach to the center of rammallah of the least crowded streets

6. the non-functional requirements

Since the current system you are dealing with gets down, especially when lots of demand happens on the system, we ensure that our presented system will be **reliable by** using infrastructural facilities. Starting with the data servers holding data and offering services, we can ensure that they can hold users at the same time up to the number of all users created on the application by this current time plus the number of expected users till 7 years ahead so that the system can be prepared till long time coming, which we can take from your departments by looking at the numbers of patients attending your clinic year by year. Then, moving to the most important feature, which is keeping the data **secure,** we can ensure that by subscribing to Cloudflare, which provides a secure and trustworthy security system. The system provided will surely be usable and suitable for all people of different ages and backgrounds. All interfaces and screens will be deeply discussed by our UI/UX designer and you during the kick off meeting, during which we usually build some screens through Figma so that we can design everything to your tastes and needs.

Software development process:

We will be using the incremental development process (Agile), since this project is considered as a MIS program so it's better to use the agile approach. Since the scrum framework has proved that its teamwork encouraging and its timeframes sprints involves the customer within the first day and last day of it. We will use it to manage this software development. We believe that involving your direct participation and touches and sharing iterative sprints with your clinic team will be the best way to produce the most effective and powerful application which has an acceptable budget with unclear requirements. Also, we have thought that adding the Reuse-oriented software engineering will be considerable in case your budget was small , we have worked on so many projects before you can check our github linked in references below to look at some of the work , and because of that we have already built up components or plans that can be affordable to you.finally we will get the help of prototyping in all our work journey since its a method that is used to create the first primary versions of the project and then gather up all the comments and the feedback from the team members and the client in order to improve until the desired standards are achieved in the final product.

These are the four stages of the process of developing our proposed software in each sprint:

1. Collecting requirements from the client through an effective meeting on the first day of the sprint, including not only an oral description of the requirements but also visual pictures of the thoughts to ensure a clear connection between us.

2. Design Interfaces with the UI/UX engineers and implement its code with the backend engineer

3. Testing built codes through automated codes and building some manual test cases by the QAs to ensure all cases are covered

4. Final integration of the work, showing complete tasks to your team, and taking comments and desired changes from you to implement them in the next two weeks. At the end of the same meeting, we are going to discuss the new requirements with the customer and the process again until we finish the project.

Releases:

It is totally referring to your preferences corroborating with our resources; we can discuss it more in our upcoming meetings, but as a suggestion:

1st release: User's accounts (Employees & Patients) with features needed so employees can connect with their patients through dental appointments, time, and uploading their data. Doctors record all data mentioned in the system main features above.Inventory management Employees can check the inventory in the program, they can request, reserve and report if there is a shortage or an item does not exist. Also fixing the website

2nd release: Linking patients' bank accounts and insurance policies so that they can have their payments as instalments. Discounts can be implemented and strategies can be deployed in this release. Reports analysing and Notification alerts to notify patients ,Ai bot for the Facebook page: To answer some main questions in the page messages.

3rd release: Mappings, Uploading Videos, Disabled people version, last thing is fixing bugs and annual system support for the amount of years we agree on.

Time frame: as the agile approach in developing software works with sprints, we would need a few of them in order to be able to determine the time we will need to get done with this project. Also adding some already built components can speed up the process significantly, so after doing our first meeting and fully understanding your requirements in details, along with your budget and timeframe, we can ensure that we will find the best way to achieve your goals and requirements.

References:

https://github.com/janaHerzallah to check our last done projects

Here are the emails you can contact:

1201139@student.birzeit.com

1200200@student.birzeit.com

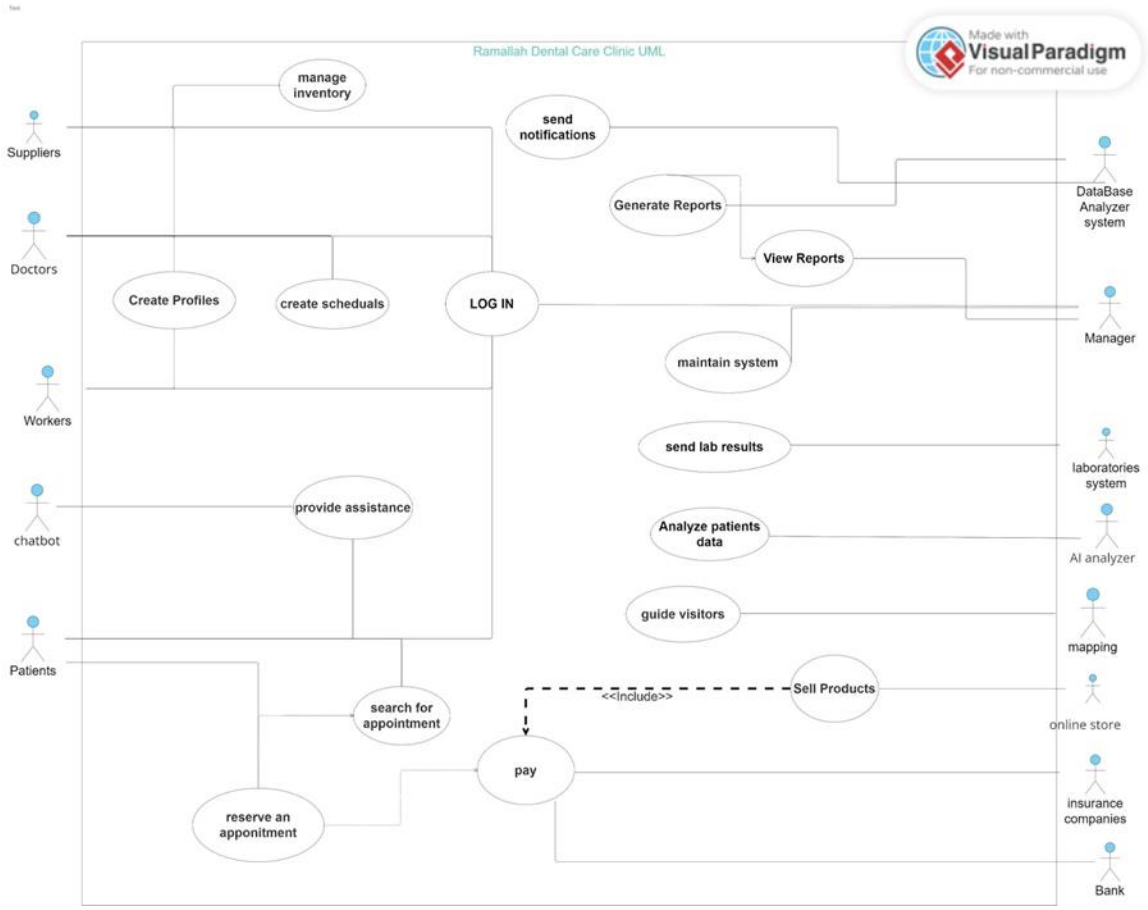
1200071@student.birzeit.com

1200353@student.birzeit.com

1202853@student.birzeit.com

2. Phase2

Use case diagram and uses cases:



1. Product Management and Sales: This feature empowers sales team members to oversee an online marketplace specifically for dental care products. It simplifies the processes of product listing, order management, and transaction processing, thereby enhancing the shopping experience for patients.

2. Workforce Scheduling: This functionality is designed for the clinic's administrative team. It facilitates the creation and management of comprehensive work rosters for all clinic personnel, including medical and auxiliary staff. Key capabilities include shift planning, task assignment, schedule adjustments, and timely communication of any roster changes to the relevant individuals.

3. Clinic Access Map: A clear and concise map guiding patients directly to the dental clinic from various common starting points, ideal for new visitors and those unfamiliar with the area.

4. Reserve an appointment: In this case, different actors as patients can pick a time to see a doctor and confirm it. It's linked to both looking for open slots and paying, which means patients can find, book, and possibly pay for their appointments all at one time.

5. provide assistance: It's an automated service facilitated by a chatbot. This chatbot can interact with various actors like doctors, workers, and patients. It's designed to respond to their questions and inquiries, providing immediate assistance. For instance, doctors might use it to get help with system features, workers may need operational support, and patients might have questions about appointments or services.

6. Pay: This transaction outcome goes to banks or Insurance companies after reserving an appointment from different actors, such as patients and workers, or after buying products from the online store.

7. Send lab results: Doctors and nurses take blood samples from patients and send them to Laboratory, then does the test, generates the reports, sends them back to the system of the clinic, and saves it in the patient folder so that doctors can access them.

8. Analyze patients data : AI analyzer actor can access the patients folder and read the stored records and help with diagnosing each case , and suggest some treatment plans to doctors so that way it can help with processing and summarizing patients data hence, doctors can faten their work and efficiency.

9. Maintain system : The system manager has unrestricted access to all data in the database and user interactions, he can view everything and ensures that the software system is working correctly and within the expected requirements, and

report it to the maintenance team which is responsible fot fixing bugs and problems.

10. Create profiles: The system allows all employees in the clinic (doctors, workers, recipients, secretaries, Sales representatives) to create their individual profiles by providing their essential information such as name, ID, contact details, role, qualifications, family members, bank accounts, insurance, .. etc. The software creates a profile page for each employee that contains their general personal and professional information. Also, it gives the employee the option to update his data as needed.

11. Log in: Each employee has his own account and can log into it with his credentials to ensure his data security and privacy, the process starts when users get to the login page and enter their usernames and passwords, the entered credentials are sent to database analyzer actor for validation. The system checks if the provided data matches the records in the database, so if it is valid the user is authenticated and his identity is confirmed.

12. Search for appointment: This use case simplifies the appointment management process. The system allows users to search for a suitable time for their appointments, they initiate the search by entering some relevant criteria, such as the patient's name, date, or specific dental procedures, then the database queries determine if the appointment is available or not. After the appointment is booked, a notification is sent to the doctor with the reserved appointment.

13. Manage inventory: System allows supplier to maintain essential supplies and devices used in the clinic, the staff receives automated reminders and notifications when a particular supply falls below a defined and known threshold, the system depends on the historical data to help in tracking the performance and lifespan of the supplies and devices.

14. Send notifications: This part is one of the major roles in the system, it is connected with a database analyzer system that will remind patients about their scheduled appointments on their accounts, also it will send suppliers notifications when the inventory falls down and let them know that they need to restock.

15. Generate reports: Data Base analyzer system is responsible for generating reports at the end of each month including reports about employees and their working hours details. It will also report the amount of money spent and gained in that month to send to the manager

16. View reports: Monthly reports will be viewed and sent by the database analyzer to the system manager in order to study the performance of each employee and the number of patients they have been treated. Also, the bills and revenue and how exactly the money was gained.

17. Sell Products: Online store is dedicated to present recommended products to patients by their doctors so that they can provide them with the high-quality products that will help with the treatment and also increase the profits gained by the clinic.

User & System Requirements

Nirmeen Al-Sheikh (1200200):

User Requirement #1:

1. **Employee Registration and Information Management System:**

Manager-Initiated Employee Registration: The system should enable managers to begin the registration process for new employees and workers. Managers will initially set up basic profiles for each employee, inputting the main details such as the employee's name, department, and job title.

Detailed System Requirements #1:

1.1 Initial Profile Setup by Managers: Managers are responsible for registering new employees by creating a preliminary profile in the system. This includes entering key information like the employee's full name, proposed position, departmental allocation, and other essential employment details.

1.2 Employee-Detailed Information Entry: Once a manager has initiated the registration, employees receive a notification to log in and complete their profile. This phase involves employees providing their personal and professional information, such as date of birth, gender, contact details, emergency contacts, employment history, skills, qualifications, and a photograph for identification.

1.3 Verification and Confirmation of Profile Completion: After the employee completes their part of the registration, the system should verify the completeness and accuracy of the information. Once verified, both the employee and the manager should receive a notification confirming that the employee's registration is complete and all necessary details have been accurately captured.

1.4 Data Security for Employee Information: Implementation of robust encryption for data transmission and storage, adhering to data protection regulations, and conducting regular security audits.

1.5 Streamlined Employee Registration Process: The system should provide a clear, intuitive instructions to guide employees through the registration process by incorporating step-by-step guide lines to make it easy for employees to register despite their technical knowledge.

User Requirement #2:

2.Employee Schedule and Task Management System:

- Schedule and Task management gives employees with tools to plan their schedules, including shifts and tasks, and delivers fast notifications for schedule changes, alerts, or new communications, assuring optimal workflow management.

Detailed System Requirements #2:

2.1 Scheduling Functionality: Our scheduling engine is adept at managing diverse scheduling requirements, accommodating an array of shift patterns, roles, and responsibilities throughout the organization. Its flexibility guarantees efficient and precise management of all employee schedules.

2.2 Performance and Response Time: The system should be able to manage several user requests at the same time without degrading performance. In addition, the response time for obtaining and changing schedules should not exceeding five seconds.

2.3 Accessible Schedule Interface: Designed for ease of use, the system presents a straightforward interface for employees to access and review their schedules. The design emphasizes clarity and simplicity, facilitating prompt updates for employees and allowing them to easily view their upcoming shifts, tasks, and responsibilities.

2.4 Immediate Schedule Notifications: The system is engineered to provide employees with immediate updates regarding their schedules and incorporates a thorough alert mechanism. It is capable of disseminating notifications via email, SMS, or in-app messages as they prefer.

2.5 Maintenance and Scalability: The system should be maintainable with minimal downtime for updates or repairs. Also, it should be scalable to accommodate growing numbers of users and data as the number of workers are expand as the clinic expands and enhances its services.

Lana Badwan 1200071:

User Requirement #3: Patient registration

3. The system allows all patients attending the clinic to register by creating an account in smooth ways, providing essential personal information their information should be protected. They are prompted to provide their full medical history, including chronic diseases, allergies to medications and foods, and any genetically inherited conditions

Detailed System Requirements #3:

3.1 The patients should register to the clinic by creating an account including their personal and medical information such as Full name, date of birth,gender, contact details, emergency contacts, and photograph for identification purposes.

3.2 The system must protect personal patients' data and all sensitive medical information through transmission and storage from adversaries by implementing a strong encryption method. This includes using some encryption algorithms for saving data stored in the system database.

3.3 A clear instructions should be provided to patients during the registration process. By providing pop-up message hints or using step-by-step instructions to ensure an easy and error-free registration experience**.**

3.4 Patients should complete the recording of data related to chronic diseases and drug allergy. This is possible by making it a mandatory record and suspending it for a period of time to make sure that the patient has filled it out

3.5 After the end of the registration, it must be confirmed that the registration is complete without any shortage by showing notifications to the patient and sending a message to his contact.

User Requirement #4: family plan integration

4. The system allows patients to associate with family members within the system. When a specified number of family members attend the clinic, the system can automatically apply discounts and awards as per the family plan according to what your preferences are.

Detailed System Requirements #4:

4.1 The system should provide a functionality that connects patients to their family members within the platform. This includes the ability to link multiple patient accounts within the same family.

4.2 The system should maintain an instant count of the family members associated with each patient. The number should be updated automatically when patients add or remove family members from their accounts.

4.3 An automated system should be implemented so that it calculates and applies discounts and rewards based on predefined critiria such as the specific number of family members who attend the clinic, the number of their visits to the clinic, and the registration date of the oldest family member

4.4 The system should include a mechanism for notifying patients when the family plan benefits are applied automatically, so that the discount mechanism is clarified by showing the discount formula that will be approved and clarifying its inputs

Noor Hamayel 1202853

User Requirement #5:

5. The system enables patients to view a list of dental services, including detailed descriptions and expected costs for treatments, and allows them to schedule and manage appointments directly from their profiles.

Detailed System Requirements #5:

5.1 The system maintains a relational database that categorizes dental services into groups: Tooth Loss Treatments, Repairs, Implants, Cosmetics, and Emergencies.

5.2 Each service category has a dedicated table with the following fields: Service ID, Name, Description, Category Type, Standard Procedure Time, Recovery Information, and Base Cost.

5.3 In each service, the 'Description' field should contain a thorough explanation of the procedure, supporting text up to 2000 characters to ensure thorough explanations

5.4 The system will calculate costs by using a pre-made pricing chart that considers the level of service (such as basic, intermediate, or advanced), as well as the expenses for materials and labor.

5.5 Basic services begin at $50, intermediate services at $200, and advanced services at $500. Additional fees will be applied based on the costs of materials and labor.

5.6 The system has a tool for setting up appointments, which is Calendly. It shows the available times as they change. The tool works together with Google Calendar.

5.7 patient data is encrypted using at least AES 256-bit encryption to guarantee data security.

5.8 Access control is enforced using role-based access controls (RBAC), to guarantee data privacy.

5.9 With a maximum response time of 2 seconds for loading and showing the list of dental services and their details, the system performs at a high level.

5.10 The system refreshes available time slots for the appointment scheduling feature in real-time, with a maximum of 3 seconds elapsing between the actual availability and presentation on the user interface.

User Requirement #6:

6. The AI tool offers dental professionals' tools for creating custom treatment plans. Also, analyzing medical images and blood tests to diagnose them.

Detailed System Requirements #6:

6.1 the AI tool provided in the system enables dental professionals to generate customized treatment plans, which include specific treatments such as cavity filling or orthodontic procedures, along with associated costs and projected treatment durations.

6.2 In the system the AI tool utilizes advanced image recognition algorithms to evaluate dental X-ray images with a precision rate that meets or exceeds the industry standard for manual analysis.

6.3 It will detect particular dental diseases, like cavities based on their size and location, and gum disease stages based on pocket depth measurements.

6.4 To increase its diagnostic accuracy over time, the AI tool will continuously learn from new situations and take professional dentistry comments into account.

6.5 It has a comprehensive database of normal value ranges for common blood test markers relevant to oral health, such as white blood cell count, glucose levels, and inflammatory markers.

6.6 The AI will identify any numbers that differ from the normal range after analyzing the results of a blood test and will offer an explanation of these deviations based on the patient's history and current dental health.

6.7 To automatically collect blood test data and notify dental practitioners of significant values requiring rapid care, it's able to integrate with laboratory information systems.

6.8 Under typical operating settings, the AI tool produces analysis results in an average of 5 seconds for the creation of treatment plans and 10 seconds for the study of medical images and blood tests.

Supply Inventory and Devices Maintenance: Roaa Ghannam-1200353

User Requirement #7:

Procurement and maintenance of essential supplies and devices, also planning and tracking the maintenance of medical devices.

Detailed System Requirements #7:

SR7.1: The roles are staff, doctors and managers, they shall be able to search any inventory/device and view their information.

SR7.2: System users can search for any inventory/ deceive by name or by unique code given to devices in the system.

SR7.3: The search result should contain the following device/inventory information: Name, purchase date, expired date and remaining quantity.

SR7.4: System shall show results in no more than 5 seconds.

SR7.5: The remaining quantity should be shown as follows: Available in the clinic, available in the storeroom, not available or the date time it will be available in the clinic.

SR7.6: Clicking on a particular inventory or device gives the user full information with a picture of it, also the doctor and staff can order a particular inventory with the quantity.

SR7.7: System will give a notification to the supplier with the order so the supplier can provide it to the clinic.

SR7.8: Doctors can send reports if they need any inventory from the storeroom.

User Requirement #8: Chatbot:

UR8: The system should allow patients to ask about their appointment scheduling and general inquiries.

Detailed System Requirements #8:

SR8.1: The system is applicable for patients, they shall be able to have chats with the system about the scheduled appointments and general questions about the clinic.

SR8.2: The chat results about patients' scheduled appointments shall be as follows: patient name, doctor name and the time and date of the appointment.

SR8.3: Patients shall be able to ask other questions about the clinic such as: the services and prices, work days and hours, available doctors in the clinic.

SR8.4: The chatbot should answer patients in no more than 2 seconds.

SR8.5: System shall save patients data in history section so users can find previous chats.

SR8.6: System saves all data about chats in the system database, so data is saved if there are any problems in the system.

Financial subsystem and online store: Jana Herzallah -1201139

User Requirement #9:

The system shall keep track of patient's payments by having a dedicated subsystem that directly connects their bank accounts or insurance companies accounts

System Detailed Requirements #9:

9.1. The system needs to provide many installments plans to present to the patients to pick the most suitable ones for their monthly income.

9.2. The system should allow doctors to access (read and write) the payment interface of the patients in order to discuss the costs of the treatment and select the most suitable plan for them in the end of their diagnosis appointment.

9.3. The system shall allow the patient to only read the payment interface and not let him overwrite the plan selected by the doctor.

9.4. The system shall have a secure way of connecting to the bank accounts of the patients to withdraw the amount according to the chosen plan.

9.5. The system shall send reminders to the patients after withdrawing the amount from their accounts.

9.6. The system shall allow all registered people to access their payment interfaces at the same time without it falling down.

9.7. The system shall be designed so that the transactions are very fast to reach to the bank accounts that it doesn't take more than 5 seconds.

9.8. The system shall include a special plan for patients with insurances

9.9. The system shall provide secure connection between the insurance company

accounts, patient accounts, and clinic accounts.

9.10. The system shall send requests for the insurance systems with the receipt of the patient so they can transact to the clinic account the right amount of money.

User Requirement #10:

The system should have an interface dedicated to an online store that patients can access and shop their dental needs from.

System Detailed Requirements #10:

10.1. The store shall provide teeth hygiene and medication products

10.2. The store interfaces should have a search bar by the product name that every one on the system can access.

10.3. The store interfaces shall allow the doctors to access their patients carts at the end of the appointment to prescribe their needs of tools and medications and put them in their carts.

10.4. The store interfaces should allow all registered profiles to access it at the same time without falling down.

10.5. Each item should have its own price and short description of how to be used by patients.

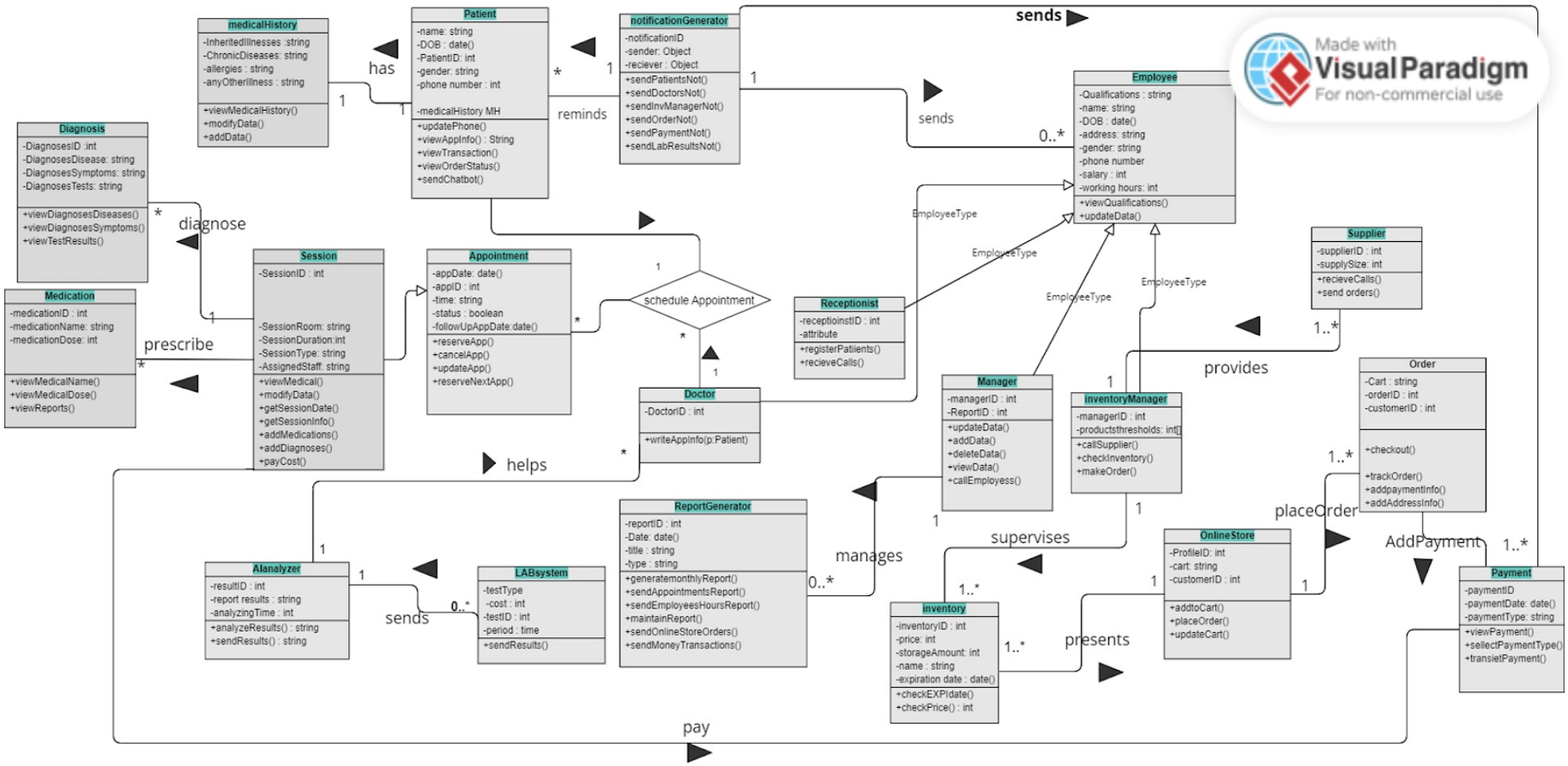
10.6. The store interfaces shall connect their carts to their bank accounts so they can immediately withdraw the cost of purchased items.

10.7. The store interfaces should have a contract with a shipping company to deliver the purchased items to patient’s registered addresses in their profiles.

10.8. The store interfaces should send notification on when the order will be shipped to the patient.

3. Phase3

1. UML Conceptual Class Diagram



2. Use Case Specification Document (individual work)

2.1.Jana Herzallah 1201139 “Shop an item use case specification”

Jana Herzallah - 1201139

Ramallah Dental Clinic System

Online Store Sub-system

Use-Case Specification

“View An Item from Online Store Use Case”

Version 2.0

Revision History

Date	Version	Description	Author
21/Dec/2023	Draft	Draft version	Jana Herzallah
30/Dec/2023	Version 1.0	Small Modifications based on meeting with client	Jana Herzallah
14/Jan/2024	Version 2.0	Add Basic flow. Add alternative flow Modify section on use case extends. Final cleanup. Resolve remaining issues.	Jana Herzallah

“Shop An item” Use Case

1. Brief Description

This use case allows the customer registered in the application to shop through the online store which is dedicated to the clinic. This includes searching for items, adding items to the cart, and checking out the order.

The actor for this use case is the Shopper who is the user of the App which could be an employee or a patient or anyone with a profile on the App.

2. Flow of Events

The use case begins when the user selects the "SHOP ONLINE" activity from the Main Form.

2.1 Basic Flow – Scroll through randomly suggested items

1. When the shopper first selects “shop online “from the main form the system will show a randomly suggested items of the products that the clinic provides.

2. The system will have the suggested items appearing in the screen as pictures with the title of the name of the item under it and the price in shekels next to the name too.

3. The shopper can scroll through the items and pick any of them to view the details of it.

4. The system will show multiple pages of suggested items.

2.2 Alternative Flows

2.2.1 Search for An Item

1. The Shopper selects "search for an item”.
2. The Shopper writes the name of the product to look for.

3. The system displays a screen of variety of items that matches the searched one with the price and a name of the item within a picture of it.
4. The Shopper can scroll until all items with matched results of the search ends.
5. The Shopper can select any item to see its details.
6. The system will display a screen when the shopper selects an item letting the user to read reviews and see pictures of the item.
7. The Shopper has an option to select “add to cart” directly from this screen if he/she wants to proceed and the system will display another screen explained in 2.2.1.
8. The Shopper can navigate back to the suggested items screen.

2.2.2 Add to Cart

1. The Shopper selects "add to cart" option after selecting an item.
2. The system updates the shopper’s cart by adding the picked item to it.
3. The system notifies the Shopper that the cart has the selected product and its price.
4. The system gives the Shopper two options of either checking out or navigating to the past search results screen that presents items to continue shopping.

2.2.4 **Product Is Out of Stock**

If in the "search for an item" sub-flow the system finds that the product is out of stock. A notification message will be displayed to the shopper of when it will be in stock again by doing a query on the database analyzer and the shopper can select the option of receiving a message when its restocked again. The shopper can navigate back to the “search for an item” and search for another item and proceed with shopping or just get out of the app until the item is restocked again.

2.2.5. **Product is not found**

If in the "search for an item" sub-flow the system finds that the product is not provided. A notification message will be displayed to the shopper that will tell the shopper that it doesn’t exist

in the store. And the system will send the manager a report having the date and the product not provided so that the manager can consider providing in the future. The shopper can navigate back to the “search for an item” and search for another item and proceed with shopping or just get out of the app until the item is restocked again.

3. Special Requirements

1. When searching for an item, the system shall respond within 4 seconds.
2. The process of requesting a query on the database analyzer for when a product will be in stock again shouldn’t take more than 5 seconds.
3. The system regularly backup shopping and user information to prevent data loss in case of system failures.

4. Entry Conditions

4.1 Log In

Before this use case begins the shopper must have finished setting his profile on the App and have logged into the system.

5. Exit Conditions

5.1. Log Out

After the shopper logs out, all shopping info must get saved; cart and information filled so that the next time the shopper logs in to return to where the shopper stopped.

5.2. check out items

If the shopper is done shopping, he has to do two things before confirming his order which are filling Payment info and his/her address info.

5.3. Track order

After purchasing items, the shoppers can track their orders by seeing where are they and how long they need to get to them.

2.2.Lana Badwan 1200071 “Patient Registration Use Case Specification”

Lana Thabit Badwan - 1200071

Ramallah Dental Clinic System

User Registration Sub-system

Use-Case Specification

Patient Registration

Version 4.0

Revision History

Date	Version	Description	Author
18/Dec/2023	Draft	Draft version	Lana Badwan
27/Dec/2023	Version 1.0	The introduction of Basic Flow, Alternative Flow and adjustment to the section on use case is extended, final clean up, resolution of outstanding issues have been carried out.	Lana Badwan
2/Jan/2024	Version 2.0	introduced with the inclusion of Basic Flow, Alternative Flow, adjustment to the section on use case extends, final clean-up, and resolution of outstanding issues.	Lana Badwan
6/Jan/2024	Version 3.0	developed with enhanced clarity in use case descriptions, refining language for better comprehension, and addressing any additional client feedback.	Lana Badwan
14/Jan/2024	Version 4.0	finalized with thorough review, polishing of language, and validation against client requirements	Lana Badwan

Patient Registration Use Case

1. Brief Description

This use case allows patients who are at clinic to create an account with the Clinic app, which they can use for registration. In order to ensure the confidentiality of patient data, an input of essential information such as names and medical details is requested. The primary actor in this use case is the patient.

2. Flow of Events

The use case begins when the user selects the "Register as patient" activity from the Main Form.

2.1 Basic Flow – Patient Registration

1. The patient selects "Register as patient" activity.
2. The system directs the user to the patient registration interface.
3. Patient inputs the following personal information: full name, date of birth, gender, contact details, emergency contacts, and provides a photograph for identification purposes.
4. Patient enters additional medical information, including: Chronic diseases and drug allergies.
5. The system employs robust encryption methods to secure and store the provided data in the database.
6. User receives clear instructions and step-by-step guidance throughout the registration process.
7. The system validates the entered information for completeness and accuracy.
8. If mandatory medical information is incomplete, the system suspends registration until the missing data is provided.
9. Upon successful completion, the system confirms registration. And a notification message sent to the patient's contact.

2.2 Alternative Flows

2.2.1 Incomplete Information:

If mandatory personal or medical information is missing during the registration:

1. The system notifies the user of these missing data.

2. The mandatory fields are required to be filled in by the patient.

2.2.2 Update Information:

1. "Update information" is selected by the patient.

2. The patient's current information is displayed in the system for review.

3.The patient can choose to edit some of the fields listed below, for example, contact information, emergency contacts.

4.The system will validate the information entered after patient edit it.

5. If everything is correct , the information shall be updated properly.

6.If not, retry the update process to ensure that all requested data are correct.

2.2.3 Registration Suspension:

If the patient decides not to proceed with registration:

1. The system suspends the registration process.

2. The patient is redirected to the Main Form.

2.2.4 Confirmation Review:

After completing the registration, the system provides a confirmation screen.

1. The patient can review all entered data for accuracy..

2. If everything is correct, the patient confirms the registration.

3. If not, the patient can choose to edit specific fields.

2.2.5. Notification Preferences:

If the patient wishes to customize notification preferences:

1. Notifications preferences, such as reminders of appointments or health updates, are available within the system.

2. Patient selects preferred notification settings.

2.2.6 Confirmation and Notifications:

Upon final confirmation of registration and notification preferences:

1. The system will send a message of confirmation to the patient's contacts.

2. The application displays notifications about successfully registered users.

3. Special Requirements

1. Strong encryption algorithms for data transmission and storage shall be introduced by the system.
2. The registration process should be user-friendly, with clear instructions and intuitive interfaces.

4. Entry Conditions

For this use case, there is no entry condition. The first step after the application has been downloaded is this use case.

5. Exit Conditions

5.1. log out

After logging out, all registration information must be securely saved. This includes the patient's details and any information that is filled in during the registration process. This ensures that the next time the patient logs in, he can smoothly return to where he stopped in the registration process.

5.2. Track Registration Progress

Patients will be able to track their progress in the application after completing the registration. This feature will allow them to keep an eye on the status of their registration and be able, when they log in again, to proceed with incomplete steps.

5.3. Feedback and Reviews

Patients may provide feedback and write reviews of their experience with registration after being successfully registered. This function can help improve the process for registering an application, as well as improving user satisfaction with its services in general.

2.3.Nirmeen Alsheikh 1200200 “Employee Registration Use Case Specification”

Ramallah Dental Clinic System

User Registration Sub-system

Use-Case Specification

Employee Registration

Version 4.0

Revision History

Date	Version	Description	Author
18/Dec/2023	Draft	Draft version	Nirmeen Al-Sheikh
27/Dec/2023	Version 1.0	implemented with minor adjustments based on feedback from a client meeting	Nirmeen Al-Sheikh
2/Jan/2024	Version 2.0	Introduced with the inclusion of Basic Flow, Alternative Flow, adjustment to the section on use case extends final clean-up and makes it clear.	Nirmeen Al-Sheikh
6/Jan/2024	Version 3.0	Modify section to use case one and add more specifications and explanation for the software.	Nirmeen Al-Sheikh
14/Jan/2024	Version 4.0	Finalized with thorough review and adding the missing points.	Nirmeen Al-Sheikh

Employee Registration and Information Management System Use Case

1.Brief Description

This use case shows the employee registration and information management system, specifically for managers to facilitate the initiation of employee registration. The system enables managers to create initial profiles for the new employees by adding their main details such as name, department, and job title.

2. Flow of Events

The procedure begins with managers using the Employee Registration and Information Management System, which is designed to facilitate employee registration.

Basic Flow - Manager-Initiated Initial Profile Setup:

1. Managers log into the Employee Registration and Information Management System to initiate the registration process for adding a new employee.
2. Within the system, managers navigate to the "Initial Profile Setup" section, where they create preliminary profiles for each new employee.
3. The manager enters the main information, including the employee's full name, proposed position, departmental allocation, and other essential employment details.
4. The system prompts managers to review and confirm the accuracy and completeness of the entered information for the employee to finish the initiation account registration.
5. The system automatically notifies the manager upon the successful completion of the initial profile creation.
6. Employees get a notification after the manager ends their registration.
7. Employees fill in their personal and job-related info, birthdate, gender, contacts, emergency contacts, work history, skills, qualifications, and a photo.

8. After employee’s finish entering their information, the system checks to make sure all info is completed and entered correctly.

9. Both the employee and manager get a notification when everything is good, confirming that the registration is done, and the profile is completed.

2.2 Alternative Flows

2.2.1 Missing employee information:

If mandatory personal or medical information is missing during the registration process:

1. The system notifies the employee to verify and complete their profiles by adding the required information and all their details to the system.

2. Employees are prompted to complete all their information to complete their profiles.

2.2.2 Existing employee

Within the register process, if the system detects an existing employee with identical identification and information, an error message will occur, indicating "Employee Already Exists." The manager has three options: to modify the employee's details, delete the existed account and generate a new one with the new employee information, or cancel the operation.

2.2.3 Update Employee Information:

1. Employee can update his profile by selecting "update information."

2. The System displays the current employee information to edit.

3. Employee choose to edit his specific information such as date of birth, telephone number and qualifications.

4. System checks the entered information if it is entered correctly and there is no missing. If all the entered new data are correct and accurate, information is updated.

5. If not, notify the employee to edit the entry until all required data is correctly entered.

3. Special Requirements

1. The system must implement strong encryption algorithms for employee data transmission and storage.

2. The registration process should be user-friendly, with clear instructions and intuitive interfaces that all employees could find it easy to use despite their knowledge and skills.

4. Entry Conditions

4.1 Log In

Before the employee adds his information to complete his profile, the manager must have completed the initial employee registration and profile setup in the Employee Registration and Information Management System. This involves entering key information such as the employee's full name, proposed position, departmental allocation, and other essential employment details during the initial profile setup by managers. Additionally, the manager should ensure that the employee has successfully logged into the system following the registration process.

5. Exit Conditions

5.1. Log out

Secure preservation of employee registration information ensures that all of his data, including personal and professional information, is securely preserved, and when the employee logs in again into the system, he will resume where he left off If the employee wishes to log out and continue entering his information later.

2.4.Noor Hamayel 1202853 “AI Tool for Dental Diagnostic Analysis Use Case Specification”

Noor Hamayel - 1202853

Ramallah Dental Clinic System

Use-Case Specification

AI Tool for Dental Diagnostic Analysis

Version 3.0

Revision History

Date	Version	Description	Author
11/Dec/2023	Draft	Draft version	Noor Hamayel
21/Dec/2023	Version 1.0	Implemented minor revisions based on initial stakeholder feedback, improving the clarity and flow of the diagnostic process within the AI tool's functionalities.	Noor Hamayel
5/Jan/2024	Version 2.0	Additional diagnostic flows were added to the use case	Noor Hamayel
17/Jan/2024	Version 3.0	Finalized the use case specification, incorporating all feedback for accuracy and user experience enhancement.	Noor Hamayel

1. Brief Description

This use case explains how an AI tool evaluates blood tests and dental X-rays to provide patients and dental professionals with diagnosis and treatment recommendations.

2. Flow of Events

The use begins when a dental professional or patient begins the "Dental Diagnostic Analysis" process within the AI system.

2.1 Basic Flow-Diagnostic Analysis and Reporting

1. The Registrar selects "Start Analysis".
2. The system prompts the user to upload dental images and blood test results.
3. The user uploads the required medical files into the system.
4. The system performs a preliminary check to ensure that the image quality and file types are suitable for analysis.
5. The user watches for the data to be processed by the system.
6. The system uses artificial intelligence (AI) algorithms to analyze medical data and produce a diagnostic report.
7. The system sends the user a notification as soon as the report is complete.
8. The user obtains and examines the system's diagnostic report.
9. Once the user has successfully obtained and reviewed the report, the use case is over.

2.2 Alternative Flows

2.2.1 Update data

1. The Registrar selects "Data Management" and then chooses the "Update data" option
2. The system shows a list of data files that have already been uploaded.
3. The user selects the data file that requires updating.
4. The system gives the user the ability to edit existing data details or upload new files.
5. The user uploads the updated dental pictures or blood test results.
6. The system instantaneously verifies the format and quality.
7. If the new data passes the check, the system processes the updated data using the AI algorithms for re-analysis.
8. The user is notified when the revised report is prepared for review and the new analysis is finished.
9. When the user examines the revised diagnostic report, the use case is over.

2.2.2 Data Deletion

1. The Registrar selects "Data Management" and then chooses the "Delete Data" option.
2. The system presents a list of all previously uploaded data and provides a search function.
3. The user can either scroll through the list or use the search function to enter the name or date of a specific report.
4. The user selects the desired data to be deleted after it has been located.
5. The system asks the user to verify that they really want to remove the chosen data.
6. The system deletes the data after confirmation.
7. A notification confirming the successful deletion is sent to the user.
8. The use case ends when the user exits the data management section.

2.2.3 Review Past Reports

1. The Registrar selects "Data Management" and then chooses the "Review Historical Reports" option
2. The system displays a list of all past reports and provides a search function.
3. The user can either scroll through the list or use the search function to enter the name or date of a specific report.
4. Based on the user-entered search terms, the system filters the list.
5. The user selects the preferred report from either the complete list or the filtered list.
6. The system retrieves and presents the chosen report for an in-depth examination.
7. The use case ends when the user has finished reviewing and exits the report section.

2.2.4 Emergency Alerts

1. The Registrar selects "Request Re-analysis" from the options menu.
2. The user's previously uploaded data is displayed by the system for selection.
3. The user chooses the specific data set they want re-analyzed.
4. The chosen data is processed by the system once more, producing a new diagnostic report.
5. The use case ends when the user has finished reviewing and exits the report.

2.2.5 Unclear Image Resubmission

When an image uploaded for analysis is inadequate, the system alerts the user, who then re-uploads a clearer image. After verifying the new image's quality, the system conducts the analysis, ensuring accurate and reliable results from the AI tool.

2.2.6 Inadequate Blood Test Data

The user is notified when the system deems blood test data insufficient and requests that they submit a more thorough blood test. To guarantee accurate diagnostics, the system then reanalyses the data using the updated information.

3. Special Requirements

1. Respect patient privacy and data encryption by following HIPAA guidelines.
2. For image analysis, diagnostic results should be produced in no more than 10 seconds, and for treatment planning, in no more than 5 seconds.

4. Entry Conditions

The patient or dental professional using the system needs to log in to access the system.

5. Exit Conditions

The process ends with the generation and access of a diagnostic report.

2.5.Roaa Ghannam 1200353 “Management Inventory Use Case Specification”

Roaa Ghannam 1200353

Ramallah Dental Clinic System

Management Inventory

Use-Case Specification

“Maintenance of essential supplies and devices”

Version 2.0

Revision History

Date	Version	Description	Author
21/Dec/2023	Draft	Draft version	Roaa Ghannam
30/Dec/2023	Version 1.0	Some Modifications in the meetings with customer.	Roaa Ghannam
14/Jan2024	Version 2.0	Modify section on use case extends. Final cleanup. Add alternative flows. Resolve remaining issues.	Roaa Ghannam

Maintain Inventory Information Use Case

1. Brief Description

This use case allows the Inventory Manager to maintain inventory information in the system. This will include to add any inventory with details, searching of exist item, update any inventory information.

The main actor of this use case is the Inventory Manager, who will use the app to maintain inventory.

2. Flow of Events

The use case begins when the Inventory Manager selects the "Maintain Inventory" activity from the Main Form.

2.1 Basic Flow – Add Inventory

1. The Inventory Manager selects "Add Inventory."
2. The system displays a blank inventory form.
3. The Inventory Manager enters the following information for the inventory: code, name, purchase date, expired date, quantity, then selects “save” option.
4. The system validates the data to insure the proper format and searches for an existing inventory with the specified code. If the data is valid the system creates a new inventory.
5. Steps 2-4 are repeated for each inventory added to the system. When the Inventory Manager is finished adding inventory to the system the use case ends.

Basic Flow – Search an Inventory

1. The inventory Manager selects “Search Inventory”
2. The system displays a search field
3. The inventory Manager enters the inventory code or inventory name.
4. The system validates the data to insure the proper format and the inventory existence, if the data is valid the system displays inventory following information: code, name, purchase date, expired date, quantity.
5. Steps 2-4 are repeated for each inventory search. When Inventory Manager search inventory the use case ends.

2.2 Alternative Flows

2.2.1 *Modify Inventory*

1. The Inventory Manager selects "Update Inventory."
2. The system displays a blank Inventory form.
3. The Inventory Manager types in the code or name of inventory to modify.

4. The system retrieves the inventory information and displays it on the screen.
5. The Inventory Manager modifies one or more of the inventory information fields code, name, purchase date, expired date, quantity.
6. When changes are complete, the Inventory Manager selects "save."
7. The system validates data, then updates the inventory information.
8. Steps 2-7 are repeated for each inventory the Inventory Manager wants to modify. When edits are complete, the use case ends.

2.2.2 Order Inventory

1. The Inventory Manager selects "Order new Inventory."
2. The system displays a blank inventory form.
3. The Inventory Manager types in the inventory information: code, name, purchase date, quantity to save the order.
4. The system retrieves the inventory and displays the inventory information in the form.
5. The Inventory Manager selects "Order."
6. The system displays a delete verification dialog confirming the order operation.
7. The Inventory Manager selects "yes."
8. The system send notification to the supplier with order information.
9. Steps 2-8 are repeated for each inventory to order from the system. When the Inventory Manager is finished ordering inventory to the system the use case ends.

2.2.3 *Inventory Already Exists*

If in the "Add Inventory" sub-flow the system finds an existing inventory with the same name an error message is displayed "Inventory Already Exists" and displays the certain quantity of the inventory. The Inventory Manager can either update the exist inventory, create a new inventory with the same name or code, or cancel the operation at which point the use case ends.

2.2.4 *Inventory Not Found*

If in the "Modify Inventory" or "Order Inventory" sub-flows the inventory code is not located, the system displays an error message, "Inventory Not Found". The Inventory

Manager can then type in a different code/name or cancel the operation at which point the use case ends.

3. Special Requirements

1. The system retrieves the inventory record in no more 3 seconds when search for an inventory.
2. System sends notifications to Inventory Manager when any inventory is near to finish.
3. System has high security when log in into Inventory system, it sends email to Inventory Manager about any log in try.

4. Entry Conditions

4.1 Log In

Inventory Manager has to log in into system to start the use case.

5. Exit Conditions

5.1 Log out

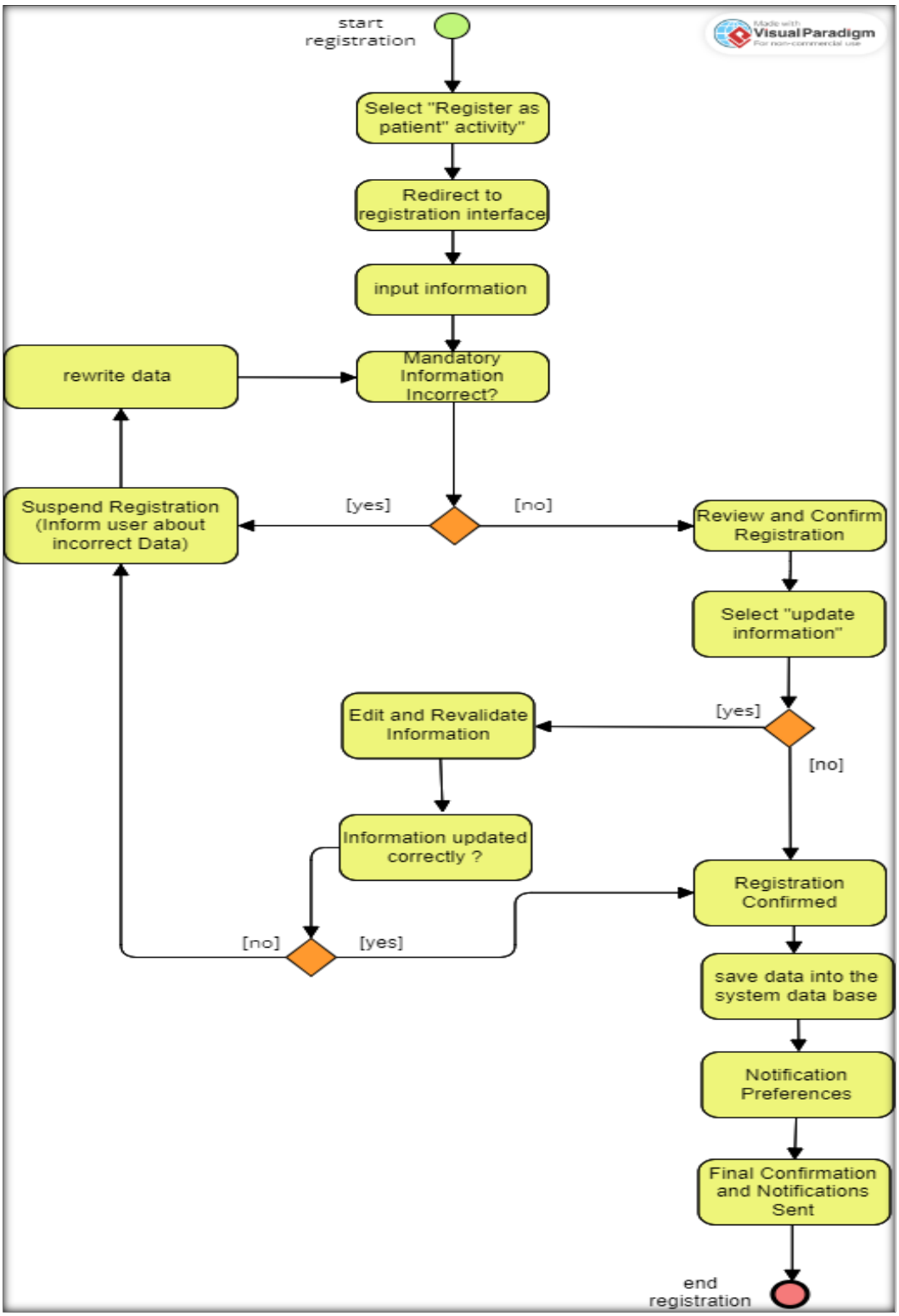
After Inventory Manager log out, all information and modifications will be saved in the database.

5.2 Track orders

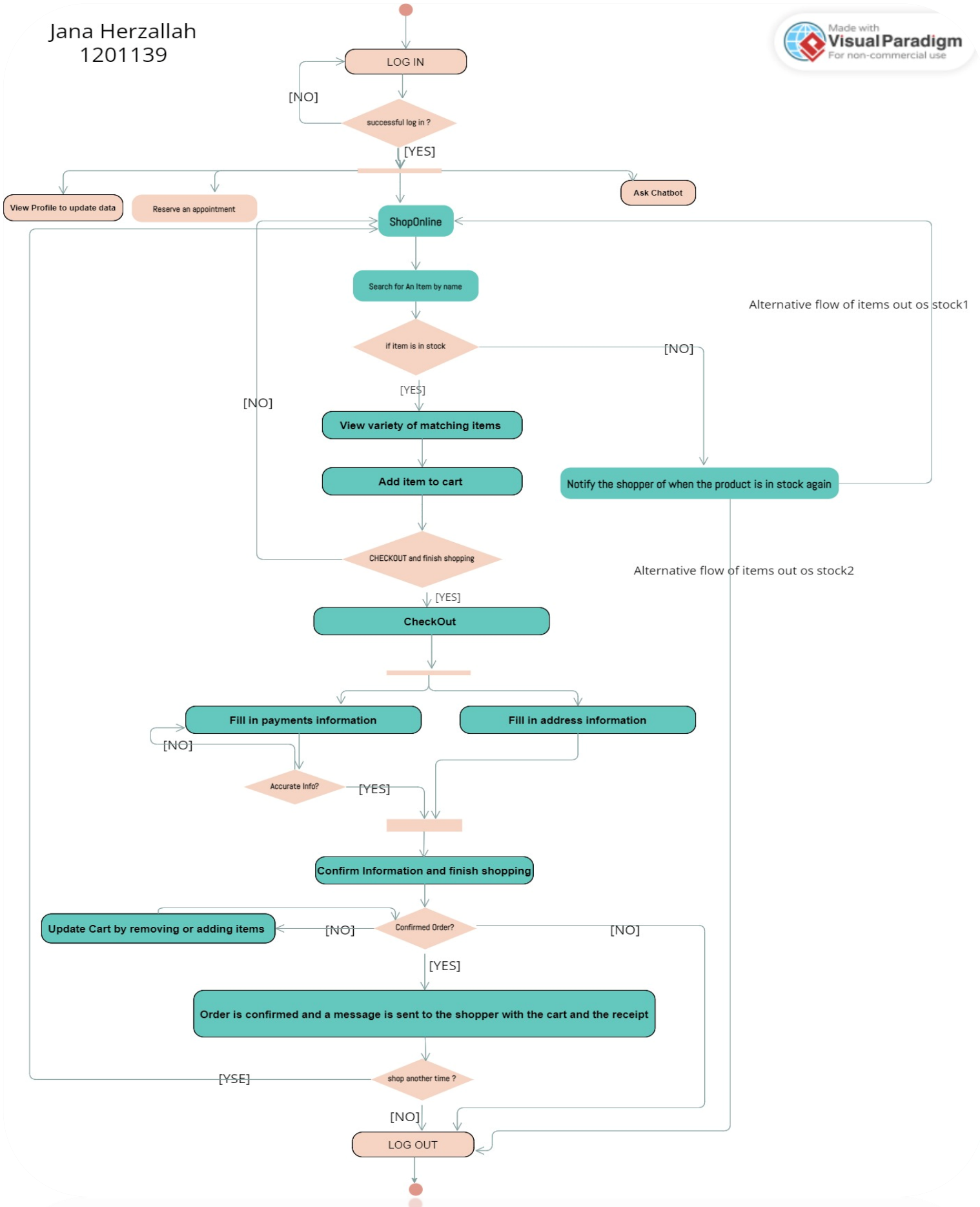
After the Inventory Manager log out from the system, system will send report to Inventory Manager account about all modifications happened.

3. UML Activity Diagrams (individual work)

3.1.Lana Badwan 1200071 “Patient Registration”



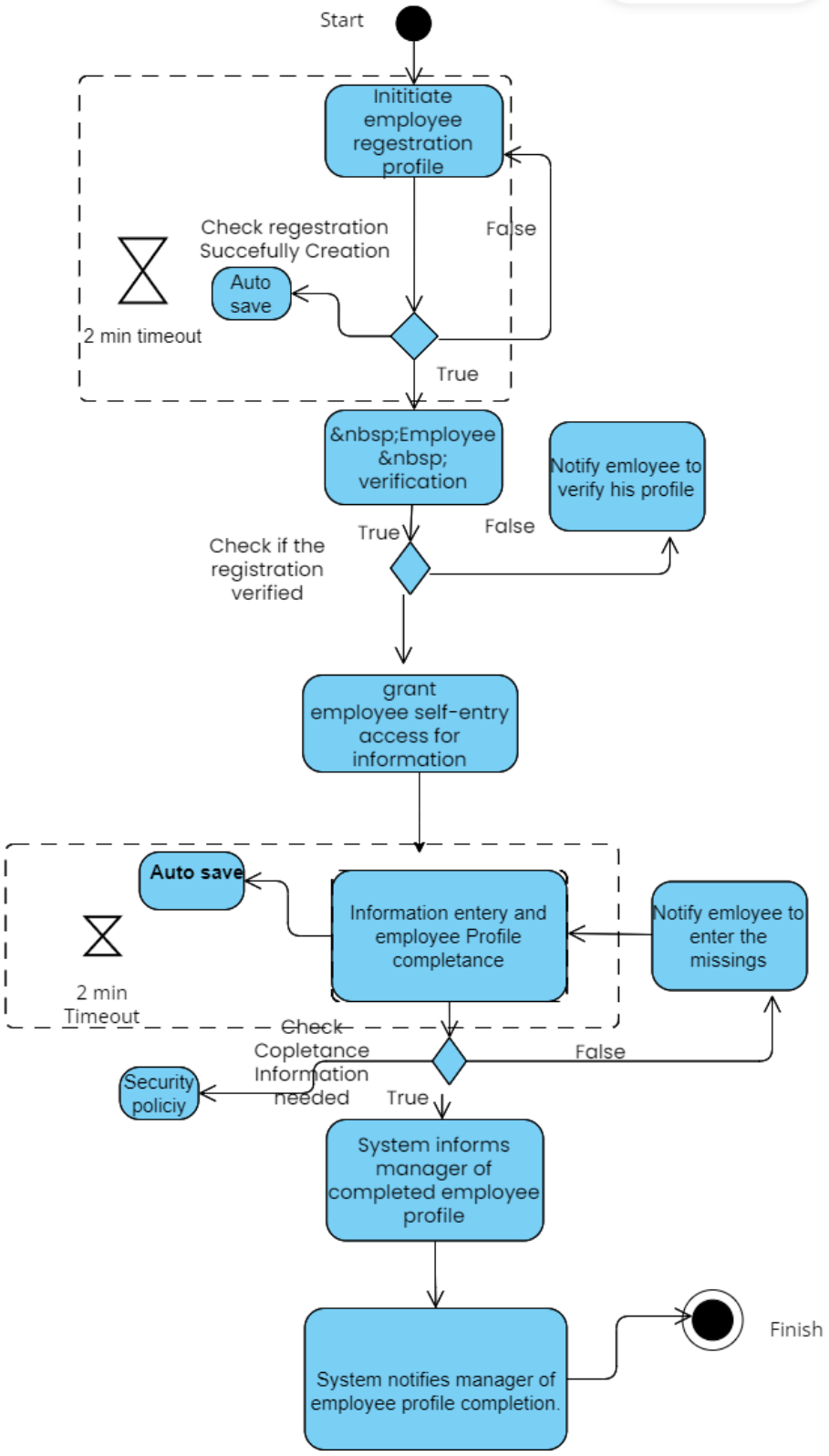
3.2.Jana Herzallah 1201139 “shop an item”



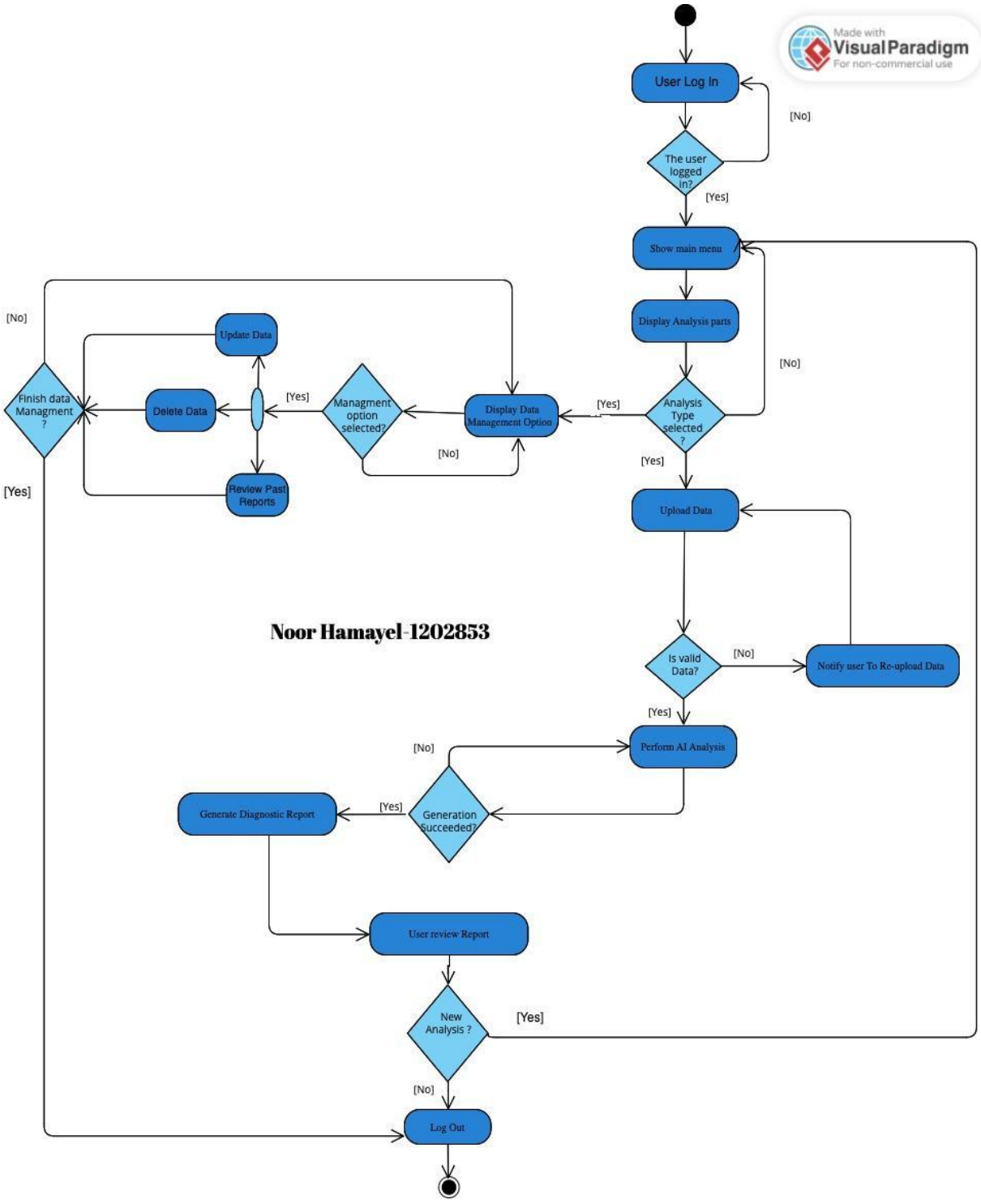
3.3.Nirmeen Alsheikh 1200200 “Employee Registration”

Employee Registration and Information Management System Requirement

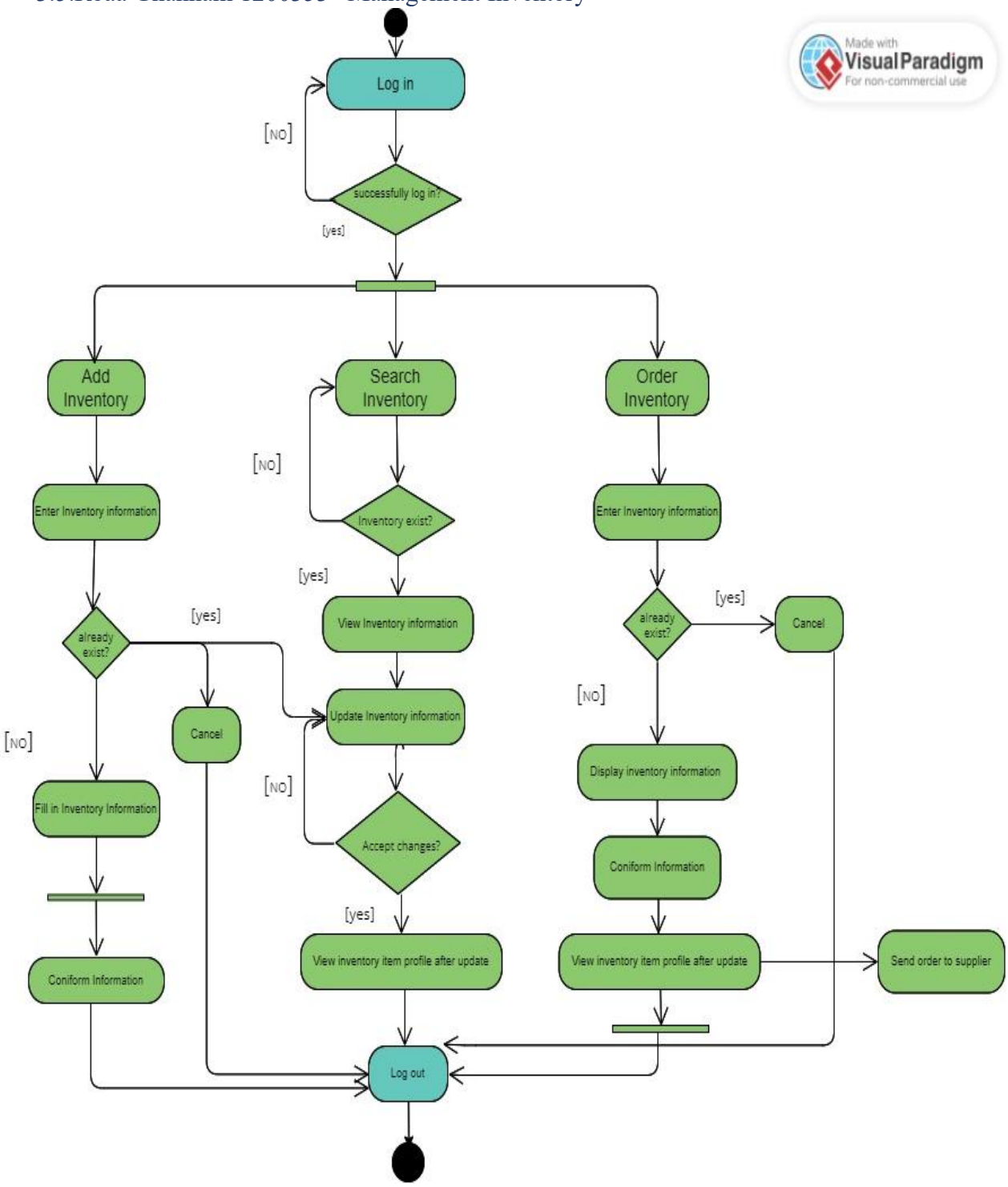
Nirmeen Al-Sheikh
1200200



3.4.Noor Hamayel 1202853”AI tool for Dental Diagnostic Analysis”



3.5.Roaa Ghannam 1200353 “Management Inventory”



4. Phase 4

1. List of software architecture design goals: choose three main goals.

These architectural design goals have been derived from the non-functional requirements above in phase 1 with aiming to have low coupling and high cohesion between the system models

1. **Reliability &Dependability:**

   • **Architecture Goal**: To build a scalable and robust infrastructure that will allow all users including dentists, patients, shoppers and inventory managers to access the system without the server falling down. And to have the data copied to multiple servers to ensure having the data in case the system crashes.

   • **Implementation Approach:**

   - We will use data servers that can handle the total number of existing users and anticipate future growth over the next 7 years which have high processing speed due to high clock cycles frequencies with a special hardware to increase the performance.
   - We will use trusted backup servers to provide efficient data retrieval in the event of a system failure and that's to ensure quick recovery, so we will store backup safely in designated locations and will make sure to perform regular examinations to restore it.

2. **Security:**

   • **Architecture Goal:** Using advanced encryption and protection mechanisms to ensure the safety of our data since we deal with sensitive medical and private data. Also, we need to authenticate the log in process to ensure that its real users trying to log in not hacking machines.

   • **Implementation Approach:**

- For optimum performance, we will subscribe to Cloudflare servers for SSL/TLS encryption service and perform a load balancing operation service.

- Check for updates of SSL/TLS certificate and configure Cloudflare's security settings on our website and application a regular basis to keep track for any potential security threats that can be hacking our system.

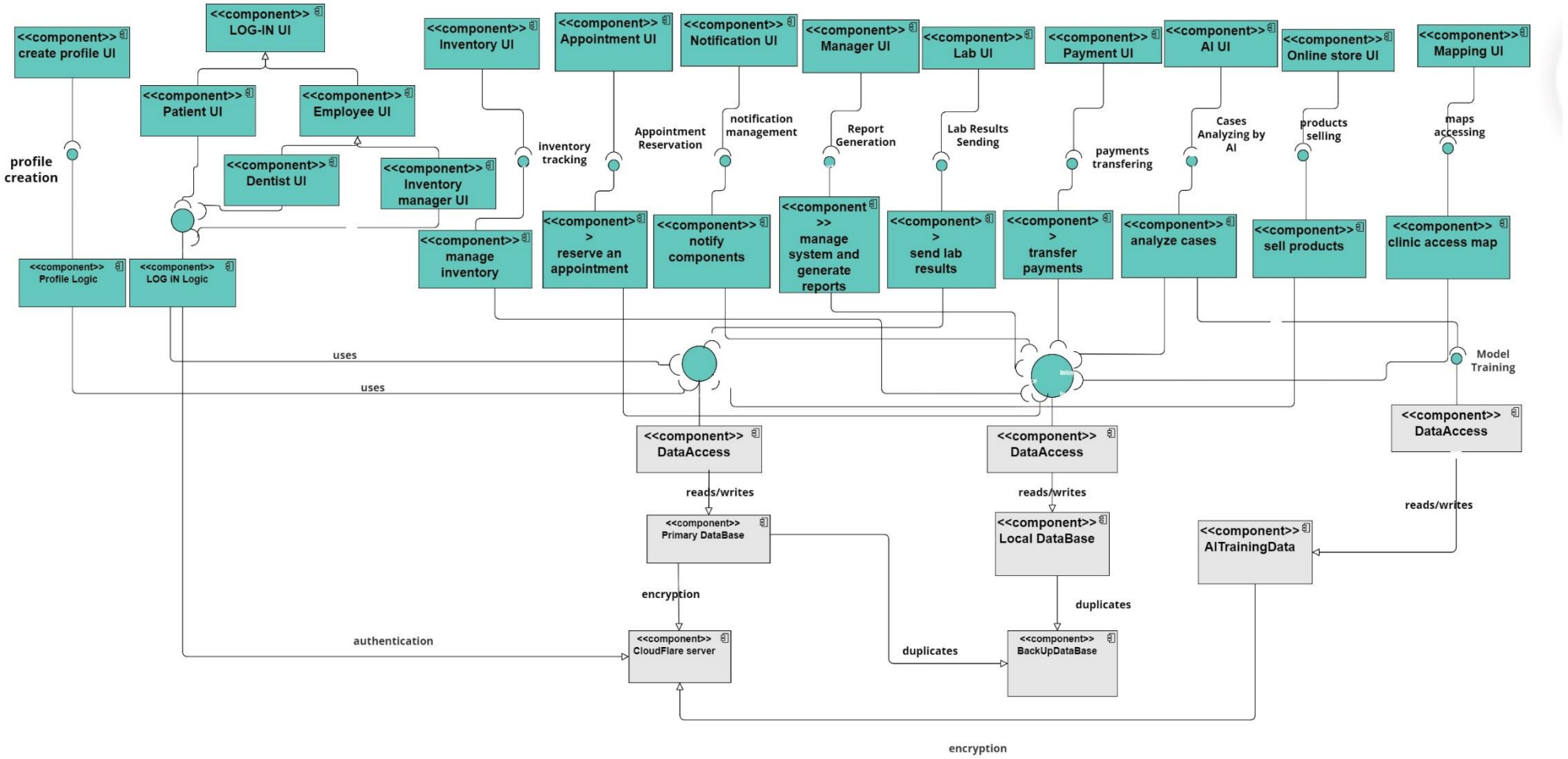
3. **Performance:**

• **Architecture Goal:** To Optimize Response Times for User Interactions

• **Implementation Approach:**

- Implementing efficient front-end and back-end processing to ensure quick responses to user actions by utilizing asynchronous processing and optimizing API calls to reduce deadlocks and non-useful waiting times which will be the quality assurance department responsibility to ensure.
- having a local database system so that these components such as appointment scheduling, inventory management, report generating, payment transferring, notification sending and analyzing reports by AI aiming for a maximum response time of 5 seconds.
- Optimizing database schema with proper indexing strategies to speed up queries. Also, we intend on employing query optimization techniques and considering partitioning large datasets to improve access speeds.
- Adding a special database system which will have training and testing data including texts and images so that our AI analyzer model can be always enhancing to get the best results with helping dentists within their diagnoses.

2.UML Component diagram, with brief description of each component and the services it provides.



Components of the component diagram and brief of its services:

1. create profile UI and profile logic components:

This UI is used by any visitor of the App so that they can create their own profiles to access the clinics services. And its directly connected to the profile logic component that stores the classes of the patient and the employees' types including the manager, the dentist and the inventory manager.

2. LOG-IN UI and LOG-IN logic components:

It has patients and employees UI interfaces packages that represent a gateway for patients that allows them to manage their details as their personal data and medical history and appointment records which are saved in the profile logic components. And for the employee its either a dentist or inventory manager which they can access their profiles including their data and schedules for the dentists. And the inventory management classes such as supplier, inventory in the UML class notation for the inventory manager.

It's connected to the cloud flare server to authenticate the users' credentials when they log in. as in the UML component diagram above.

3. Inventory UI and Inventory management logic components:

It has the user interface to manage and view the inventory of medical supplies and equipment by the inventory manager employee and in which he can updates and make orders and connect to the suppliers. It connects to the classes of the inventory and the manager to send reports about the management process and the supplier class as jars.

4. Appointment UI and appointment reservation logic components:

It provides tools for patients to reserve appointments and their medical procedures, also it allows the doctors to make their schedules. It's connected to the appointment reservation logic which has the patient class, the dentist class, the session class which is connected to the medications and diagnoses classes as jars. To ensure the correct process of reserving the suitable slot.

5. Manager UI and management and reporting system components:

Report viewing UI: A specialized interface to view different reports generated by the system.

Financial statements, inventory levels and treatment records could be included.

Report Generation: A backend component responsible for compiling data into structured reports. It collects data from a variety of sources such as inventory, appointments and patients' records.

Maintenance User Interface: this is an interface for maintaining facilities in the clinic such as tools and devices and software as well that the employees can access and post about what needs to be fixed so that the manager sees and fixes.

6. Payment UI and transfer payments components

This UI is specialized in accessing the payments types in the clinic that patients can access to pay for their sessions and for their surgeries and their purchases from the online store. It connects to transfer payments logic component which have the payment class as jar which have attributes shown in the class UML diagram. And its connected to the local database so that it ensures the fast processing and response.

7. Lab Results UI and sending results logic components

A platform to manage laboratory tasks such as testing requests, results reviews by doctors to see their patient’s information which have the patient class with the medical history one as jars.

8. AI UI and analyzing cases logic components

Its employing artificial intelligence strength which is a model trained by the clinic that connects to a special database for training and testing. This module will examine patient information (by accessing the patient classes) to help doctors to in diagnosing medical conditions and suggest treatment plans along with analyzing the lab results sent by the above component in case its text written or as images.

9. Online store UI and list products logic components

This is a front end through which users interact with the system. It would include viewing items and search items by name that shoppers can place in their carts. which connects to the inventory class , payment class , order class as jars.

10. Mapping UI and mapping system components:

It connects to the local database so that its performance is very fast so that the clinics visitors can access quickly to navigate to its location in the shortest path that could be taken.

11. notification system logic component

This interface would alert users to different events within the system, such as low inventory, appointment reminders, or lab results being available so it will have so much classes in its jars as patient , dentist , the appointments , the order, the inventory , lab results and the payment classes.

12. Data Access component

This component connects the logical components of our system to the local or the primary databases so that in case in the future we change in the databases implementation , we don't have to redesign all the classes to match the new design instead we only change the data access component.

13. Local Database:

This is the database which is local database system so that these components such as appointment scheduling, inventory management, report generating, payment transferring, notification sending and analyzing reports by AI , can be easily performing their tasks in a maximum response time of 5 seconds successfully since accessing a local database will be much faster than opening a connection with a faraway servers.

14. Primary Database

This is the primary database of the whole system which is stored in servers to make the system services correctly done, it has all of our classes and components stored in. its connected to the data access component to access its components.

15. back up Data

This is the database which is stored in extra servers to ensure if the main server that stores the database gets corrupted which we will refer to in such case. So that the clinic will be available no matter any technical problem takes place. Its connected to both the local and the primary databases to duplicate the data from them.

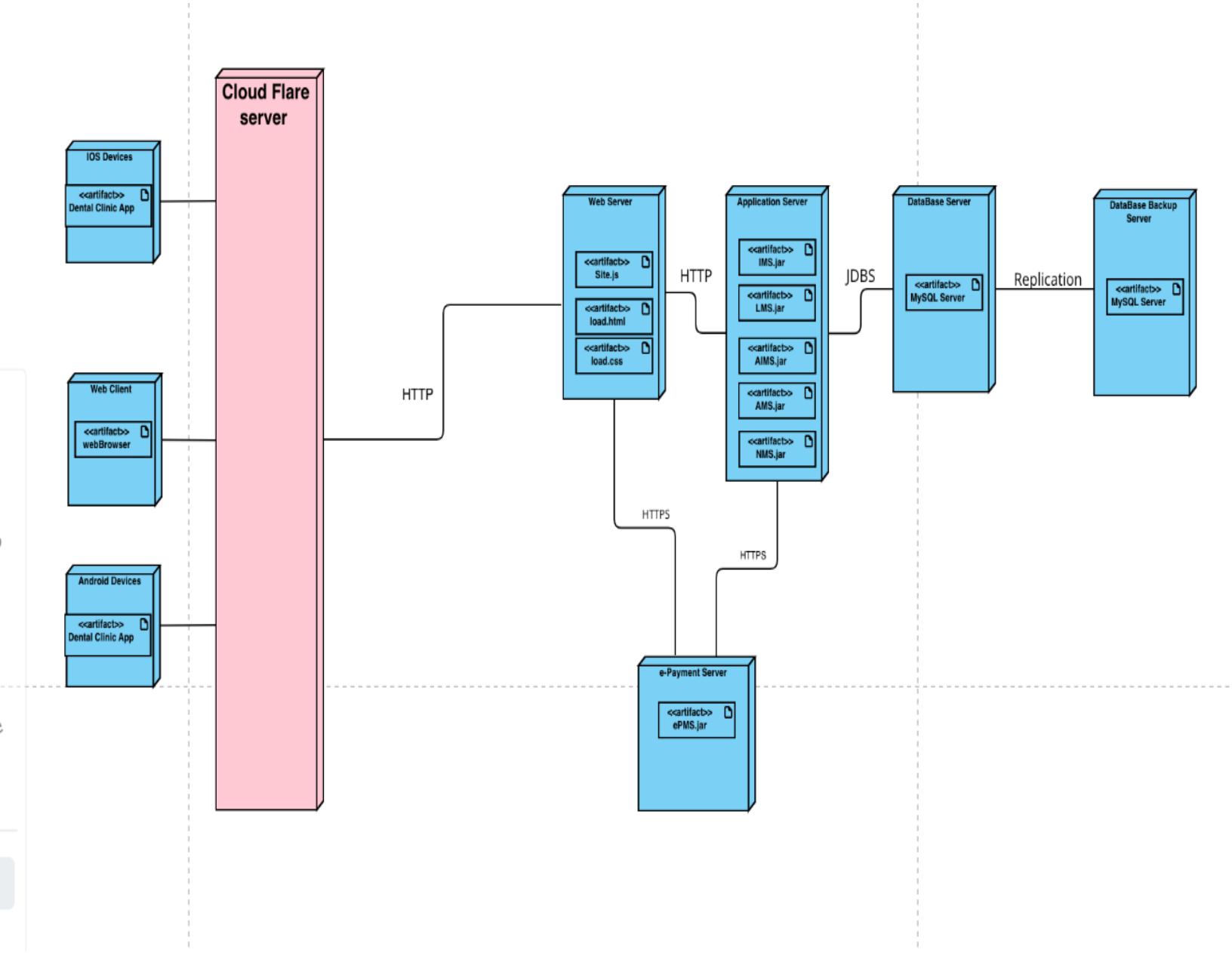
16. AI training database

This is the database that will store the training and testing data for the AI model that the clinic will enhance to be supporting their dentists with so that they can work more efficiently.

17. cloud flare server

This is the server that will gets the authentication services for the log in processes and the encryption services for our private and sensitive medical data for our patients. It is connected to the primary database server to encrypt the whole system information to protect form hackers. And to the log in component to validate the credentials.

3. UML Deployment diagram



On the left side is the client that could be a web client or ios device or android device then we have the cloud flare server that authenticates the clients credentials and secures the whole system data through advanced encryption techniques , which will make a TCP connection to the web server that has the html and csv and Jason files and the application servers that has the IMS which is the inventory management system and LMS (Log in management system) , AIMS (AI management system) , AMS (appointment management

system) and NMS(notification management system) all in jars referring to java archive files of our system which make JDBS connection to my sql server in the main database server. We also have a duplicated database server for back ups just in case the system crashes. And the external epayment server that conncets our system with other banking systems