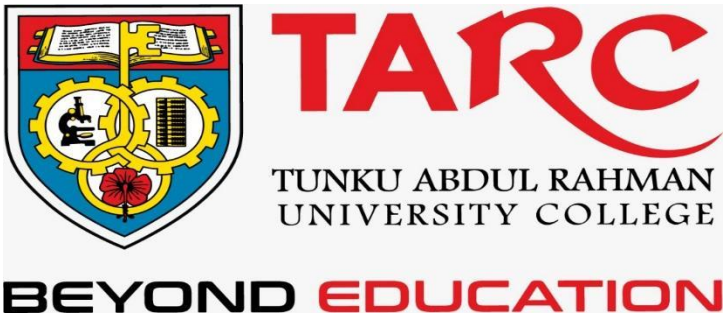
Efficiency and performance boost on dentist in dental management system

By

Soon Yi Hong



FACULTY OF COMPUTING AND
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TUNKU ABDUL RAHMAN UNIVERSITY COLLEGE
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Efficiency and performance boost on dentist in dental management system

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Department of Information and Communication Technology
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Declaration

The project submitted herewith is a result of my own efforts in totality and in every aspect of the project works. All information that has been obtained from other sources had been fully acknowledged. I understand that any plagiarism, cheating or collusion or any sorts constitutes a breach of TAR University College rules and regulations and would be subjected to disciplinary actions.

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Bachelor of Information Technology (Honours) in Software Systems Development

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Chapter 1

Introduction

1 Introduction

DENTAL MANAGEMENT SYSTEM (DMS) is the application of helping dentist and nurse to record their patients' details, making appointments, and dental management.

Technology is rapidly advancing in the year of 2021 in Malaysia, but there are still traditional dental clinics which operate everything through paperworks and human efforts. With the mention of paperworks and human efforts, there will always be mistakes or accidents which will cause a delay to the dental clinics operating flow. Paper documents can take up a significant amount of space, and the quantity of paper will increase day by day (Melo, November 12, 2019).

To overcome the issues, technology is recommended to implement so that human efforts will be reduced to produce better productivity than before. Paperworks documents will be eliminated and become electronic documents to save time and space. This will reduce human error and reduce environmental damage by converting the documents from paper into electronics. By using electronic documents, the documentations are able to save at a more secure place compared to paper documents. Therefore, data is secured through the implementation of technology.

With the common implementation of technology to the business especially in this era, traditional dental clinics are required to follow up the others with the help of technologies. Technologies that dental clinics implement might help their work flow speed up and decrease the efforts needed compared to before. So, we decided to develop a new dental management system for the dentist and nurse to speed up the flow and secure the data of patients.

1.1 Objectives

The proposed project is to develop a Dental Management System (DMS) that allows users to install the system in their devices such as smart tablet, desktops. Firstly, the project is trying to improve the working flow of dentists and nurses, reducing the unnecessary steps to perform a task. Steps for users to complete a task will be shortened by using a better user interface for the system. Secondly, it also helps dental clinics to reduce data losses such as from floods, data consistency and accuracy. By using this system, paperwork documents will be fully converted into electronic documents for more efficiency in searching and safety in terms of data. Technology such as ASP.net and Visual studio is chosen for the purpose of creating the system.

The objective of the proposed system are :

1. Provide interface for user operating purpose
2. To enhance user experience and satisfaction
3. To reduce the steps required to perform tasks
4. To eliminate the non-environmental friendly paper documents
5. To secure the data for future use.

1.2 Background

Dental Software is one of the best practice management systems that helps in automating the entire hospital/clinic (Kumar, 24 December 2019). Speed is everything in terms of workflow, human efforts should be minimized in order to increase efficiency. Therefore, a dental management system is introduced in order to speed up the process of dental tasks such as recording a patient's details. As the technology rapidly evolves, the faster you are, the more efficient your business will be. The system should be able to minimize the steps needed to complete the task for users compared to traditional ways. Customer satisfaction and speed are directly correlated to one another (Bechervaise, 31 May 2017). They also state if your business does things quickly, then customer satisfaction goes up and up.

Besides, accuracy and consistency in data management is one of the most important things that a dental clinic should take care of. Accurate and consistent data leads to better decision making for employees. It also improves productivity as the decision-making process is reduced. Data errors are extremely costly for any business, but the risk is far greater than just losing money (Roberts, 27 October 2019). That article concludes aside from exhausting your financial resources, poor data quality will negatively reflect on your brand credibility, productivity, and efficiency. Data needs to be very accurate and consistent as this dental business is sensitive. Customers might be having allergies or something else that will cause health problems if not stated clearly.

Lastly, the simplicity in the user interface makes life easier. No training required in order to operate the system. Therefore, a simple and clean design could make a lot of difference. Users should be able to complete the task successfully without any problem as the interface is user friendly with the simple and clean design.

1.3 Advantages and contributions

I. Cleaner and Simple User Interface for dentist and nurse

Put the complexity in the backend so it doesn't appear in the User Interface (Green, 26 October 2015). The proposed application system will provide a user-friendly interface for users. No user training is required in order to operate the system. The proposed application system will bring benefits such as reduced time wastage on training users to understand the application system. The interface will be simple and easy to locate where the function is. This will greatly enhance the experience of users and their satisfaction towards the system. As the article said "The user interface of apps is important because that is how people interact with your product to achieve their needs and goals. "(Eaton, 18 May 2018).

II. Easier appointment functionality

Instead of using paper to record patient's appointments made, nurses are allowed to key in the appointment into the system for further use. During making the appointment, nurses are allowed to check the availability of the time slot and inform patients for reschedule. The system is also able to inform users when the appointment is near.

III. Data is secured without losing accuracy and consistency.

The application system will provide more accurate and consistent data for the workflow. Users are able to view the same data with different devices. The data will be backed up to prevent data losses caused by natural disasters or other incidents. Businesses such as dental clinics heavily rely on data of patients. Therefore, data is very important to manage and preserve for the sake of dental clinics and patients. Data helps you understand and improve business processes so you can reduce wasted money and time (www.grow.com, MARCH 9, 2020). In this case, other than reducing wasted money and time, we should also aim to eliminate accidents like data inaccurate patient allergies.

IV Speed up the time for completing tasks.

Simple interface is very important for the dental clinic for productivity and efficiency. Speed is taking a heavy part in the business flow, speed equals to the satisfaction of the user. With the simplicity of interface, users are able to perform more swiftly and precisely on what they want. Users are able to memorize the functionality of the interface and are able to perform more efficiently due to the simplicity of the interface.

1.4 Project Plan

1.4.1 Project Scope

The project is given in figure 1.4.1.1

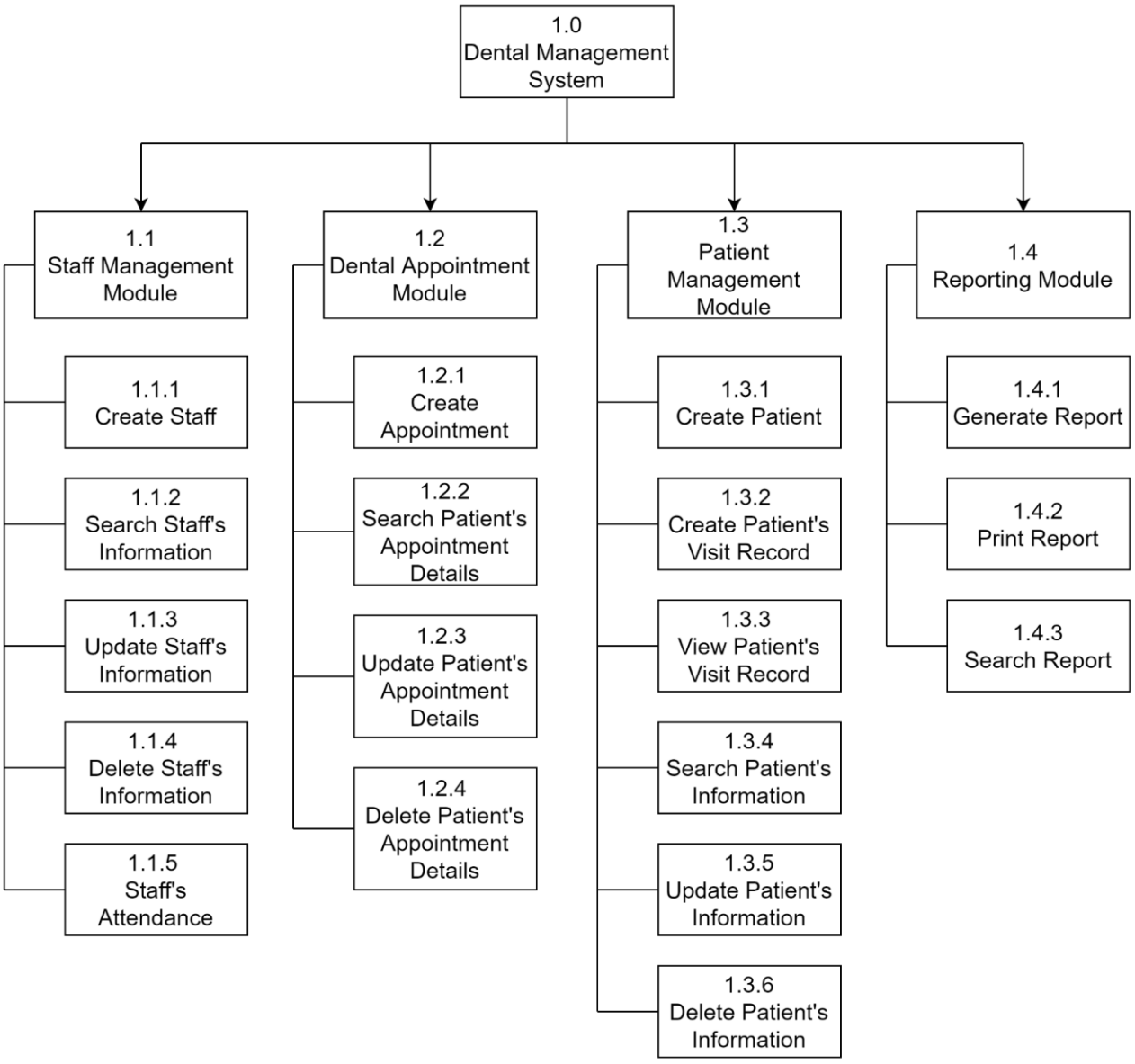


Figure 1.4.1.1 System Hierarchy Chart

1.4.2 Functional Requirement

1. **Staff Management Module**

    A. Create Staff

    Admin allows the creation of 2 types of staff such as Nurse and Dentist.

    B. Search Staff's Information

    Admin are allowed to search staff profile information such as address or contact information.

    C. Update Staff's Information

    Function such as changing staff address, contact information, and password.

    D. Delete Staff's Information

    Staff's information is allowed to be deleted in this sub module.

    E. Staff's Attendance

    Staff's attendance is able to record and review.

2. **Reporting Module**

    A. Generate report

    Reports can be generated through this sub module

    B. Print Report

    Reports can be printed through this sub module

    C. Search Report

    Users allow to search for the respective report

1.4.3 Non-Functional Requirement

1. Usability

   The system is made for easy to use, clean and simple interface which allows users to understand without extra training. It served as a user-friendly interface.

2. Availability

   The system can be installed in any device such as laptop, smart tablet , and even desktop.

3. Accuracy

   The system will produce accurate and consistent data across the system.

4. Recoverability

   Data is backed up in other locations to prevent data losses and allow us to perform data recovery.

1.5 Project Milestone

The Project Milestone is given in table 1.5.1.

Milestones	**Milestone Goals**	**Deadline**
Task Distribution	Title and task distributed among team member	28/2/2021
Chapter 1: Introduction	Determine the project scope for the project	29/3/2021
Chapter 2: Research Background	To investigate the research background of current project	12/4/2021
Chapter 3: Methodology and Requirement Analysis	Examine the requirement needed for the project	25/6/2021
Database Design	Rough database design for the system	28/6/2021
Chapter 4: System Design	To produce a design for the system	5/7/2021
Develop System	Start developing the system that is proposed earlier	7/7/2021
System Checking	Eliminates the error of the system	15/8/2021
System Preview	Presenting the system that is	27/8/2021

	developed	

Table 1.5.1 Project Milestone

1.6 Project Team and Organization

Project team and organization is given in table 1.6.1

System and Subsystem	Soon Yi Hong	Kelvin Lim Ding Qi
Staff Management Module		
Create Staff	X	
Search Staff's Information	X	
Update Staff's Information	X	
Delete Staff's Information	X	
Staff's Attendance	X	
Dental Appointment Module		
Create Appointment		X
Search Patient's Appointment Details		X
Update Patient's Appointment Details		X
Delete Patient's Appointment Details		X
Patient Management Module		
Create Patient		X
Create Patient's Visit Record		X
View Patient's Visit Record		X

Search Patient's Information		X
Update Patient's Information		X
Delete Patient's Information		X
Reporting Module		
Generate Report	X	
Print Report	X	
Search Report	X	

Table 1.6.1 Project team and organization

1.7 Chapter Summary & Evaluation

This chapter is focusing on the objective and problems of this project. that needs to be achieved. Problems are stated in the project background that need to be solved. Objectives are listed to be achieved in this chapter. Besides, each member ‘s individual scopes have been identified clearly. Project plan serves as a purpose for increasing the productivity and efficiency of the project proposed system. Dental Management System (DMS) is developing to improve the quality of life for the dentist and nurse. Therefore, when the system is developed it will solve the problem faced and achieve the objectives stated above.

Chapter 2

Literature Review

2 Literature Review

Dental Management System (DMS) is the spotlight of this literature review in this chapter. In this chapter, the things will be included are: The company background, project background, literature review, feasibility study.

2.1 Company Background

According to (TARUC, 2018), Tunku Abdul Rahman University College ('TAR UC') which was formerly known as Tunku Abdul Rahman College ('TAR C'), is a premier institution of higher learning in Malaysia that was established in 1969 by the Malaysian Chinese Association (MCA) to provide tertiary education opportunities as well as quality education for young Malaysians. The college started with a single campus in Setapak, Kuala Lumpur which is also known as the main campus of TAR UC. Subsequently, another 5 branches have been established in Penang, Perak, Johor, Pahang and Sabah. TAR UC offers programmes at pre-university, diploma, Bachelor's degree and postgraduate levels that are widely recognized by the academia and industries for their depth and breadth of scope and academic rigor. Today, TAR UC has a student population of about 28,000 including international students for more than 20 countries enrolling in more than 120 programmes over a wide range of disciplines from foundation and A Level to accountancy, finance, business, economics, engineering, built environment, applied sciences, ICT as well as mass communication, creative arts, social science and hospitality management. These programmes are conducted by 7 faculties and 1 centre namely Centre of Pre-University Studies, Faculty of Accountancy, Finance and Business (FOFB), Faculty of Applied Sciences (FOAS), Faculty of Computing and Information Technology (FOCS), Faculty of Engineering and Technology (FOET), Faculty of Built Environment (FOBE), Faculty of Communication and Creative Industries (FCCI) and Faculty of Social Science and Humanities (FSSH). In addition, there is also the Centre for Postgraduate Studies and Research that focuses on research. TAR UC Main Campus in Kuala Lumpur sits on a piece of 186-acre land and the main campus is an iconic landmark for its architectural feat in blending historical buildings with modern structures as well as the verdant greenery. Meanwhile, the branch campuses in Penang, Perak, Johor and Pahang are purpose-built, complete with state-of-the-art infrastructure and

facilities for learning and teaching. TARUC is one of the oldest institutions of higher learning in Malaysia with more than 190,000 students having passed through its doors.

The University College primarily targets students who have just finished their SPM, STPM, A-Level or Diploma, from other institutions or schools. A lot of teenagers as well as adults are facing oral and teeth problems such as pain in the gum area and decaying of teeth. Until now, there have been tons of students and teachers visiting the dental clinic of TAR UC due to their teeth condition and pain. System of the TAR UC dental clinic must change in order to gain competitive advantage as well as increase in the student population.

The current system used in managing the dental record and appointment record of patients is not computerized, but rather in a traditional way with writing everything on paper, which is very ineffective and inefficient due to delay in completing the tasks as well as information not secured enough. It has been carried out manually by writing every record and information through paper, which would waste a lot of resources and the time of the clinic staff, for arranging or rescheduling appointments, as well as recording every single important information and details about the process through paper.

2.2 Project Background

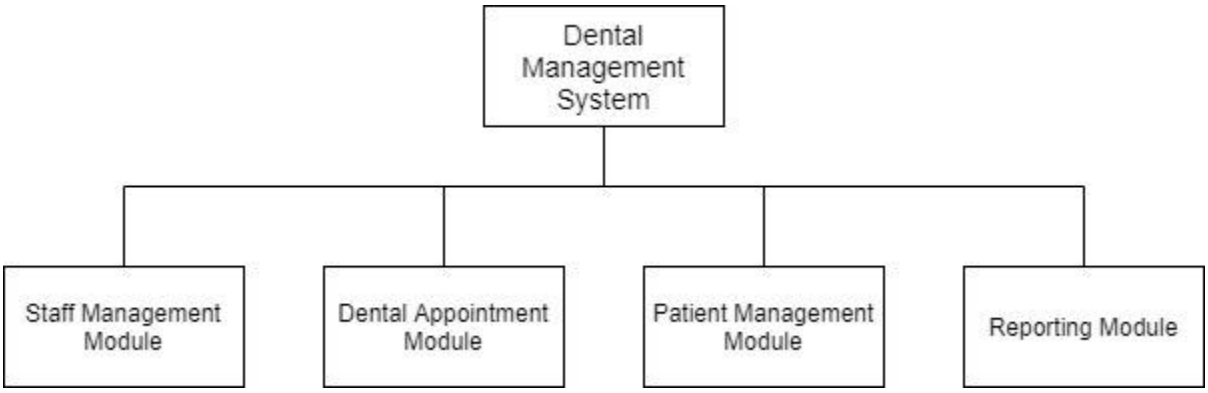


Figure 2.1 - Overall structure diagram for Dental Management System

In figure 2.1 the legacy of the dental management system exists in manual operation which is a traditional way, where the dental clinic staff records are all in paper.The respective staff will be required to find the records through paperwork for the purpose to manage the staff details. However, it would be difficult for the staff to achieve, because the staff details are all on paper and the attendance list will increase day by day which causes stacking in paper documents.. In fact, there might be multiple staff working the same shift and not only one staff member, which will lead to delay in finding all these documents one by one and performing records based on their attendance. It will be wasting a lot of time just by finding all these documents one by one as the attendance documents are not limited to one paper only. Moreover, if there is new staff, it might lead to using additional paper to record down their details. Sometimes it might be hard to keep track of these documents compared to using a computerized system, this would slow down the workflow and productivity of the dental clinic and might cause huge delays in completing the tasks. The legacy system has lesser error tolerance towards the important information or details that are wrongly recorded. They would be stressed out if any important paper documents went missing due to not having any backup and might be difficult to find it back since paper is easy to crush. This would increase their workload and might stress them out. Such as paper documents which record the staff's attendance is missing. Which will cause a lot of trouble when summing up the work time at the end of the month for the salary.

Implementation of the new system allows dental clinics to have their own system. With the new system, staff are able to record or make changes to the information or details more

efficiently and accurately. They would be able to manage these data easier since the system will help them to categorize it accordingly, as well as be able to back up these so that it would be able to be retrieved back if it went missing. Operations such as Create, Read,Update, Delete (CRUD) gives staff abilities to manage their details and information by means of electronic documents. Lastly, reports can be generated, view, or print which allow dentists to view back the reports or print out for other purposes.

2.3 Literature Review

Most of the business sectors are all adapting into the implementation of information technology to survive in the highly competitive market due to the evolving of information technology in this era. Accurate and real time information, better decision making which is brought by information technology will lead to efficiency and productivity increased. Information which is related to privacy information will be more secure and prevent information leaked to publicity by adapting Information technology. Currently, dental clinics use the old system in managing information and details which are all manually written down on paper. Paper documents which contain privacy might be lost if there is any natural disaster or human behavior. Database which is brought by implementing a dental management system able to secure all the privacy information and other data of the dental clinic safely. Database which is organized and easy to viewback all the information and data without any hassle, and it is real time and accurate.

Compared to using the previous system, the new system aimed to improve the speed and reduce the amount of workload and paperwork. Human error which is unavoidable during the process of recording down every detail and information into paper documents. This will cause data not to be accurate and hard to trace back the information needed. Paper documents do not have any back up, if the document is lost it will be a big trouble to the staff and business flow. One of the reasons that paper documents are not efficient is that everyone has different writing styles, other staff might spend some time to understand what information is written down because of ugly writings.

By implementing the new dental management system, most of the problems that have been stated above will be solved, as well as assisting the staff in managing information and records well such as managing staff and patient details, arranging appointment schedules and managing reports. The dental clinic staff will be benefited when the amount of paperwork is reduced to lowest, errors could be fixed efficiently with the new system implemented. System will be more productive and efficient with the elimination of extra steps and time taken to complete the appointments, reports, and details of patients and staff. Improvement will be expected and

abilities to attract more customers, improve the satisfaction of current customers of our dental clinic with the new system.

Management Information System (MIS) involves processes, people and technology in an organizational context. The ultimate goal of the use of Management Information System (MIS) is to increase the value and profits of the business (Wikipedia, 2003). Management Information System (MIS) is the most suitable computerized system for our dental clinic to help benefit our dental clinic in terms of efficiency and accuracy of data. The figure below is the basic model of Management Information System (MIS).

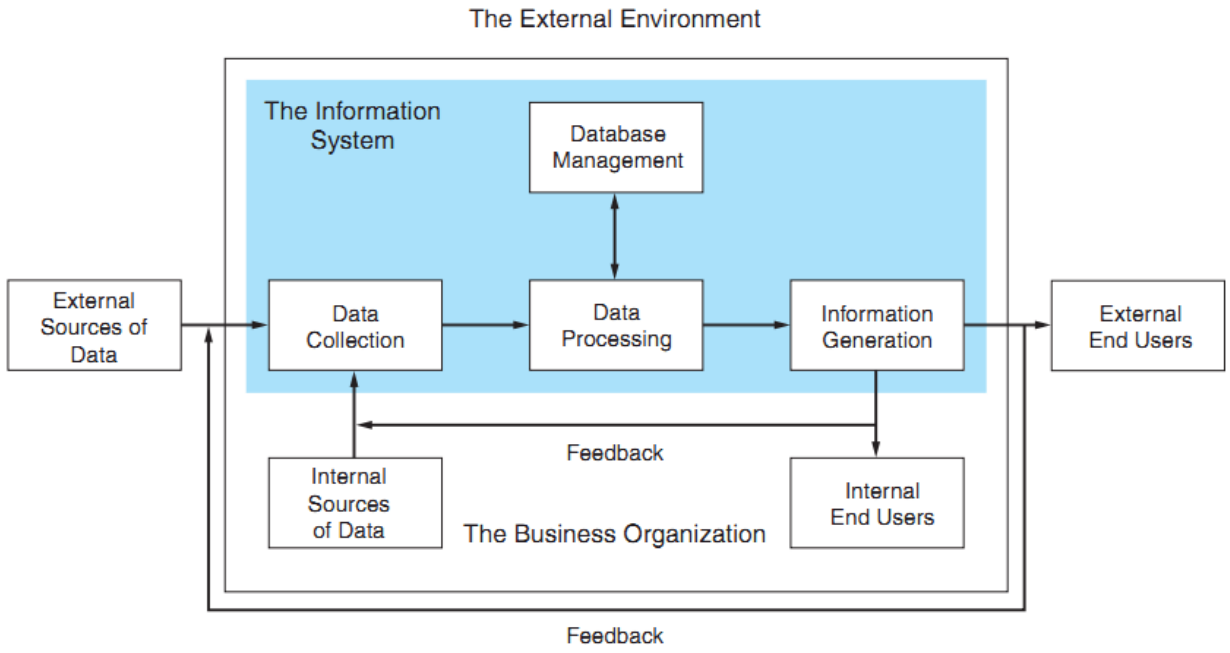


Figure 2.2 (The Model of MIS)

2.4 Feasibility Study

2.4.1 Economic Feasibility

The Dental Management System (DMS) will be designed and developed based on the existing hardware, which would require no cost for buying and installing the Dental Management System (DMS). New hardware or software is not required to develop the Dental Management System. Therefore, it is economically feasible for this project.

2.4.2 Operational Feasibility

The Dental Management System (DMS) is implemented to aid the dental staff in managing the various data that is used in business, as well as allowing the staff to access the system at any time and anytime for the function stated above. Staff only required an internet connection and devices such as smartphones, tablets or computers to operate the system. Recognition is required before being able to make any changes of the data through the system. After recognition has been confirmed, they will then be allowed to make any changes required. Appointments could be created or modified by the user with the aid of the system, as well as be able to view and modify the details of their patients or staff immediately. This would help the users to save their time and increase efficiency where they do not have to wait till the next day to make any changes because of a little forgetfulness mistake.

Moreover, human error is minimized, and data is secured, protected from natural disaster with the help of Dental Management System (DMS). Personnel cost will be reduced as staff are not required to work overtime and managing the information is easier when the Dental Management System is implemented. The GUI of the new system (DMS) will be user-friendly and easy to understand how the system operates without any training. Therefore, in the long run, the project is operationally feasible.

Last but not least, the developer will be developing the system with the help of computer as well as including Microsoft Visual Studio, ASP.net and Azure SQL.

2.4.3 Technical Feasibility

For the technical aspect, the Dental Management System (DMS) will be designed through ASP.net, and the software that has been chosen that will be used is Microsoft Visual Studio. Azure SQL is used to store and retrieve the important data for the whole process. Computers and laptops are the hardware that will be used in developing the DMS system. Desktop and laptop are able to access the system without any hassle.

Development Tools and Minimum Requirements	
Hardware	Software
Desktop/Laptop ● Windows 7 and above ● Minimum of 2GB RAM ● Able to have Internet Connection ● Storage space of 4GB available	● Microsoft Visual Studio ● MySQL (Database)

2.5 Chapter Summary and Evaluation

This chapter provided a description of the organization background as well as the project background. The use of Management Information System (MIS) has been discussed, as well as the importance of implementation of information technology into the business sector. For the organization background, the history and any information regarding the organization has been clearly stated above. Moreover, the project background has been stated clearly as what the existing operation is and what is needed to help improve the operation of the entire dental clinic.

Furthermore, in the literature review above, the disadvantages of continued use of the existing system and the problems faced in the existing system have been stated clearly. The solution for this has been stated above and why it is a must to have a change for the way the dental clinic is operating. Besides, the economic feasibility, operational feasibility and technical feasibility have been stated above as well. In the economic feasibility, the procurement of a new system is suggested as well as the cost for designing, developing and implementing the new system have been stated. In operational feasibility, the benefits of implementing the Dental Management System and procedure of how to use the system has been studied and stated above. For instance, reduce the amount of workload and paperwork, reduce human effort, higher accuracy of data, etc. In technical feasibility, the development team has chosen the software and hardware that they will be using, together with the project supervisor in guiding and helping with the perspective of users. The development tools and minimum requirements of hardware have been stated clearly as well.

Lastly, the project should be able to carry out smoothly as the research of the system has been done thoroughly, and with the cooperation between the development team as well as the project manager.

Chapter 3

System Design

3 Methodology and Requirements Analysis

Methodology, project scope, development and operational environment, functional and non-functional requirements will be discussed through this chapter.

3.1 Methodology

In this project, the current Dental Management System is facing a problem which is not computerized and requires a lot of manpower in order to complete the tasks. When it comes to manpower, a system which is not computerized will drag down the efficiency, and accuracy of users when completing the tasks. Computerized system is definitely required so that the entire process will be smoothen and polished.

Waterfall model is chosen to be applied into the system because the six steps that the waterfall model implements are suitable for the development (Refer to figure 3.1). The six steps are Requirement, Analysis, Design, Coding, Testing, and Implementation. Due to the inherent linear structure of a waterfall project, it is well-suited for teams that work well under a milestone- and date-focused paradigm (Airbrake, December 8, 2016). Besides, waterfall methodology works well for smaller projects where requirements are very well understood. Milestone of our project is also clearly stated. Therefore, a waterfall model is chosen in this project development process.

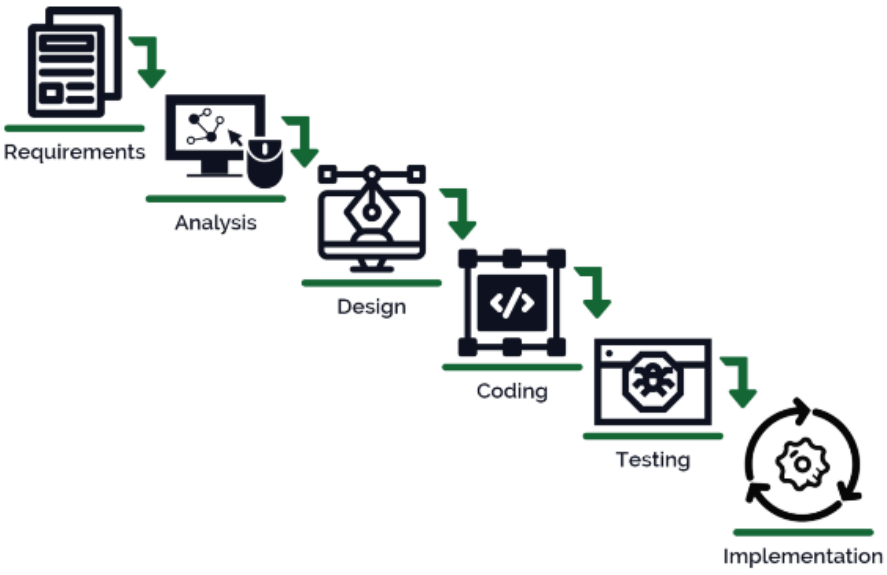


Figure 3.1 The process of waterfall model methodology (ZULQADAR, FEB 12, 2019)

3.1.1 Fact Gathering

In this project, the first fact gathering techniques used are interviews. Interview able to let programmers obtain user's thoughts and feelings towards the current system. Useful information obtained from users able to apply into the new system and improvement will be expected. As we all know, users are the one who operate the system. Therefore, the user's opinion is the most important thing when it comes to improvement. Besides, interviews are designed to collect a richer source of information from a small number of people such as Preferences, Opinions, and Knowledge (Tech, Sep 21, 2018). Article also mentioned that interviews help to explain, better understand, and explore research subjects' opinions, behavior, experiences, phenomenon, etc. Few open-ended questions are prepared to obtain more feedback from users. As currently the world is facing a serious pandemic which is Covid-19. To follow the rules and regulations set by the government in MCO we decided to use online interviews to prevent any close contact during the interview session. With the online interview session, developers are able to obtain useful information from users without violating the rules of MCO. This will reduce the chance of getting Covid-19 for both interviewer and Interviewee.

Secondly, literature review is used as the fact gathering method for the project. Literature review is performed on a similar system. With literature review, it will help us to justify our methodology. Organizations such as Plato are chosen which offer a Clinic Management System as a solution which is similar to our project Dental Management System. It is selected to serve as a purpose such as source and example for our project. By studying what Plato company offers, a better understanding of their solutions that we are able to acquire to improve our project. Module and interface is taken from their offered solution for the purpose of referencing. By using literature review on similar systems, we are able to obtain various techniques and ways that a system is developed. Proposed system is deemed better and polished compared to the current system that dental use.

3.1.2 Fact Recording

I. Use Case Diagram

Relationships between use cases, actors, and systems are shown in a use case diagram. Meanwhile in this project, the relationship between actors that are involved in the Dental Management System is shown. Use case diagram able to clearly state where users interact with the system. Besides, requirement of a system able to be captured through a use case diagram. By using use case diagrams, relationships or interactions between users and systems are able to be visually shown.

II. Activity Diagram

A flow chart that indicates the flow of activity to activity is called activity diagram. Modeling how a collection of use cases coordinates to represent business workflows can be achieved by using activity diagrams. In this project, activity diagrams are able to show us how activities are coordinated to provide a service which can be at different levels of abstraction. With the presence of activity diagrams, developers in this project are allowed to have a clear understanding of workflow which consist of activity to activity.

3.2 Requirements Analysis

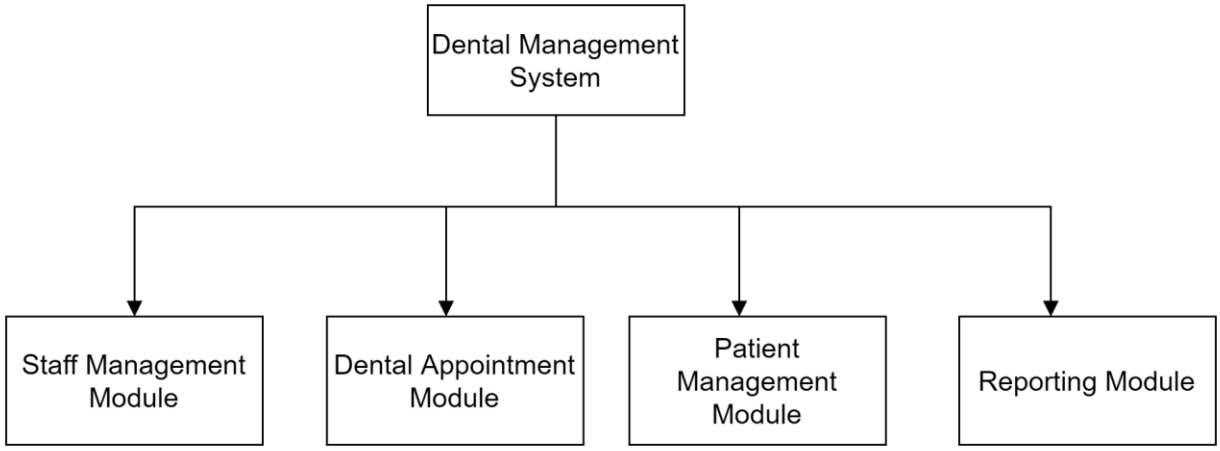


Figure 3.2 Overview of Dental Management System

3.2.1 Project Scope

Staff Management Module	This module allows Admin to manage the staff department by performing tasks such as create, search, update, delete staff information. Besides, Admin is also allowed to manage the staff's attendance.
Reporting Module	This module allows users to search reports, view or print reports. Reports can be searched by criteria such as date categorized by module. Besides, reports can be saved as a pdf file.

3.2.2 Development Environment

During the project development, software tools and hardware used are all listed as below:

1. Microsoft Visual Studio

   Microsoft Visual Studio is an Integrated Development Environment (IDE) offered by Microsoft. In this project, it allowed developers to develop Dental Management Systems. Language that is used in this project is also supported by Microsoft Visual Studio such as VB.NET or even C#. Besides, there is a version of Visual Studio which is Microsoft Visual Studio Community which is an open-source software.

2. MySQL

   An open-source software developed by a famous company which is Oracle Corporation. MySQL is a relational database management system and based on structured query language in short SQL. It can serve as a purpose of database management in this project. Which is able to store every data and manage them in real-time.

3. Programming Language

   - HTML 5
   - SQL
   - VB.NET

4. Draw.io

   Draw.io is a solution offered to developers to use drag-and-drop functionality to create diagrams. Diagrams used in this project such as UML class diagram and Entity Relationship Diagram can be created in Draw.io. It offers users the choice of web-base or download as software. Draw.io also enables users to add toggle layers with customizable

URLs and align texts within the shapes. The most convenient part is the diagram created in Draw.io can be downloaded or directly copied as an image and pasted in documents.

5. Office 365

   Consist of Microsoft Word which is a software that is used in this project. It provides various powerful features to make our project's documents look more professional. Due to the good user interface design, it is easy to understand and operate without any training. Document can be trimmed and beautified with the help of Microsoft Word.

6. Operating system: Microsoft Windows 10

7. Hardware

   - Processor: Intel i7 x64 Processor
   - Memory: 16GB DDR4 2666MHz RAM
   - HDD: 1TB 5400rpm

3.2.3 Operation Environment

Development Tools and Minimum Requirements	
Hardware	Software
Desktop/Laptop ● Windows 7 and above ● Minimum of 2GB RAM ● Able to have Internet Connection. ● Storage space of 4GB available	● Microsoft Visual Studio ● MySQL (Database)

3.2.4 Non-functional Requirement

1. Usability

   The Dental Management System should be easy to use and without going into any extra training. Users should be able to operate the system without any hassle and the system only allows users with the correct credentials to login. Credentials should be applied to the account when admin creates the account for users. By registering, credentials of the account would be compared with the system database. With the help of a database, the system should reject all other users which do not have a correct identification or authorities.

2. Availability

   Dental Management System should be available to the users 24/7. The system can be installed in any device such as laptop, smart tablet, and even desktop. Therefore, users are able to access the system fairly easily and the availability of the system is greatly enhanced. Appointment can be viewed by users without any place restrictions or time restrictions. Because of that, users of the system are able to wisely arrange appointments without causing any inconvenience.

3. Accuracy

   The system will produce accurate and consistent data across the system. Dental Management System involves many important functions such as appointment. Therefore, the system should be below 1% error rated in terms of system reliability. Examples of appointment functions should be accurate and consistent when users use them. Because the appointment modules are related not only to the user, but also to the dentist and customer of the dental clinics.

4. Recoverability

   Data is backed up in other locations to prevent data losses and allow us to perform data recovery. Due to the characteristics of dental clinics, information and data is very important and should be kept safe and able to be backed up. Patients' details could be

very crucial as the information should keep record of the patient's allergy to any substances or medicine. In the Dental Management System, this data is very important because it is related to the customer's safety and health.

3.2.5 Functional Requirement

1. **Staff Management Module**

   A. Create Staff

   In the Dental Management System, admin allows to create 2 types of accounts such as Nurse and Dentist. With the success of creating an account, future users would be able to login into the system with the required information such as email and password.

   B. Search Staff's Information

   Staff information, details can be searched with the criteria provided by users. Such as name, or staff's age. Information should be shown to the users when they provide the match or similar information. If not, the system will show empty results instead.

   C. Update Staff's Information

   Staff information such as address, contact number can be updated by users. Information that is incorrect can be modified and updated in this module. Users are able to fix the incorrect information provided into the system previously.

   D. Delete Staff's Information

   The system will provide users the ability to remove the staff's information. Staff that retire or resign, their information will be removed from the system with which the users operate.

E. Staff's Attendance

The system can keep track of staff's attendance and allows users to view the attendance details. Staff's attendance is able to record and review in the system.

2. Reporting Module

A. Generate report

Reports can be generated through this module. The system is able to retrieve the data needed from the database and generate reports for the users.

B. Print Report

Reports can be printed through this module. The system has the ability to print out the reports once the report is generated by the system.

C. Search Report

Users are allowed to search through the report with the help of the system. Criteria should be provided by the user or else there will be no result shown during the search process.

3.2.6 Use Case Diagram

The use case diagram for the Staff Management Module is shown in Figure 3.3 while the use case description of each use case is shown in Table 3.1, 3.2, 3.3, 3.4.

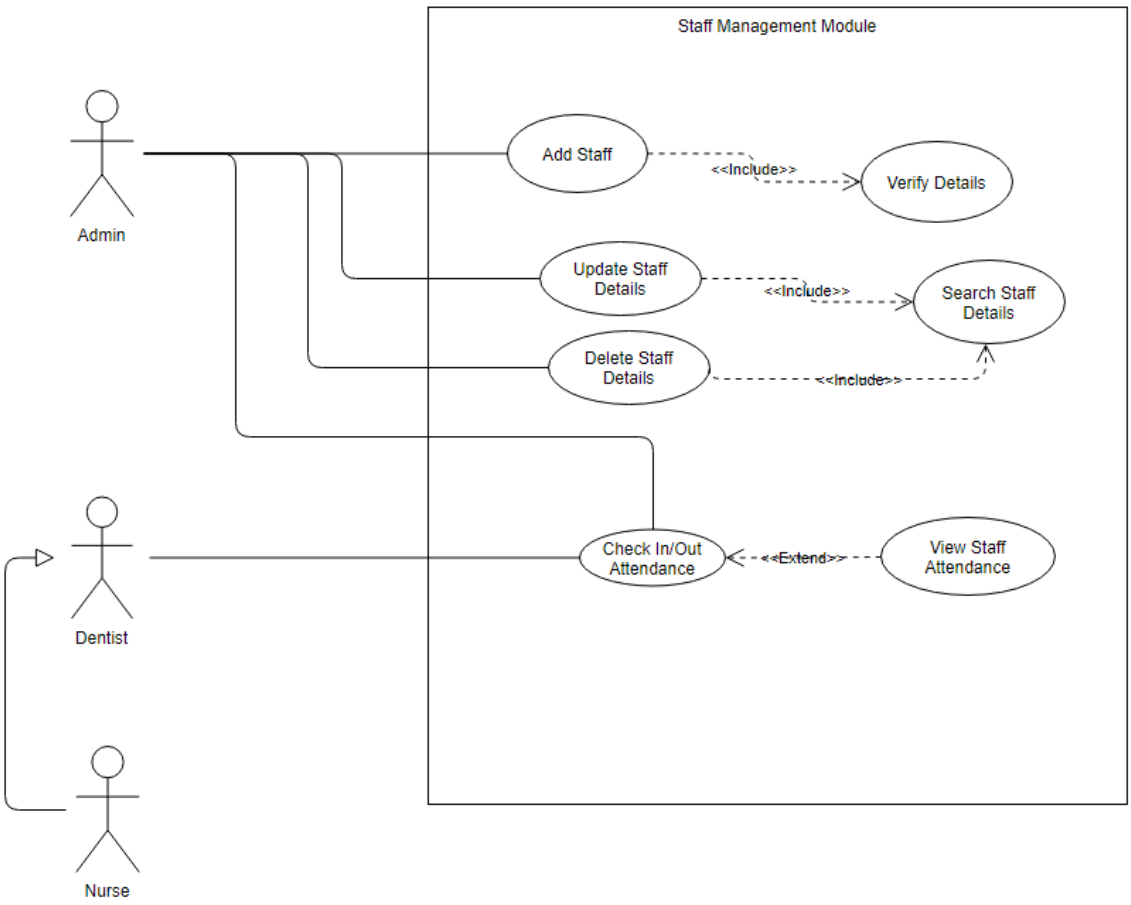


Figure 3.3 Use Case Diagram for Staff Management Module

Use Case	Add Staff
Brief Description	This use case allows the admin to add new staff into the system.
Actor	Admin
Precondition	Valid Admin credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instruction and request for

	account type.
2. Select account type.	3. Display field required for selected account type.
4. Enter details into the field required.	5. Validate details provided by the user.
	6. Details validated and displayed a successful message.
Alternative Flow	A1.Step 5 : Incorrect details provided by the user. A1.Step 6 : Display an unsuccessful message, system brings user back to step 4.
Post-Condition	System update account details into database.

Table 3.1 Use Case Description for Add Staff

Use Case	Update Staff Details
Brief Description	This use case allows the admin to update existing staff details.
Actor	Admin
Precondition	Valid Admin credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instructions and request for staff name .
2. Enter Staff name.	3. Validate staff name with database and request for new staff details.
4. Enter new staff details.	5. Validate new staff details.
	6. New staff details are validated and display a successful message.
Alternative Flow	A1.Step 3 : Staff name not found in database.

	A1.Step 4: Display unsuccessful message and bring the user back to step 2. A2.Step 5 : Incorrect details provided by the user. A2.Step 6 : Display an unsuccessful message, system brings user back to step 4.
Post-Condition	System update new staff details into database.

Table 3.2 Use Case Description for Update Staff Details

Use Case	Delete Staff Details
Brief Description	This use case allows the admin to delete existing staff details.
Actor	Admin
Precondition	Valid Admin credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instructions and request for staff name .
2. Enter Staff name.	3. Validate staff name with database and display confirmation message.
4. Provide confirmation	5. If confirm, display deleted successfully message
Alternative Flow	A1.Step 3 : Staff name not found in database. A1.Step 4: Display unsuccessful message and brings user back to step 2 A2.Step 5 : If not confirm, cancel the process
Post-Condition	System delete staff details from database.

Table 3.3 Use Case Description for Delete Staff Details

Use Case	Check In/Out attendance
Brief Description	This use case allows the actors to Check In/Out attendance
Actor	Admin, Dentist, Nurse
Precondition	Valid credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instructions and request for action.
2. Provide action.	3. If action is check in/out, request identification.
4. Provide identification	5. Validate Identification with database.
	6. Identification validated, display successfully check in/out message.
Alternative Flow	A1.Step 3: If action is to view attendance, display staff attendance. A2.Step 6 : Identification incorrect, display unsuccessful message, return to step 4.
Post-Condition	System update staff attendance into database.

Table 3.4 Use Case Description for Check In/Out attendance

Figure 3.4 shows the use case diagram of the Reporting Module. The use case description of each use case is shown in Table 3.5, 3.6.

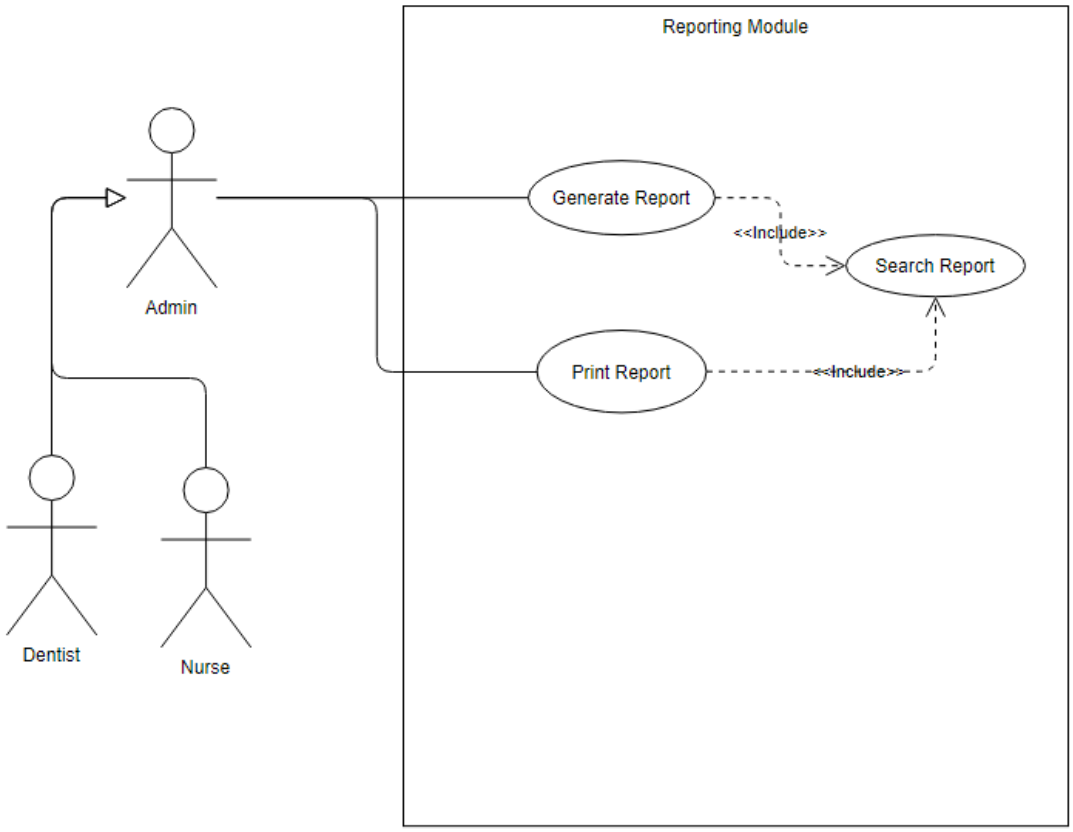


Figure 3.4 Use Case Diagram for Reporting Module

Use Case	Generate Report
Brief Description	This use case allows the actors to generate report
Actor	Admin, Dentist, Nurse
Precondition	Valid credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instruction and request report category

2. Select report category.	3. Request for date.
4. Choose date	5. Display report preview and request for confirmation.
6. Provide confirmation	7. If confirmed, generate a report.
Alternative Flow	A1.Step 7 : If not confirmed, cancel the process.
Post-Condition	System generates reports and stores them into a database.

Table 3.5 Use Case Description for Generate Report

Use Case	Print Report
Brief Description	This use case allows the actors to print report
Actor	Admin, Dentist, Nurse
Precondition	Valid credentials and identity
Main Flow of Event	
Actor Action	**System Response**
	1. Display instruction and request report category
2. Select report category.	3. Display available report
4. Choose Report	5. Display report preview and request for confirmation.
6. Provide confirmation	7. If confirmed, print a report.
Alternative Flow	A1.Step 7 : If not confirmed, cancel the process.
Post-Condition	System print report.

Table 3.6 Use Case Description for Print Report

3.3 Chapter Summary and Evaluation

In fact, during the preparation of this chapter we are facing difficulties choosing the suitable methodology. During the discussion with my team member, we both came to the conclusion that in this project we will use the Waterfall methodology. With that saying, we choose waterfall methodology in our project because it fits better compared to the other methodology. With the characteristics of a streamline waterfall, it is best for small unchanging projects which definitely describe our project. This chapter defines requirements, including functional, non- functional. Thus, we are able to proceed to the next step which is System Design since the requirement is clearly defined.

Chapter 4

System Design

4 System Design

This chapter shows the detailed design of the Dental Management System with the help of diagrams and design.

4.1 Data Design

4.1.1 Class Diagram

The Class Diagram below shows the system's classes, attributes, functions and the relationship between the objects.
Figure 4.1 shows the class diagram of the Dental Management system

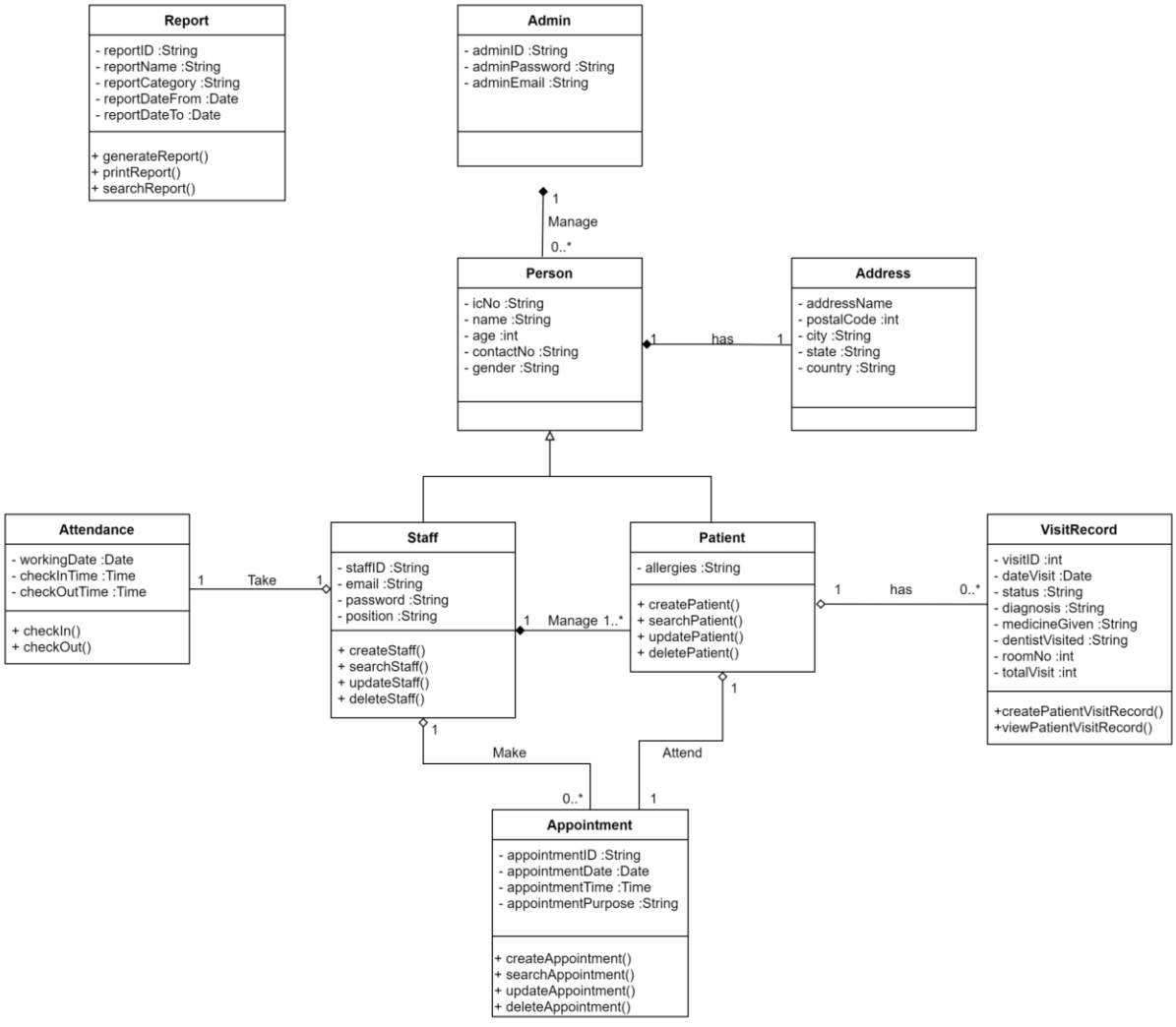


Figure 4.1 Class Diagram for Dental Management System

4.1.2 Entity Relationship Diagram (ERD)

The entity relationship diagram in Figure 4.2 graphically shows Dental Management System's entities and the relationships between the entities.

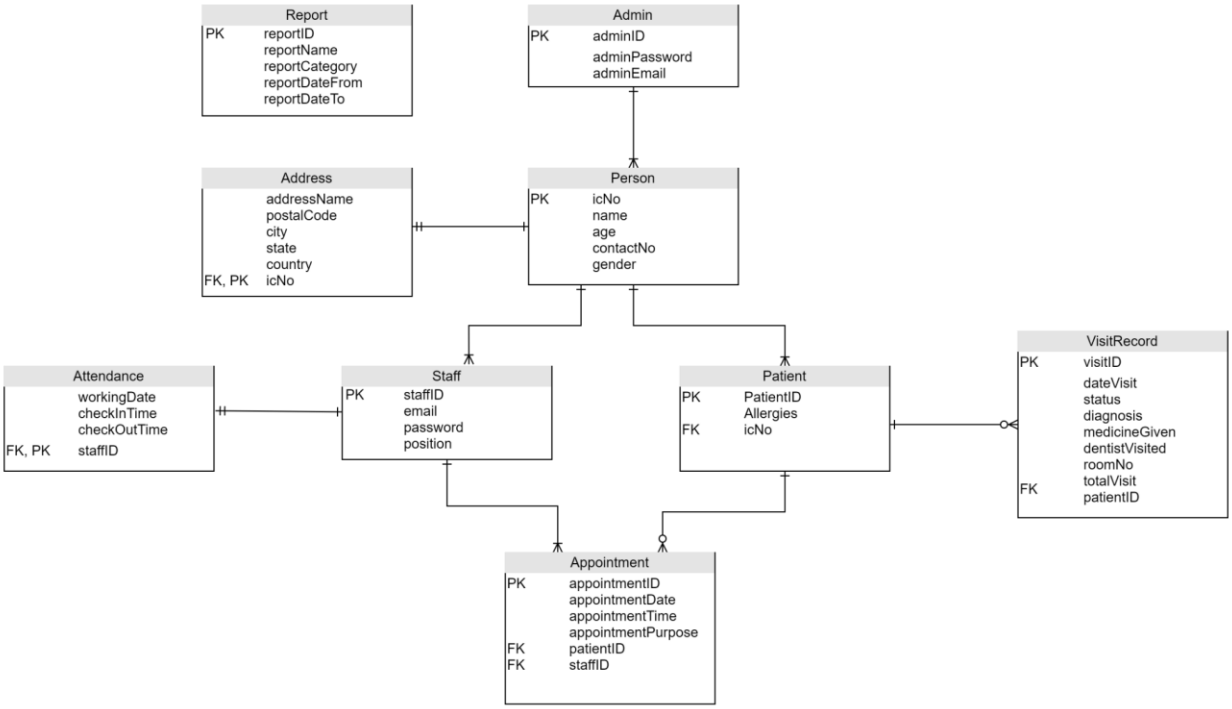


Figure 4.2 Entity Relationship Diagram (ERD) for Dental Management System

4.1.3 Data Dictionary

Table below shows the data dictionary used in the Dental Management System. The entities included Report, Admin, Address, Person, Attendance, Staff, Patient, VisitRecord, Appointment.

Entity Name	Attributes	Data Type	Description
Report	reportID (PK)	Varchar(10)	Unique ID for Report, auto increment
	reportName	Varchar(100)	Name of report. Eg. May 2020 Attendance Report.
	reportCategory	Varchar(50)	Report category. Eg. Attendance

	reportDateFrom	Date	Date range from.
	reportDateTo	Date	Date range to.

Entity Name	Attributes	Data Type	Description
Admin	adminID	Varchar(10)	Unique ID for Report, auto increment
	adminPassword	Varchar(50)	Password of admin.
	adminEmail	Varchar(100)	Email of admin.

Entity Name	Attributes	Data Type	Description
Address	addressName	Varchar(100)	Address name.
	postalCode	integer	Postal Code of address.
	city	Varchar(50)	City of address.
	state	Varchar(50)	State of address.
	country	Varchar(50)	Country of address.

Entity Name	Attributes	Data Type	Description
Person	icNo	integer	Identification Card Number
	name	Varchar(100)	Person’s name
	age	integer	Person’s age
	contactNo	integer	Person’s contact No Eg. +60(**177777777**)

	gender	Varchar(50)	Person's gender

Entity Name	Attributes	Data Type	Description
Attendance	workingDate	Date	Date of working
	checkInTime	Time	Time of check in
	checkOutTime	Time	Time of check out

Entity Name	Attributes	Data Type	Description
Staff	staffID	Varchar(10)	Unique ID for Report, auto increment
	email	Varchar(100)	Staff's email
	password	Varchar(50)	Staff's password
	position	Varchar(50)	Staff's position Eg. Dentist

Entity Name	Attributes	Data Type	Description
Patient	allergies	Varchar(100)	Patient's allergies

Entity Name	Attributes	Data Type	Description
VisitRecord	visitID	Varchar(10)	Unique ID for Report, auto increment
	dateVisit	Date	Date that patient visited.
	status	Varchar(50)	Status of the visit
	diagnosis	Varchar(100)	Diagnosis of patient

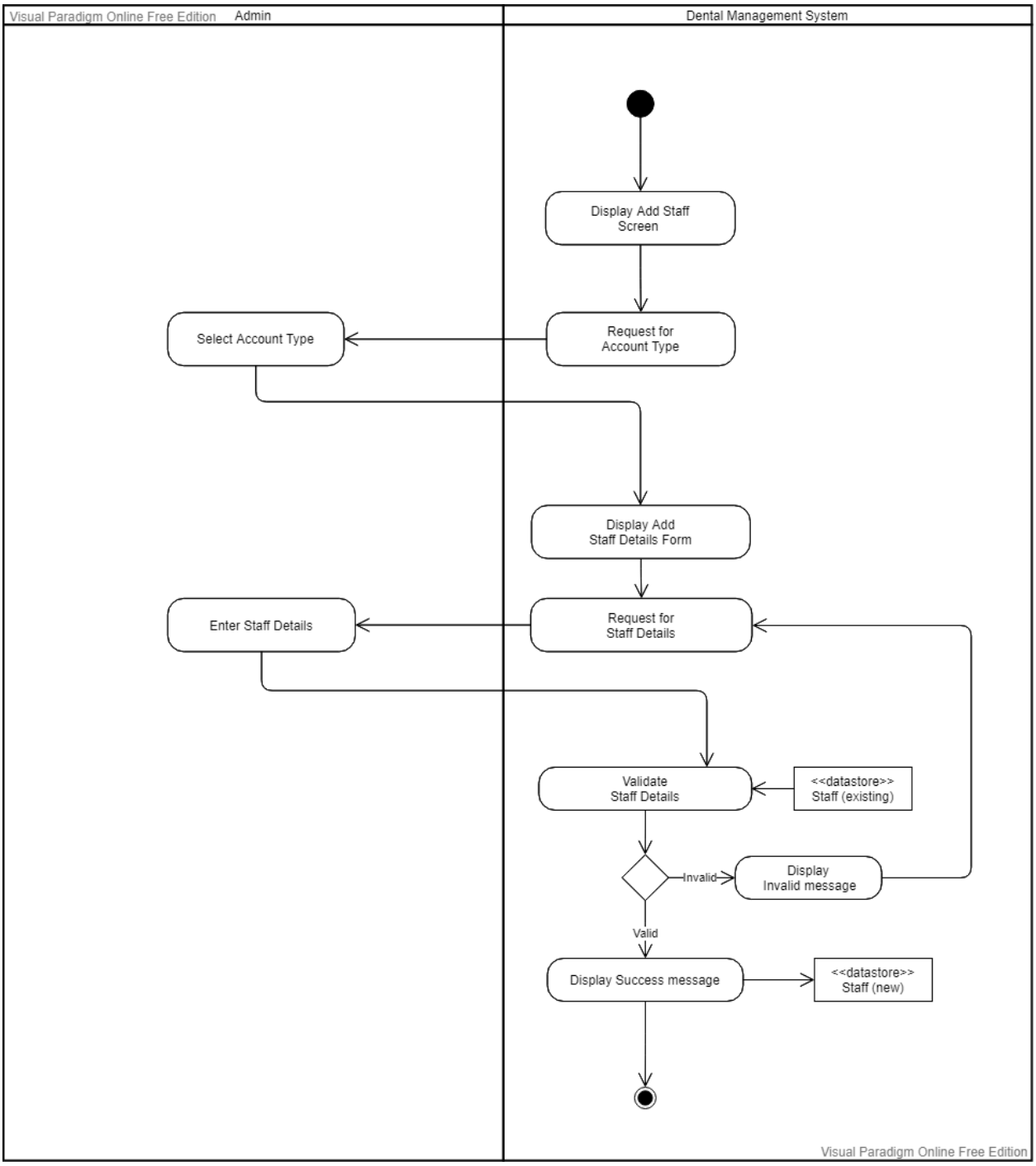
	medicineGiven	Varchar(100)	Patient's medicine
	dentistVisited	Varchar(100)	Dentist related
	roomNo	integer	Room number

Entity Name	**Attributes**	**Data Type**	**Description**
Appointment	appointmentID	Varchar(10)	Unique ID for Report, auto increment
	appointmentDate	Date	Date appointment made
	appointmentTime	Time	Time appointment made
	appointmentPurpose	Varchar(100)	Purpose of appointment

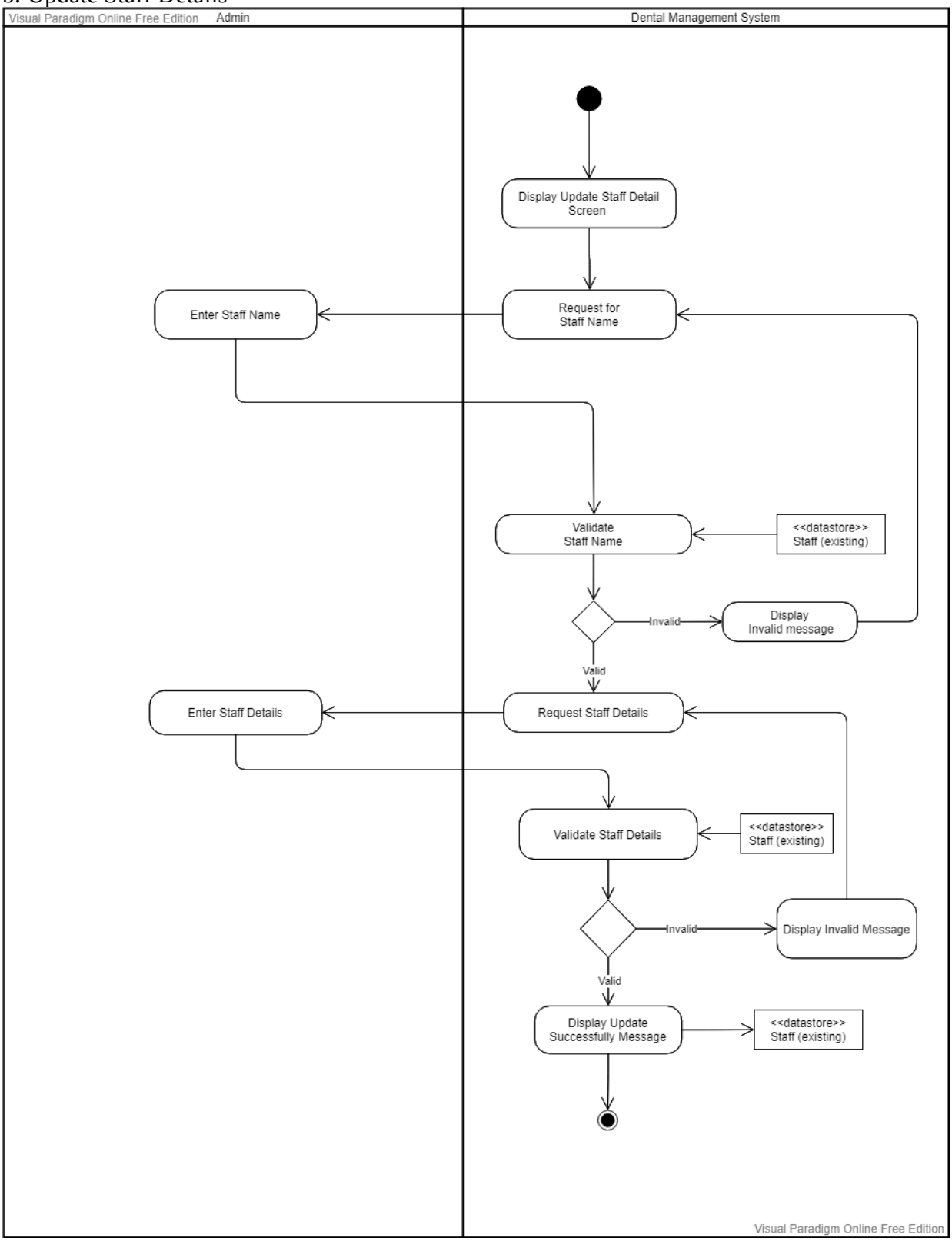
4.2 Process Design

4.2.1 Activity Diagram

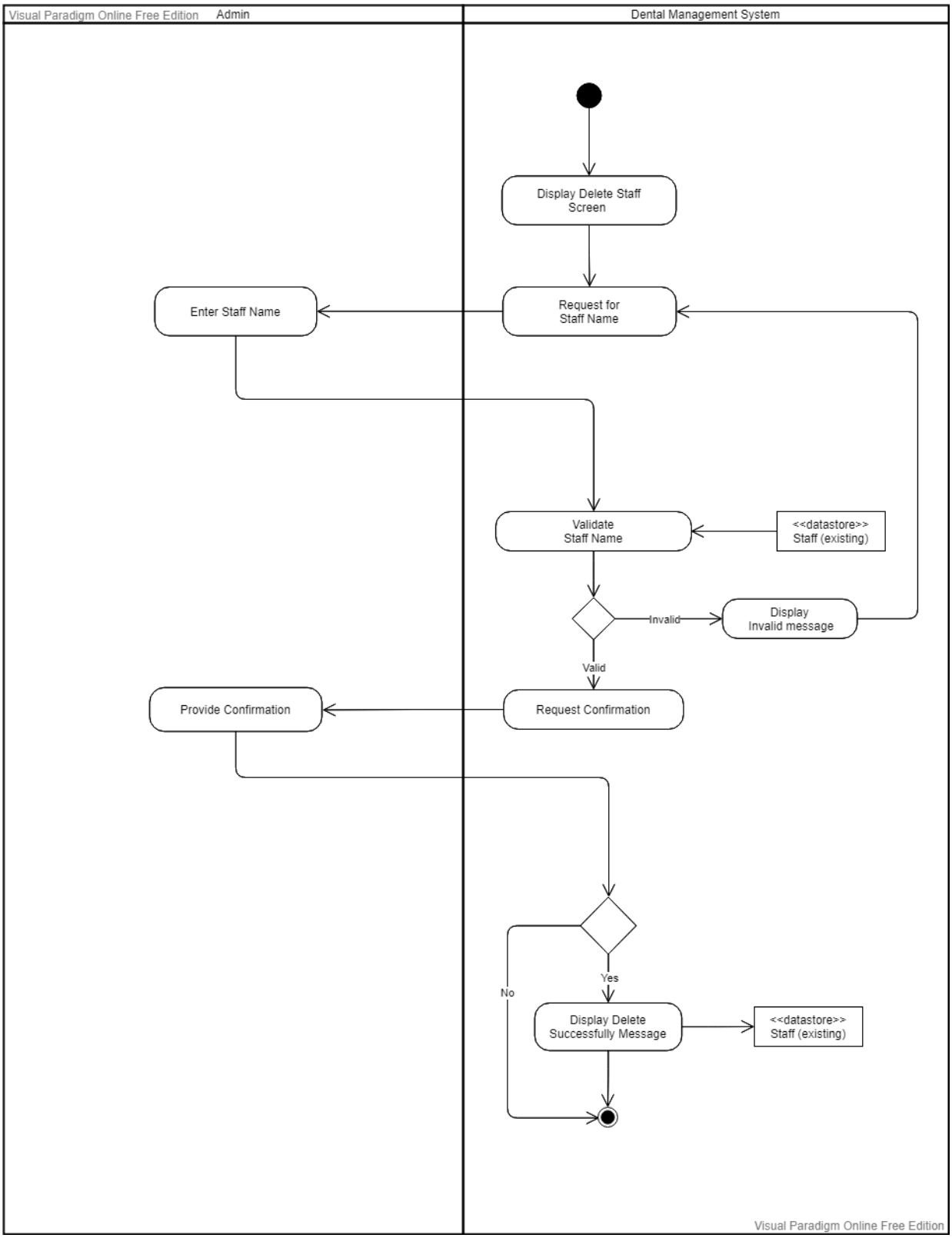
a. Add Staff - Staff Details



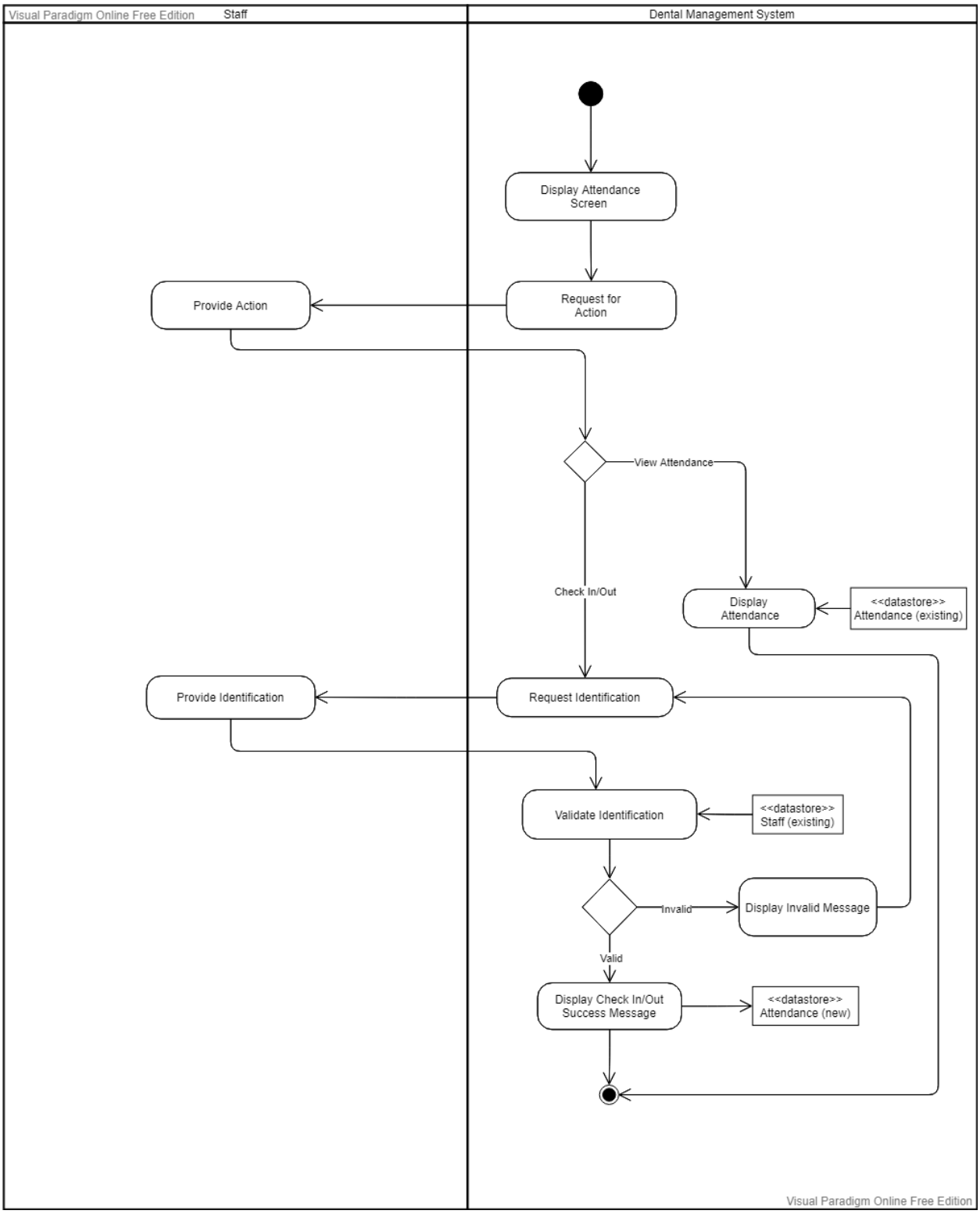
b. Update Staff Details



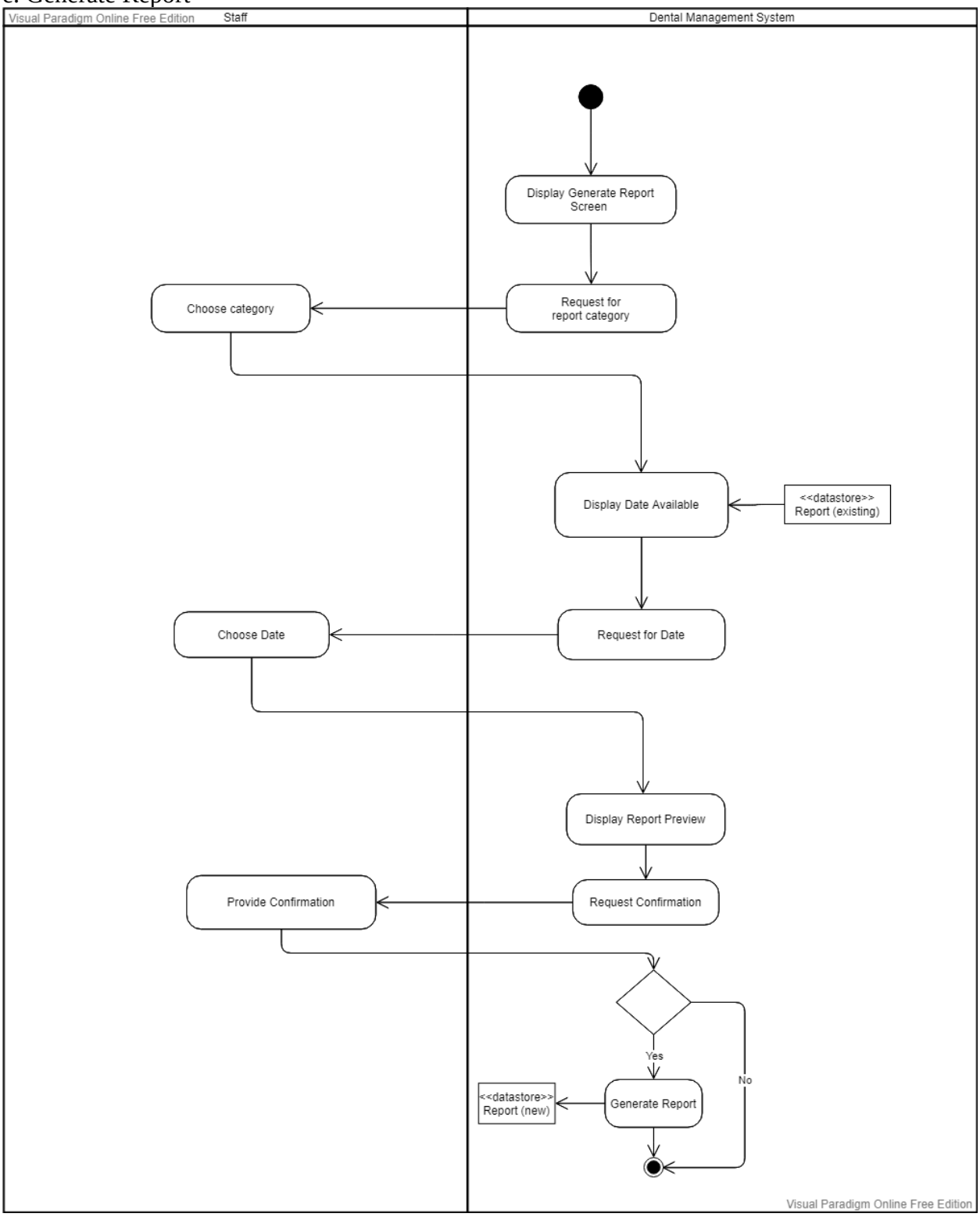
c. Delete Staff Details



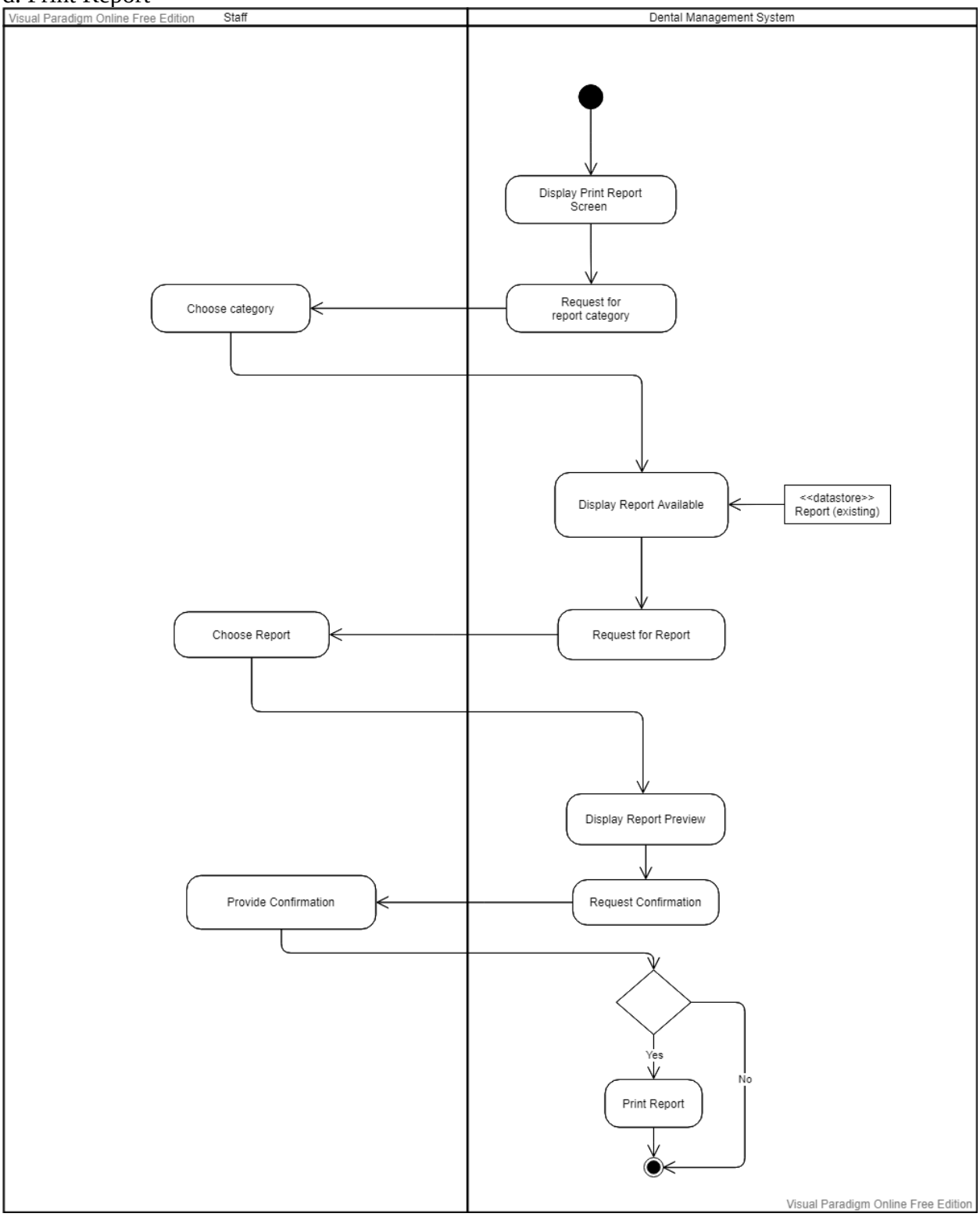
d. Staff's Attendance - Check In/Out/View



e. Generate Report



d. Print Report



4.3 Security Design

1. Login.

   Login UI shows the username and password field. Users can login with email and password. The password length is fixed at minimum 8 characters and requires an upper case character and a special character. Input mask is implemented when users typing in the password field, instead of showing the password typed, the character will become "**********" to prevent the user's password being exposed. The username is the user's email and the default password will be the user's identification card number. Password change is available after the account is created. A valid credential and identification is a must for accessing the system.

2. Password Recovery

   Password Recovery functions are implemented to help users recover their forgotten password. Users can access the function by clicking the hyperlink at the bottom of the form in the login page. The "Forgot password" hyperlink is blue in color and underlined to help users recognize it as a clickable word. Users will be redirected to the page after they click on the hyperlink. Necessary fields and valid information required users to fill in, in order to let the system send a confirmation email to the user mailbox. Password recovery tasks can only continue if users click on the confirmation emails on their mailbox.

3. Admin Role

   Admin role has the ability to create staff accounts or delete them. With the mention of the ability to create and delete. The staff account role which is dentist and nurses are prohibited to access the module. Only admin can access the page in order to prevent the staff accessing the page outside their power. In the future plans, new modules which allow respective roles users to access, therefore having an administrator role will help to limit and control the roles privileges of accessing their respective module.

4.4 User Interface Design

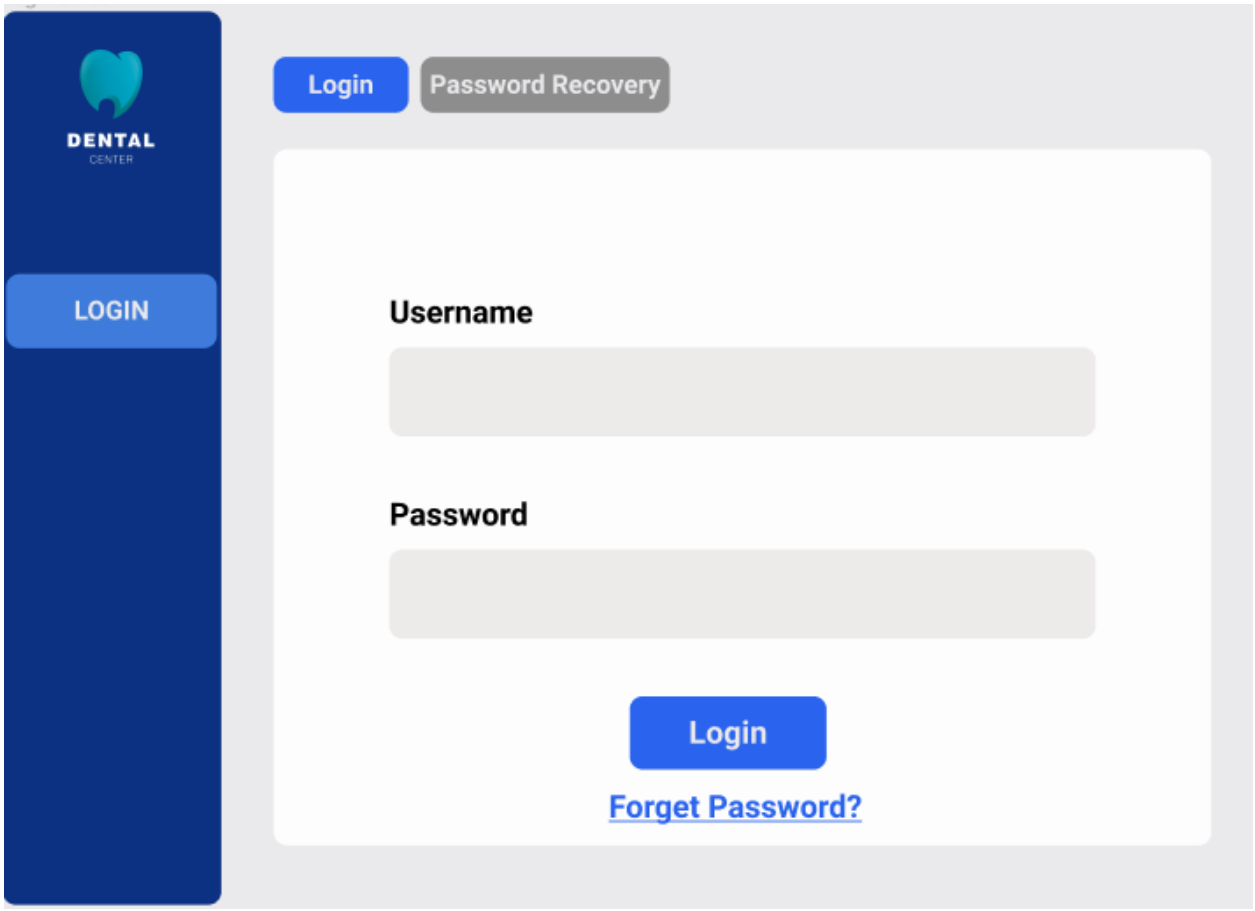


Figure 4.3 Dental Management System Login Page

User Required to login as a user accessing the system. System will allow the user to access the system after the user input the correct username and password. Else, the system will prompt the user to key in the correct details.

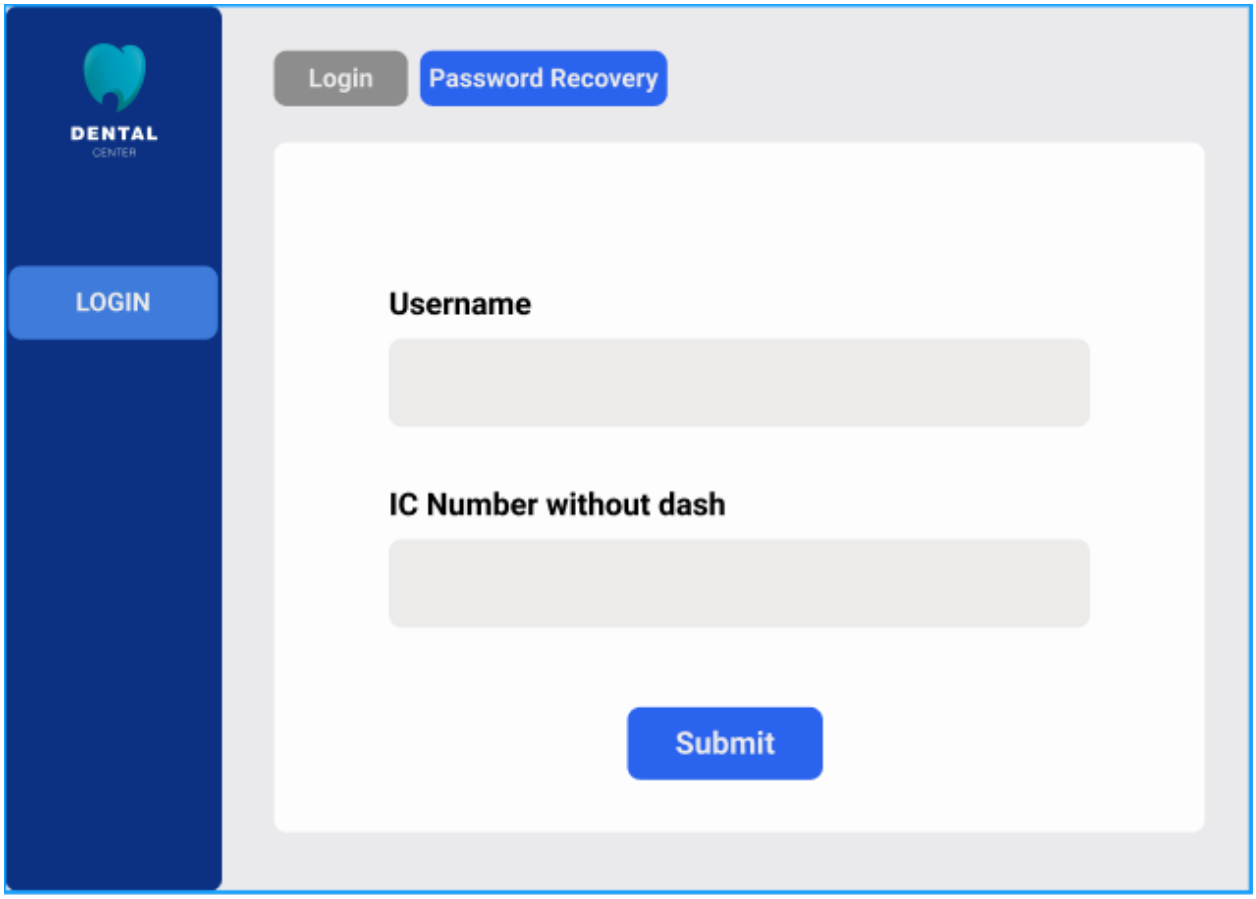


Figure 4.4 Password Recovery Screen

Figure 4.4 is a password recovery screen. It allows the user to perform password recovery functions by entering their username and IC number. The system will then send a confirmation link to their email address that matches the account. After the users click on the confirmation link in their email then they are able to continue the process of password recovery.

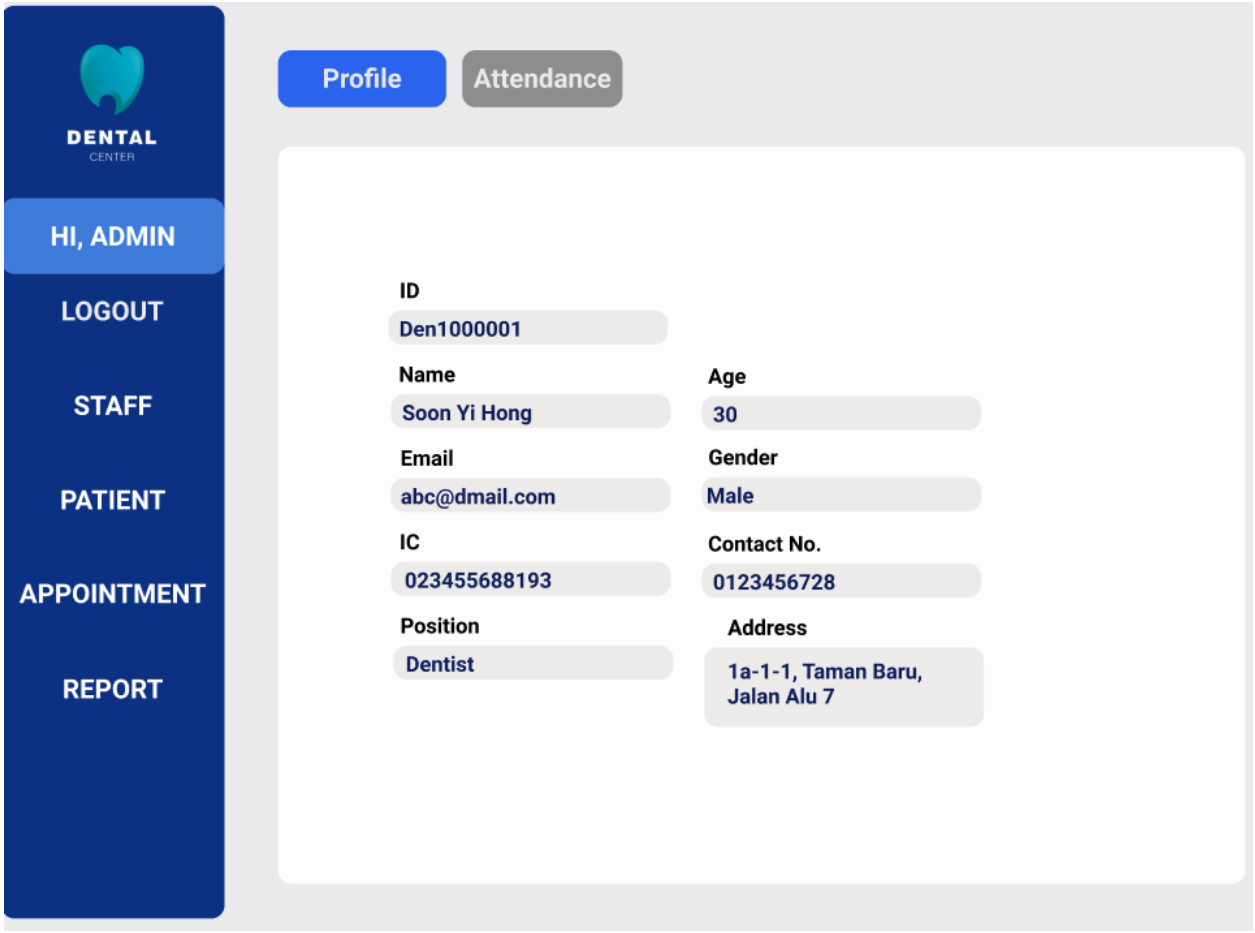


Figure 4.5 Account Profile Screen

This screen is accessible by the user after the user has logged into the system. It shows the profile details of the login account. Users can view their personal information on this screen.

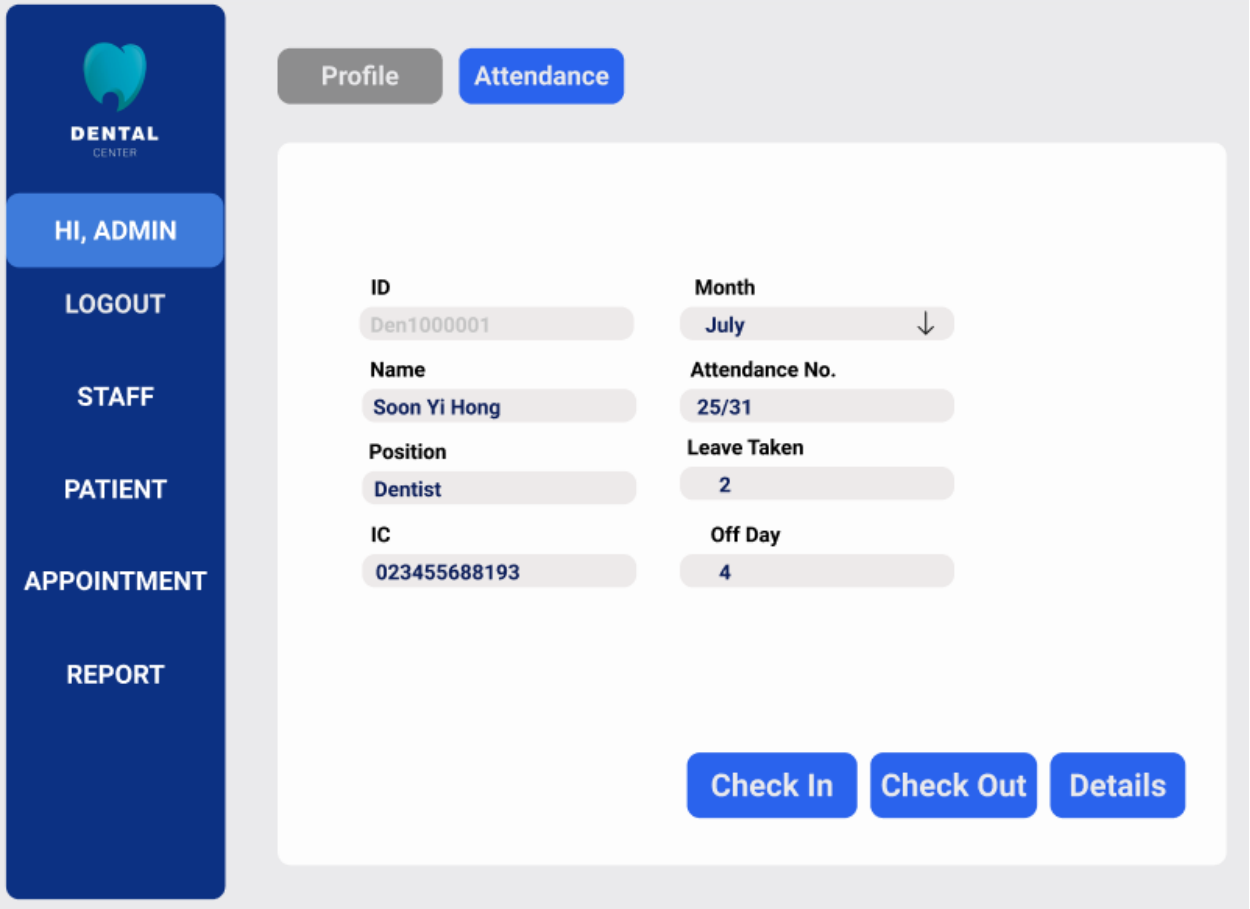


Figure 4.6 Account Attendance screen

In this screen, users are able to see their attendance after login. There is a summary of their attendance details and allows users to view more detailed attendance in a time duration of a month. Besides, check in and out can access inside this screen for users.

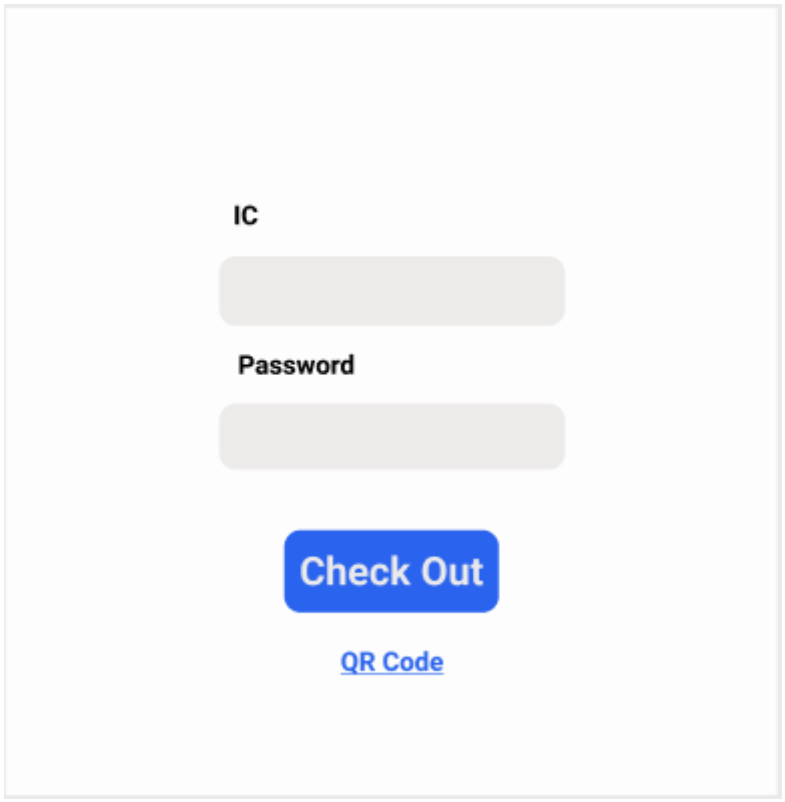


Figure 4.7 Check Out Screen

This screen requires users to fill in their IC and password to check out attendance. Other options such as check out by scanning QR code are also available to users.

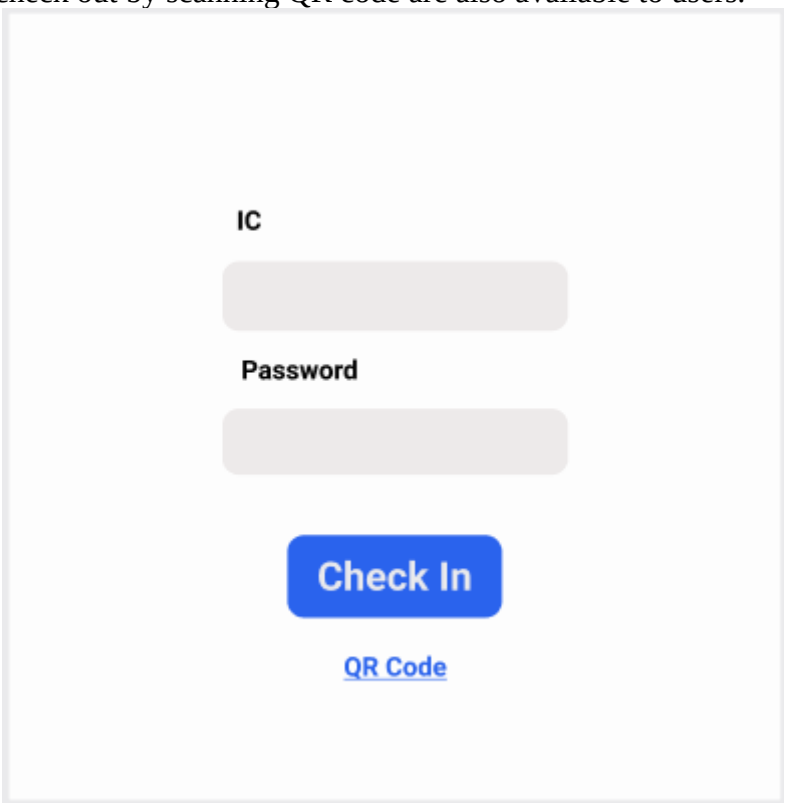


Figure 4.8 Check In Screen

This screen requires users to fill in their IC and password to check in attendance. Other options such as check in by scanning QR code are also available to users.

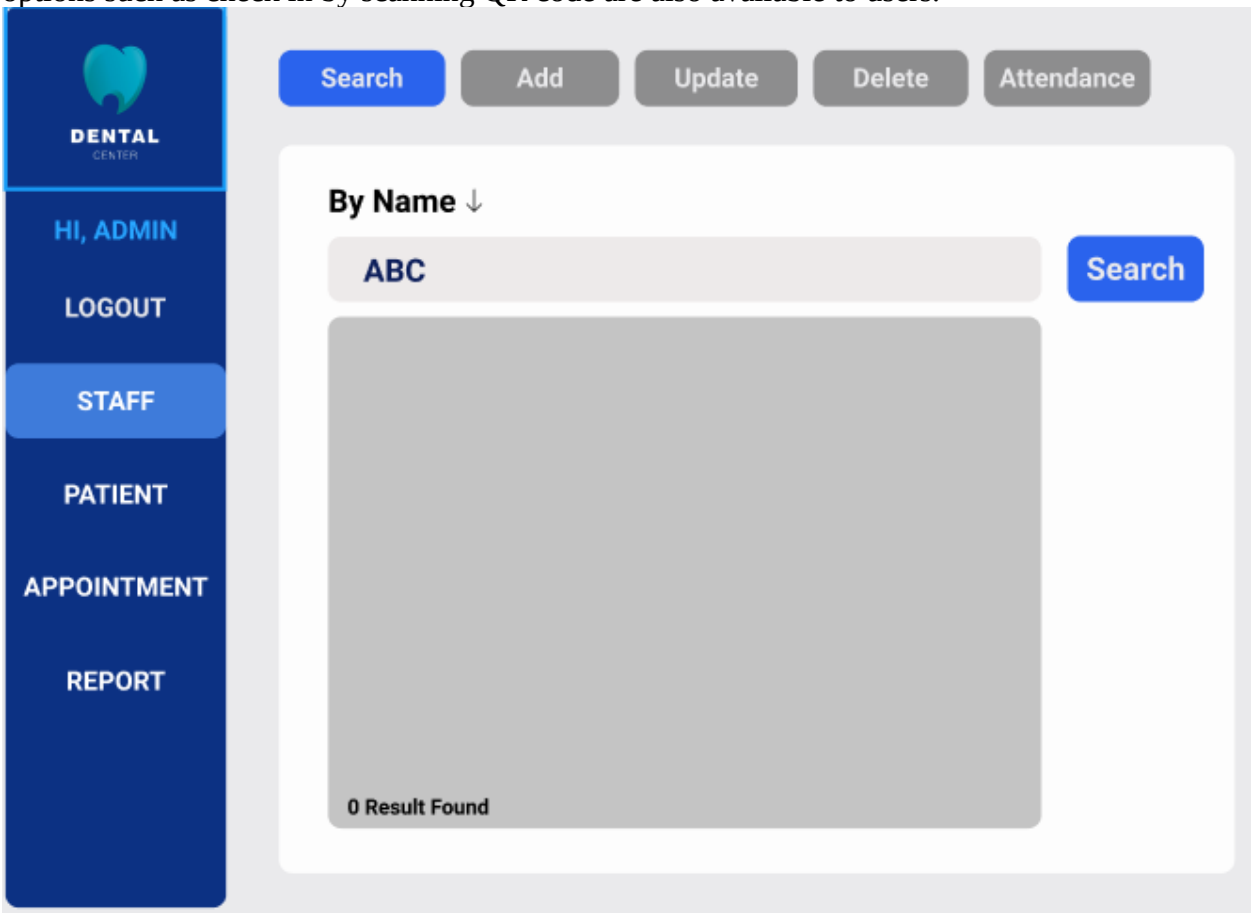


Figure 4.9 Search Staff Screen (Empty Result)

This screen is a staff search screen, it is only accessible by admin. Admin is allowed to search by criteria such as name or telephone number. If no results are found, 0 results are found, and a gray background will be shown.

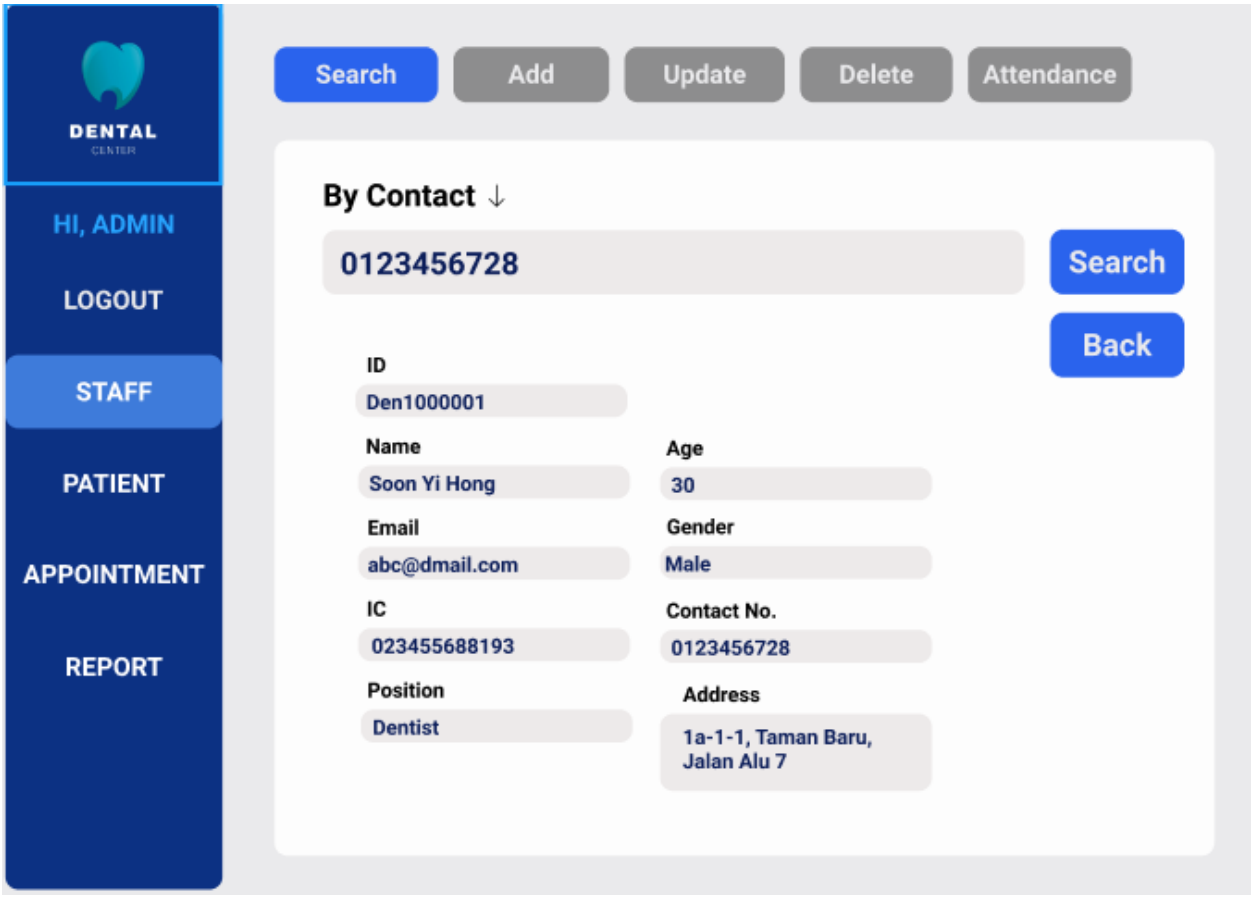


Figure 4.10 Search Staff Screen (With Result and clicked in)

This screen is a staff search screen, it is only accessible by admin. Admin is allowed to search by criteria such as name or telephone number. If results are found, the admin then can click into it to view the staff details.

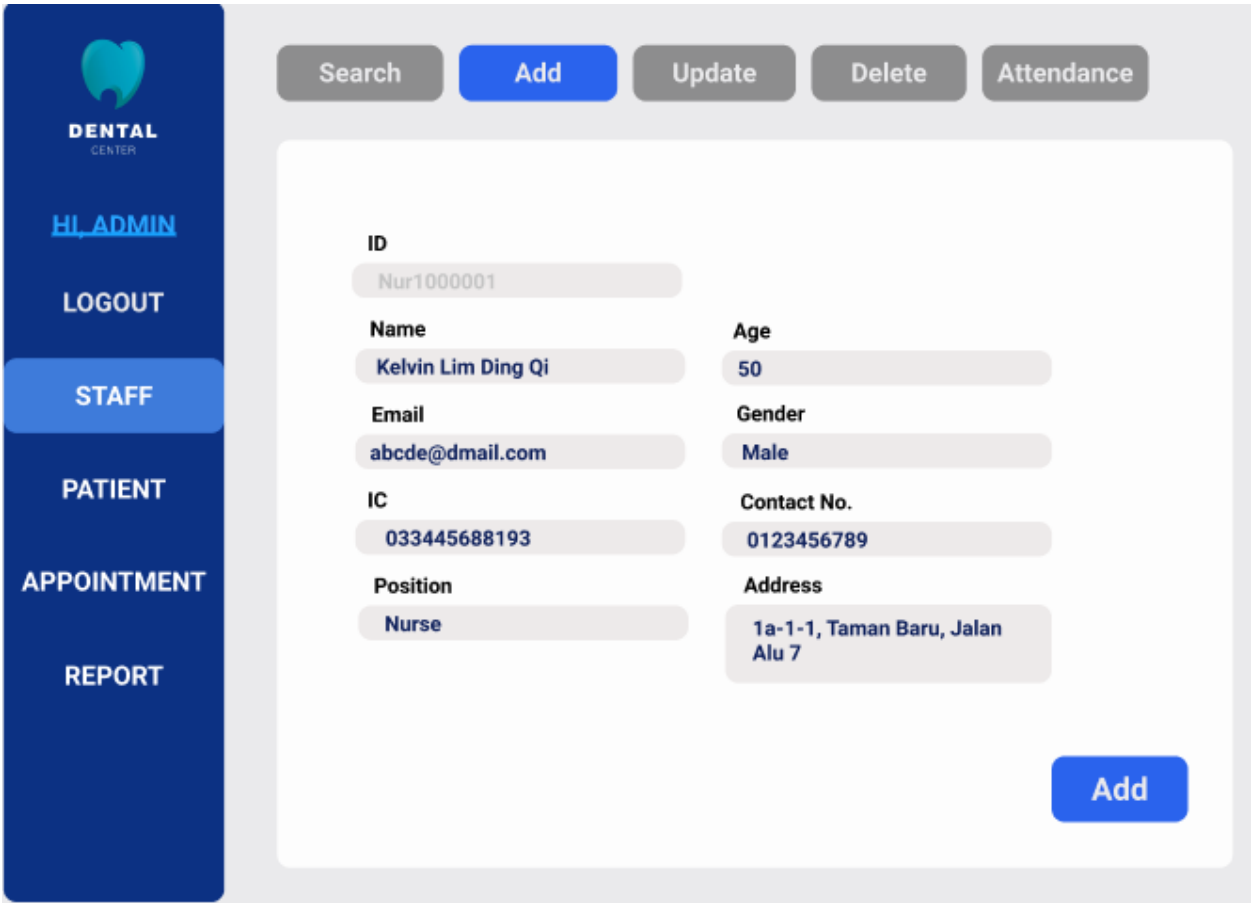


Figure 4.11 Add Staff Screen

This screen is Add Staff Screen, admin allows to add new staff into the system by accessing this screen. Field and details are required and should be valid in order to successfully add new staff into the system. The ID will be auto incremented and does not allow admin to key in.

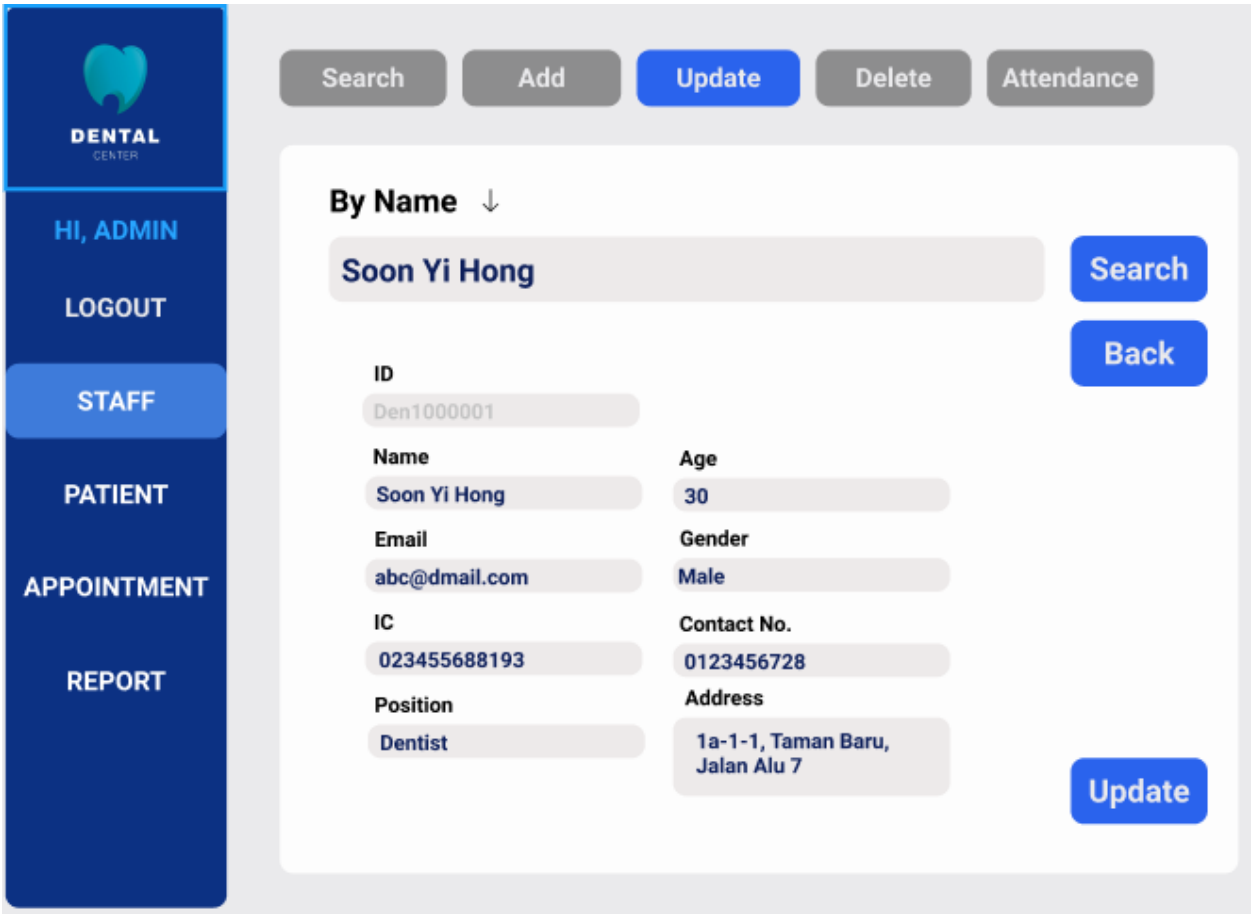


Figure 4.12 Staff Update Screen

This screen is Staff Update Screen, admin allows to update staff details into the system by accessing this screen. Field and details are required and should be valid in order to successfully update existing staff details into the system. Some fields such as IC and age are not changeable.

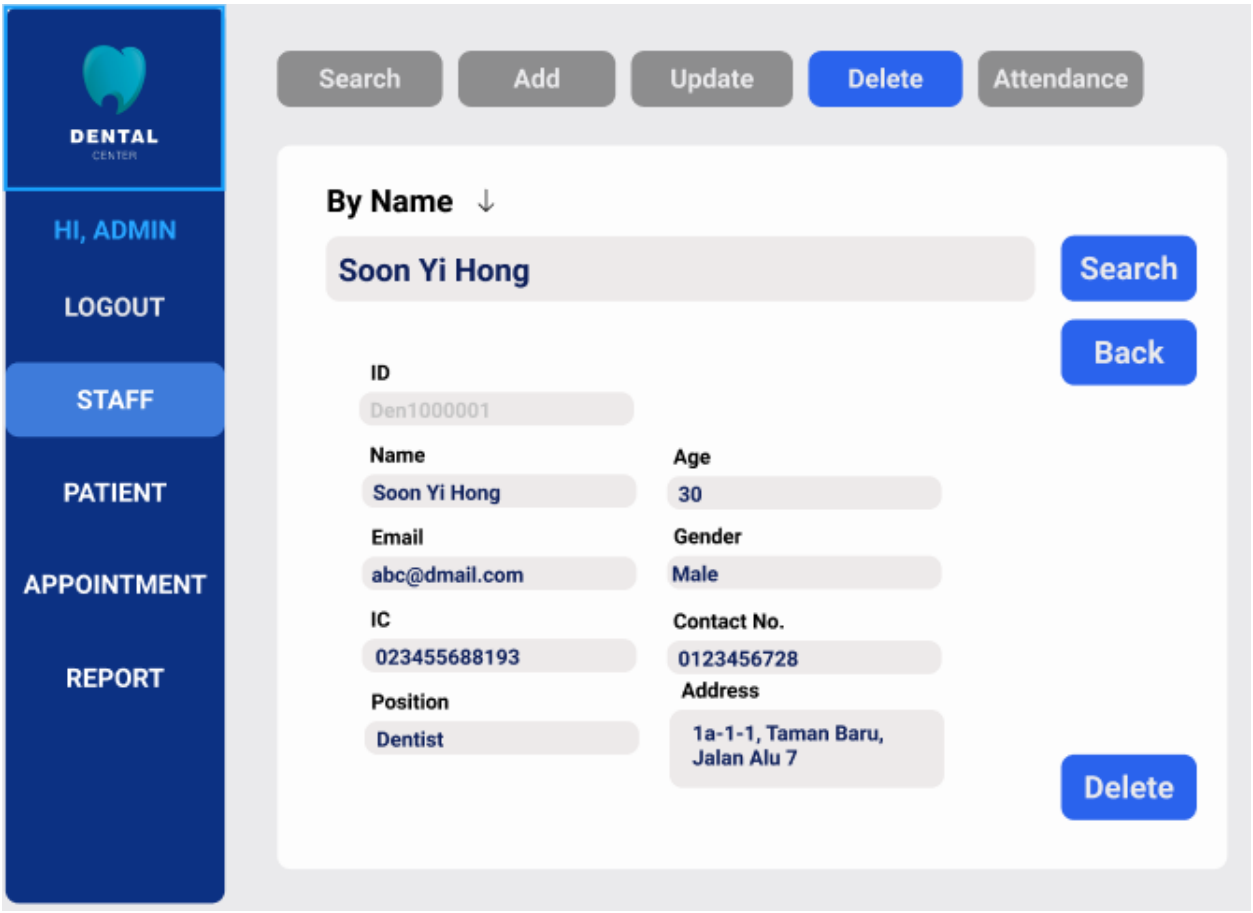


Figure 4.13 Staff Delete Screen

Only Admin are allowed to access this screen. Admin allows to delete the existing staff details by clicking on the delete button. Admin can perform a search by criteria to locate the staff details that need to be deleted.

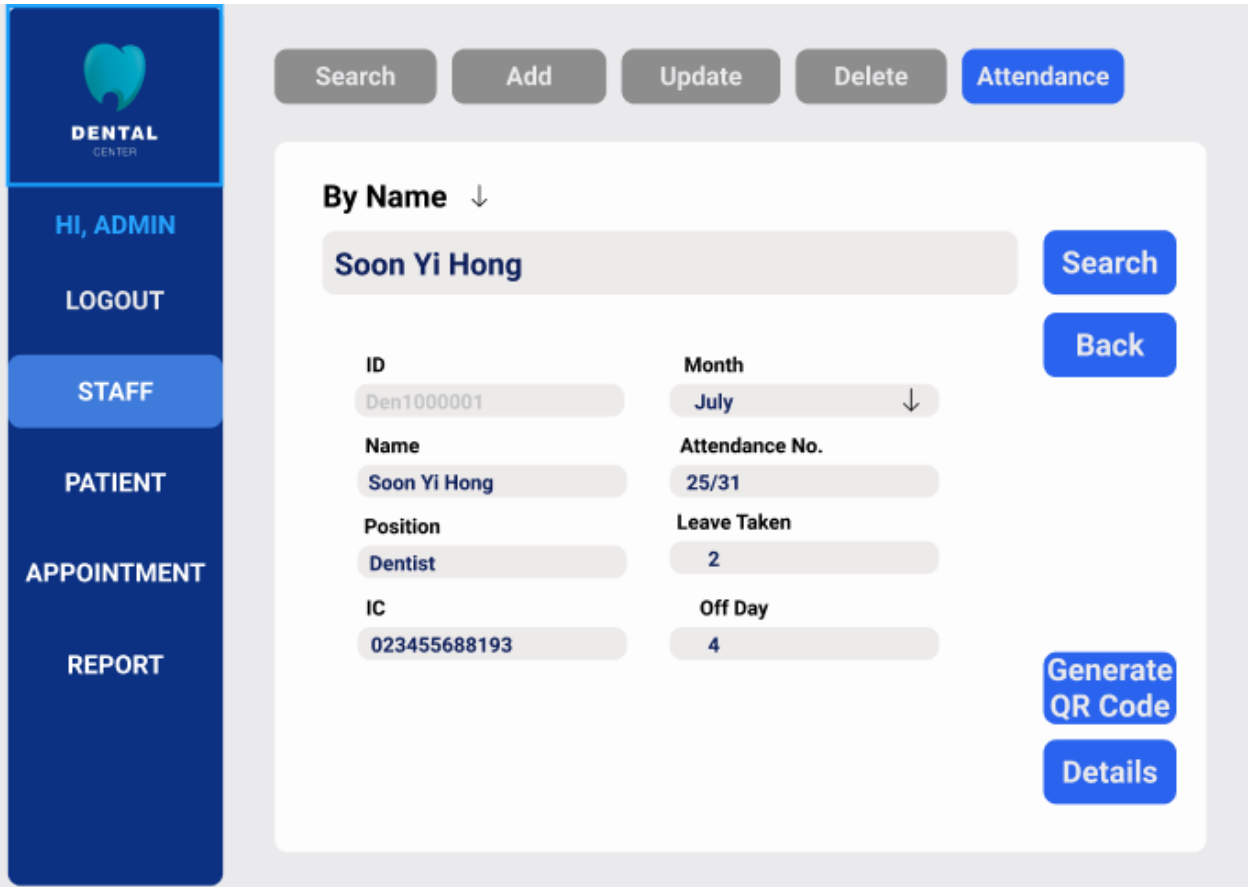


Figure 4.14 Staff Attendance Screen

Unlike the account attendance screen. This screen is only accessible by the admin, admin can perform search by name to view their attendance. Admin also allows to view the details of the respective staff attendance and is capable of generating a QR code for staff to check in and out in the future.

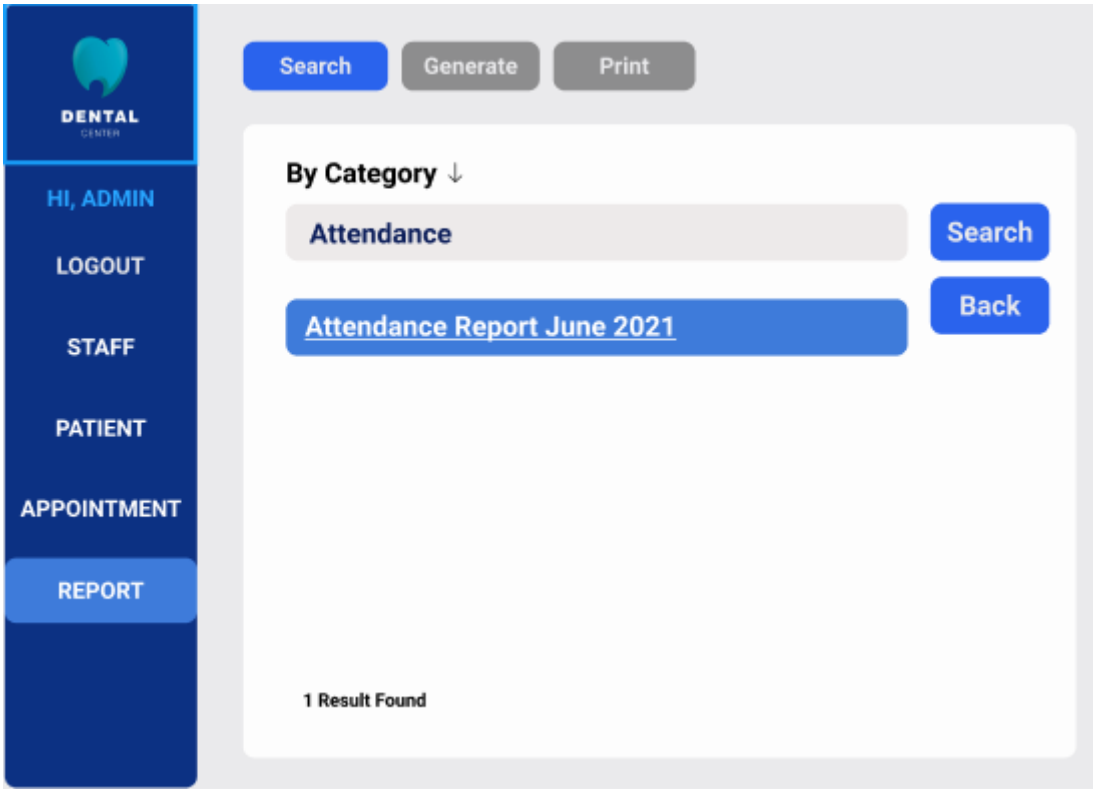


Figure 4.15 Search Report Screen

Search Report Screen can be accessed by users after login. Users are allowed to search attendance by category field and if there is result, the clickable content will be displayed. Users may click into the clickable content to view the attendance report that is previously generated.

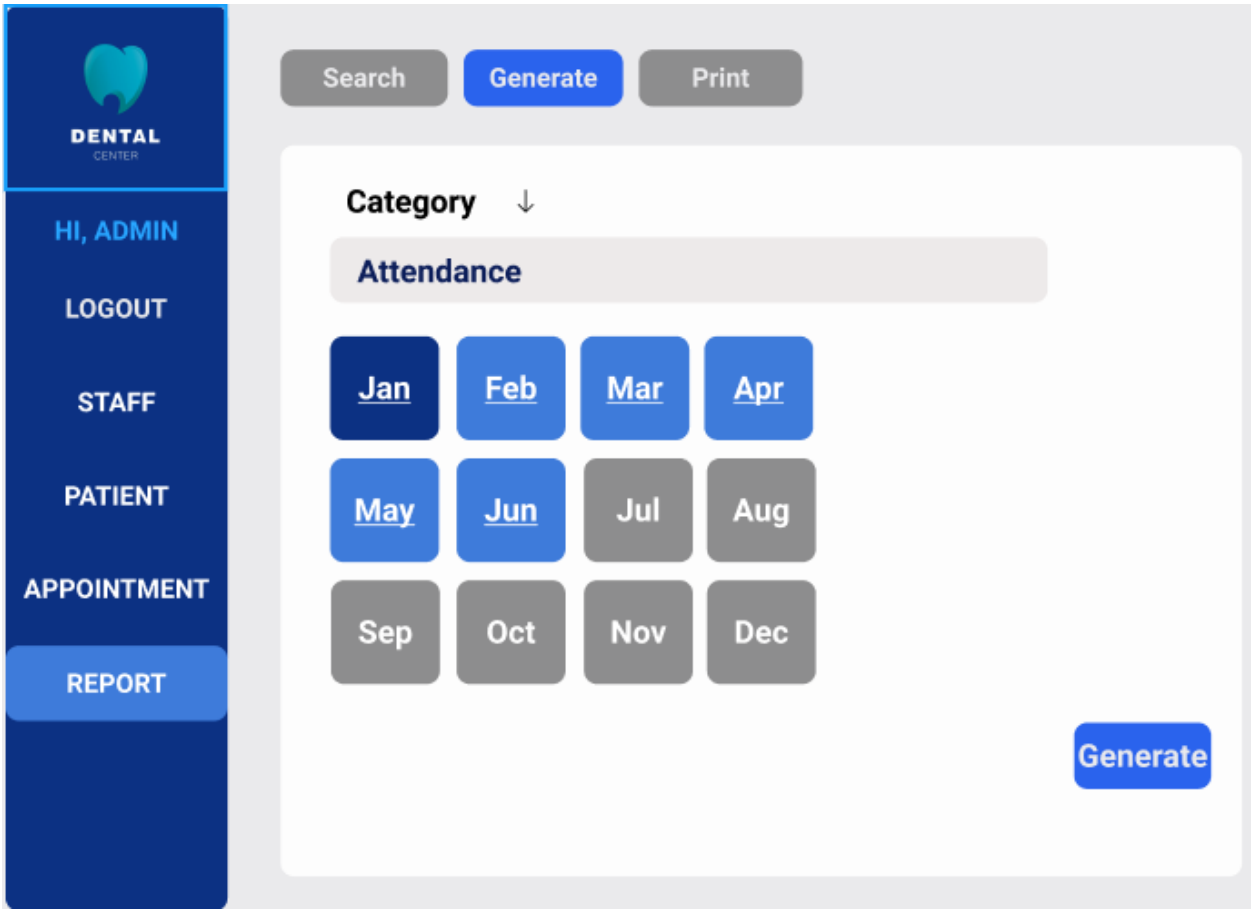


Figure 4.16 Generate Report Screen

Generate Report Screen allows users to generate reports. Users need to choose the category of the report and choose the available month which shows in light blue in color. The gray color month is not accessible.

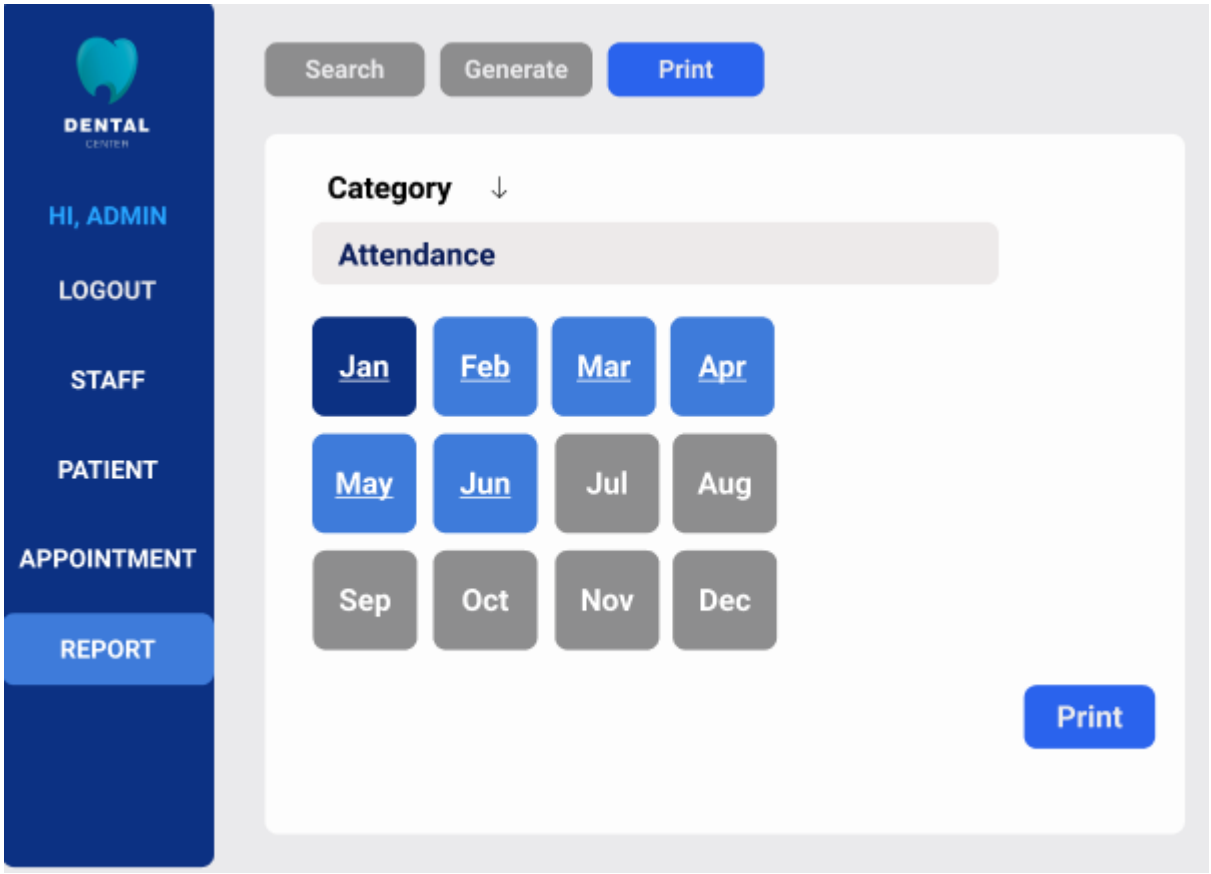


Figure 4.17 Print Report Screen

In this screen, users are allowed to print the report by choosing the category of the report. Besides, months also need to be selected in order to proceed to preview and confirmation to print steps. Report will be printed after users provide the confirmation.

4.5 Chapter Summary and Evaluation

This chapter includes class diagram, Entity Relationship Diagram, Activity diagram, data dictionary, security design and the user interface design of the system. Class diagram able to bring out the relationship between class and object. Entity relationship diagram (ERD) shows the relationship between entities in the database. With the help of a data dictionary, database entity and field is shown with explanation. Activity diagrams present us with the activity flow of the module function. Security design showed the security of the Dental management system. Lastly, the user interface design showed us the Dental Management System UI with explanation.

Problems occur during the design phase. Therefore, there are changes made throughout the chapters. With the help of Draw io and Visual Paradigm, our team was able to make corrections to the diagrams.

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Appendices

TAR UC Dental Management System
Interview Questions

Date/Time : 31/05/2021 (Tuesday) at 11.00a.m.
Location : Google Meet - Online (https://meet.google.com/fuo-bvhu-kbx)
Interviewee: Project Manager, Soon Yi Hong & Assistant project manager, Kelvin Lim Ding Qi
Purpose: This interview is to aim to understand how the existing system works and the problems faced by the end users of the system. It also aims to understand what the end users need in their new system and user's expectations on the new system.

1. **How long have you been using the current Dental Management System?**
2. **Do you think there is any inconvenience while using the current Dental Management System? How will the system cause you guys to feel inconvenient?**
3. **What are the problems faced while using the current Dental Management System?**
4. **How does the current Dental Management System perform during the work process? Explain in detail.**
5. **Do you think that the current system is easy to operate? If no, state the reason.**
6. **What are the most common mistakes made while using the current Dental Management System?**
7. **What are the major concerns that you have while using the current system?**
8. **What process is involved in the current Dental Management System? Explain the functions and features as well.**
9. **Who will be allowed to access the system and the features provided? State clearly.**
10. **What improvements or changes would you like to see in the new system? Please note down clearly any additional features or functions to add into the system, as well as any changes needed to make to the features or functions.**

Figure A1 Interview Question Sample