ADaMaS (Apelo Database Management System)

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In Partial Fulfillment of the Requirements for

Introduction to Systems and Design for CS

SNTSDEV

By

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Table of Contents

[Abstract i](#_Toc104462802)

[List of Figures ii](#_Toc104462803)

[List of Tables iii](#_Toc104462804)

[I. Introduction 1](#_Toc104462805)

[1.1 Project Context 1](#_Toc104462806)

[1.2 Statement of the Problem 1](#_Toc104462807)

[1.3 Objectives 2](#_Toc104462808)

[1.4 Significance of the Project 2](#_Toc104462809)

[ Apelo Dental Clinic's patients and employees - This will make it easier to locate each individual patient in the clinic: 2](#_Toc104462810)

[ Employees - Employees at Apelo Dental Clinic will directly benefit from this project because they will be the one to use the system once it is implemented. The project will reduce their time spent on data administration, processing, and maintenance, allowing them to focus on their work and respond to other issues that may arise. 2](#_Toc104462811)

[ Patients - Once the project is completed, the clinic's patients will profit. Their data at the clinic will never be lost again, unlike the prior data management system, which had a high risk of losing patient data on paper. 2](#_Toc104462812)

[ Future Developers - This project will assist future developers since it may be used as a reference for any similar or related projects. 2](#_Toc104462813)

[1.5 Scope and Limitations 2](#_Toc104462814)

[II. Review of Related Literature / Systems 3](#_Toc104462815)

[III. Methodology 5](#_Toc104462816)

[IV. Results and Discussion 5](#_Toc104462817)

[4.1 Current System 5](#_Toc104462818)

[4.1.1 Technical Background 5](#_Toc104462819)

[4.1.2 List of Processes 6](#_Toc104462820)

[4.1.3 Gap Analysis 6](#_Toc104462821)

[4.2 Proposed Solution 7](#_Toc104462822)

[4.2.1 Technical Background 7](#_Toc104462823)

[4.2.2 Feasibility 8](#_Toc104462824)

[4.2.3 Requirements Analysis 8](#_Toc104462825)

[V. Conclusion 10](#_Toc104462826)

[References 11](#_Toc104462827)

[Appendix A: Teams Meetings 12](#_Toc104462828)

# Abstract

This paper contains the initial plan for the project development of Apelo Dental Clinic’s database management system for patients’ information. This contains initial analysis for the requirements, SWOT analysis for the clinic’s internal and external factors, processes from the current and proposed system, feasibility, and the current progress that the team have made so far.

*Keyword*: clinic database management system

# List of Figures

[Figure 1: Apelo Dental Clinic's file system for patient information 5](https://asiapacificcollege-my.sharepoint.com/personal/jtpedrola_student_apc_edu_ph/Documents/Documents/2ndYearSubjects/2ndYear3rdTermSubjects/SNTSDEV/ProgmatiksMidtermPaper_updated.docx#_Toc104191008)

[Figure 3 SWOT Analysis for Apelo Dental Clinic 6](#_Toc104191009)

[Figure 4 Fishbone Diagram for Apelo Dental Clinic 7](https://asiapacificcollege-my.sharepoint.com/personal/jtpedrola_student_apc_edu_ph/Documents/Documents/2ndYearSubjects/2ndYear3rdTermSubjects/SNTSDEV/ProgmatiksMidtermPaper_updated.docx#_Toc104191010)

[Figure 5 User stories 9](#_Toc104191011)

[Figure 6 Roles and Description 9](#_Toc104191012)

[Figure 7 Release plan for Application 9](#_Toc104191013)

[Figure 8 1st Meeting with the Client 12](https://asiapacificcollege-my.sharepoint.com/personal/jtpedrola_student_apc_edu_ph/Documents/Documents/2ndYearSubjects/2ndYear3rdTermSubjects/SNTSDEV/ProgmatiksMidtermPaper_updated.docx#_Toc104191014)

# List of Tables

[Table 1: List of Current System Processes 6](#_Toc104191128)

# Introduction

A pleasant smile is one of a person's most valuable qualities. It makes a significant impact as it is the first thing that people notice. Most people's hearts are captivated by that unspoken language. To acquire and maintain one such smile, proper oral health is required. This should not be overlooked or ignored because it is the gateway towards the body's general wellness. Hence, effective dental hygiene is essential for maintaining a healthy grin.

Dentists are companions in dental health. Professionals have the training and license to work in dentistry facilities, hospitals, and medical clinics. They are acknowledged to conduct a thorough oral assessment of the patient and to formulate treatment options based on the results. Moreover, a dentist's primary responsibility is to provide high quality patient care. However, most dental clinics are still associated with manual processes to manage their businesses, such as putting all their records in a desk drawer that when it comes to maintaining and updating records, there is a lot of room for error. Additionally, keeping track of dentists and business’ performance is also difficult.

The developers are challenged to develop a dental clinic management software for Apelo Dental Clinic (ADC) since this clinic has no existing computerized system yet. This will help in storing patient information/records, medical history, payment records and other patient data. Moreover, it will also include features such as appointment scheduling with Short Messaging Service (SMS) notification and other additional features necessary. The said software will help them to focus on other areas that needs attention.

## Project Context

Apelo Dental Clinic (ADC) is the chosen client of the developers. It’s owned by Dr. Denroe Apelo, located in Dr Arcadio Santos Ave, Parañaque City, established since 2001. Their mission is to provide quality service with affordable price, so no one is deprived of good oral health care and their vision is to continuously upgrade to deliver highest dental care in safe environment for life-long. However, ADC’s current processes such as queueing of patients and recording patient information still relies on traditional or manual process.

The technique of patient’s queuing has been changed for several times to find the best way to handle numerous patients. Their latest technique is with combination of listing names and time of arrival in a paper as early as 5 am in the morning and giving a numbered card to patients at 8:30 am before the clinic operates from 9 am – 5pm. This results in long waiting time for some patients because of scenarios like; patient who was able to get a number around 20 will come back on a later hour because he knows he will wait for long, on the time he comes back, he can cut those patients who are about to get served because he has a lower number. Aside from that, the patient’s duration of procedure is very indefinite as well, because the time will only be based on the doctor’s findings on what procedure should be done for a certain patient (which means, this factor that also cause the long waiting time is out of control by the clinic or the developers).

However, as we go further in interviewing personas, we found out that there were certain weeks in a month where patients are less and other weeks where the number of patients is overwhelming. One of the reasons for this is the salary period of the patients, they tend to visit the clinic more likely on the day they have money.

The clinic allows minimal balances for patients with existing records. Having said that, if we can spread the number of patients throughout the day in a month since most of the procedures done in a day are still orthodontics which means that these patients will still come back and allows a minimal balance only, they can be assigned on weeks with a smaller number of patients instead of heaping on a certain week.

Aside from the concern on long waiting time, patient’s information such as personal information, medical history and payment records are manually written in an index card. This is prone to long time of retrieval or sometimes the index card gets lost because of too many records since 2001.

Manual filing system also slows the day-to-day process of the business. When patients are about to be served, their index card will be retrieved by the front-desk staff, if the staff found it, she will prepare it with all the other files needed by the patient, but when it’s lost, the patient is required to fill another index card that cause problems like untimely diagnosis. During the treatment, the index card will be handed to the doctor where he/she will put information like what he did, how the tooth looks like by putting marks on the visual teeth model, and putting the procedure done with the total amount on a piece of paper clipped with the index card. The patient will then go to the accounting staff where he will pay the amount which sometimes leave some balance that is why the accounting staff should be the one to enter the total money paid by the patient in the index card.

The accounting staff will also need to write all the payment in piece of paper that she receives which at the end of the day she will forward to Dr. Denroe. While the index card will be put back to where it should be placed based on alphabetical order of names.

## Statement of the Problem

The patient information is stored in an index card that is placed in a box, while patient’s files like radiographs and images are also placed in a separated box or storage which causes slow retrieval of information needed and sometimes the files get lost.

Hence, doctors consume longer time in making diagnosis because of delayed medical information from the patient, or less accurate diagnosis because of the lost records.

## Objectives

The main objective of this project is to improve the current system of Apelo Dental Clinic from processes such as admitting patient from the lobby, retrieval and storage of patient information and storing of payment records and processing. Thus, the developers want to achieve the following:

* Decrease the waiting time for patients in the lobby area to approximately 20 minutes – 1 hour.
* Decrease the time for retrieval of patient’s information from approximately 3 minutes using index card to 2 seconds.
* Decrease the time for retrieval of payment records from approximately 3 minutes using index card to 2 seconds and make it available to customer’s end.
* Increase number of patients to be served around 10% based on the previous system.
* Develop a prototype for PC, laptop, and tablet.

## Significance of the Project

This project will help the Apelo Dental Clinic (ADC) to have a dental clinic management system that will allow then to reduce the waiting time of the customer through appointment system, store patient information in digital format that will make retrieval and related processes easier, and track performance of the clinic that will help them in optimizing it. Hence, this project will benefit the following:

## Doctors – Storing and navigating medical history and other patient information will be easier which can improve the quality and time of making a diagnosis

* Front-desk staff - The project will reduce their time spent on data administration, processing, and management, allowing them to focus on other scope of their work and respond to other issues that may arise.

## Accounting staff- Recording of payment and generating sales report can be done in easily a supported by the system.

## Patients – Waiting time will be reduced and records doesn’t have to be filled multiple times when it gets lost. They will also be able to see their payment records and balance or credits.

## Future Developers - This project will help future developers since it may be used as a reference for any related projects.

## Scope and Limitations

This study aims to determine the problems in Apelo Dental Clinic’s (ADC) current system and provide possible solutions that will address it.

Scope:

The focus of this project is to lessen the waiting time of the patients of ADC and digitalized the manual processing of patient’s information. This will include features such as user login, inputting of patient information from different users, visual teeth model, appointment system and SMS notification. Thus, providing solutions to make a better way of appointment and accessing patient information including how it will go from day to day process is the main concern that will be developed in this study.

Limitations:

In the software, inventory management of clinic supplies will not be included that is common in most dental clinic management software that has bee developed. Data migration of the clinic’s patient information will also not be handled by the developers.

# Review of Related Literature / Systems

This chapter will discuss the related studies and systems developed for dental clinic and other health care facilities.

**Related Dental Clinic Systems**

Dental clinics around the Philippines are coping up with the technology to provide better services to their patients, however, most of the improvement are just limited to reaching the dental clinic through social media for booking an appointment and having general inquiry. Storing of patient information in manual file system are still largely adapted by most dental clinics, hence, several problems such as loss patient data, redundant and slow retrieval of data happens that even branch to other problems [1]. Computerization in healthcare facility such as dental clinics provides electronic patient records which consists of basic information, data related to allergies, medical history, and other dental procedures with graphical representation of teeth model where pathological processes on each tooth are stored that can help doctors to have better diagnosis and prognosis [2].

There have been various dental clinic systems implemented around the world. Most of their similarities include features such as storing patient information, payment information, appointment system, data syncing to multiple devices, storing files and inventory management [3, 4, 5]. One of the main frustration in dental clinics is the patient waiting time before they get served, thus, dental clinic system provides features such as sending SMS to patients when there are next to few patients in line, resulting in lesser waiting time that can cause agitation [3, 4].

**How Dental Clinic System can help during scenarios like Covid-19**

Being a dentist is already hard enough since you are making direct contact with a client amidst the pandemic, what’s worse is that the coronavirus could possibly spread to you even with proper precautions as it affects your respiratory system mainly. It is not easy being a dentist during a pandemic as it is also considered to be a front-line job since teeth health is important for everyone and with the tools a dentist uses, various patients from all around the vicinity, and being prepared to take risks even with proper precautions.

Tracing back to the origin of the origin of the coronavirus or once known as nCoV back in Wuhan, China, a worldwide pandemic could have easily been avoided during the early stages of the outbreak, however there had been reports that people have already traveled out of the country for various reasons. At first, doctors thought that it was only a worse case of pneumonia but after discovering that it was highly contagious and causes different severe symptoms to people, it was then declared as a pandemic by the World Health Organization (WHO) in March 2020.

Being a dentist and having to operate on your patient up close and face to face, it would be a huge risk on your health and career if ever you have caught the virus. Of course, you can always wear your own personal protective equipment that would at least minimize the risk of catching the virus. To increase your odds, make sure to thoroughly examine and screen your patients ahead of time before operating them face to face. If possible and to set your risk to the minimal, operate only on safe and immediate patients [6].

**Hybrid Appointment System**

Consultations with family doctors are a critical aspect of health policy. Accessing healthcare services is a difficult undertaking since it is a key barrier to receiving appropriate care and has a negative impact on service quality and the formation of a positive customer relationship. Considering current government policy health advocates' and patients' concerns about long wait times and patients' lack of ability to book appointments prior to seeing doctors, this paper investigated the perspectives of healthcare providers and patients in primary healthcare centers in Dubai on the need to implement a Hybrid Appointment System (HAS), which schedules patients' attendance by doctors based on their preferences, thereby reducing the system's wait time. [7]

Klinika is a user-friendly medical clinic management system that is perfect for healthcare workers who are on the go or who operate from many institutions. Its corresponding app may be downloaded on any mobile device, allowing you to access your medical patient record system from anywhere. Klinika's medical clinic management system software and mobile app allow you to operate across boundaries, across platforms, and across places. Klinika's revolutionary technology offers private practices healthcare record management solutions for improved diagnosis and treatment. [8].

**Interactive Teeth Model**

One of the fundamental components in patient’s information in dental clinics is the teeth model that represents the current situation of a patient’s teeth. This model will be very useful in determining diagnosis and giving the doctors the idea on what should they suggest based on their patient’s current situation. Several dental clinic software such as “My Dental Clinic” and “Plato” that are mentioned above supports this kind of feature [3] [4]. The difference in the two software being referred to is that the Plato’s feature has more precise representation as each tooth is divided into quadrant which can help to make a more detailed analysis of a certain problem. Each quadrant will be colored specifically based on the classification of what disease is associated within and extracted tooth will be colored black. Doctors can input information in a specific tooth quadrant which, when clicked, can be viewed for a more detailed information.

# Methodology

This chapter explains the methodology used to collect and analyze data that is important to the research. The process will include data gathering and planning for the application's development. Appendix B contains the minutes of the meeting with the client and adviser.

**Data Gathering**

The researchers have set aside time and effort to schedule a face-to-face meeting with Apelo Dental Clinic to discuss the project idea. Following the discussion, the researchers and clients agree to create a database application to store patient information and payments. The researchers then examine Apelo Dental Clinic's present data storage to familiarize themselves with their database.

**Plan for Application Development**

The researchers will create the application using the Python programming language. The researchers will use My SQL in phpMyAdmin for the application's database because the capacity of this database is sufficient for the data of Apelo dental clinic's patients. Since the client requested a tablet-based application, the researchers will also do data synchronization from the PC to the tablet through Wi-Fi.

# Results and Discussion

## Current System

### Technical Background

Apelo Dental Clinic still uses physical storage and uses index cards for their patients. Patients queue up starting at 5 am to be given a number that would determine their place in line to be served. A secretary organizes the index card and other files like dental x-ray which she will hand to the doctor when it’s the patients turn in the operating room. Whenever a dentist needs to take pictures or videos, the dentists’ transfer and save it on iCloud.

A picture containing text

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Figure 1 Apelo Dental Clinic's file system for patient information

### List of Processes

Table 1 List of Current System Processes

|  |  |  |
| --- | --- | --- |
| Process ID | Process Name | Process Details |
| P001 | Patients list their name in a paper | Patient queues up as early as 5 am to list their name, procedure, and date of arrival in a sheet of paper which will be the basis of numbered card. |
| P002 | Getting numbered card | At 8:30 am, the front-desk staff will give all the patients their numbered card based on date of arrival. |
| P003 | Waiting at the lobby | Patients who get smaller number will wait at the lobby while some patients leave the clinic for a while and comes back at a later hour |
| P004 | Retrieval of index card | Front-desk staff will retrieve the patient’s index card that contains all the patient’s information. If not found, the patient will fill another index card. |
| P005 | Fill-up an index card | New patient or those who haven’t found a record (lost) will fill another index car |
| P006 | Next patient | Once a patient in the operating area is done, new patients will go inside, and the front-desk staff will hand over the index card to a doctor. |
| P007 | Looking at the index card | Doctor will look at the index card to see all the needed information such as recent procedure done, visual teeth model etc. |
| P008 | Procedure starts | Once diagnosis is made, all the necessary procedure will be made or depends will be agreed upon |
| P009 | Procedure done | When the procedure is done, the doctor will write the payment cost in a small piece of paper clipped in the index card. |
| P010 | Paying the procedure | The patient will go to the accounting staff to pay the amount, when their money is not enough, the clinic allows balances to be paid on the next visitation. |
| P011 | Record the payment | Accounting staff will record all the payment made in that day in a paper and records the payment info in the index card |
| P012 | Putting back the index card | At the end of the day, all the index card will then be rearranged again to its tray holder. |

### Gap Analysis

#### SWOT Analysis

|  |  |
| --- | --- |
| **Strengths** | **Weaknesses** |
| * Affordable dental procedures. * There are several doctors inside the operating area for customer treatment efficiency. * Enough seats for the waiting area (around 10-16 capacity) * Established since 2001 | * Number-card-basis on serving customer queue * Long queue of customers due to poor appointment system. * Customer heads as early as 3 am to the dental clinic to be first in line * Records of patients’ teeth and x-rays are stored physically in a file cabinet which has a high chance to be lost or destroyed. |
| **Opportunities** | **Threats** |
| * Owned and managed by a doctor with more than 20 years of experience. * Along the main road of Paranaque for quick access. * Strong word of mouth from clients * Apelo Dental Clinic is standing for 10 years. | * Another dental clinic in the vicinity has active social media pages. * Various dental clinics are starting to grow in the vicinity due to proper time management even though they offer a higher price. |

Figure 2 SWOT Analysis for Apelo Dental Clinic

#### Fishbone Diagram

Figure 3 Fishbone Diagram for Apelo Dental Clinic

Diagram

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## Proposed Solution

### Technical Background

ADENICSY will be automating the process of scheduling a patient for a slot within a day and the storage of patient information and the process related to it such as inputting additional medical records, adding payment records etc. This will result to increase efficiency, minimize risk of data loss, and less physical storage consumed by the records.

The software will be developed in code using a computer and a mobile device that will then be tested and used on mobile phones, tablets, and computers. The main functions will be created using various coding languages as well as the design and overall look of the application. For software, the researchers will possibly use Visual Studio Code, Notepad++, Jupyter, GitHub or other hosting platforms. For the peopleware, the required staff as well as the owner will be taught about the application or be provided with documentation to avoid errors and confusion. For the network, the developers would like the files, pictures, videos, and other documents to be transferrable via WIFI, Bluetooth, USB, and even downloading through internet storages such as Google Drive and iCloud. In terms of data syncing in all the devices, information should be consistent via the devices used in the clinic through routers while available data in the website from the patient’s side accessing it remotely should be syncing as there is a internet connection available.

### Feasibility

**Operational feasibility**

Apelo Dental Clinic's (ADC) patient information are stored in the index card that are filed in a box. As the team propose to Doctor Denroe the initial plan to implement a website with the main feature to address the appointment system, he declines to it due to the reason that there's no fix time for each patient's procedure. He rather suggests having a database for patient's information due to several problems that the traditional file system is causing. Hence, the support of the management to the project is certain.

Soon as the clinic will transition from index card file system to computerized, there would be a need for testing and brief training for navigation and how-tos of the system.

The secretary and staff in payment section has the knowledge of using computer programs, while the doctors have no problem in transitioning to tablet-based information retrieval as they all agreed in implementing the application and are using smartphones.

Documentation will also be available to the development of the application so that the future IT who will maintain the program will not have a hard time to make modifications on it.

**Economic Feasibility**

ADC's facility is already equipped with desktop computer, Wi-Fi and printer which are the initial hardware equipment needed for the project. However, the tablets which are the alternative for index card are still needed to be canvas for estimated price, nevertheless, Doc Denroe was already informed about the possible cost as the idea of tablets are suggested by him.

There will be no need for any software subscription for the development of the system as the language for development will be open-source and the database will be RDBMS of phpMyAdmin via XAMPP.

Although the development of the project will not assure to increase the profit of the clinic, customers’ and employees' satisfaction for faster waiting time due to fast retrieval of information and paperless transaction will outweigh the cost of the project development.

**Technical Feasibility**

Tablet is the only hardware that the clinic lacks for the initial assessment of hardware requirements, nonetheless, tablet can be easily purchased today with lower specifications that can support the program to be installed. Since RDBMS is the database needed for the application, the future needs for memory capacity of the program are more likely to be contained in free database software as they offer large memory capacity in terms of clinic-size database.

### Requirements Analysis

#### Product Backlog / User Stories

|  |  |
| --- | --- |
| Users | Story |
| Doctor 1 | “As the doctor, I want to see my patient’s information easily and search them according to their name”. |
| Doctor 2 | “As a doctor, I want to take pictures of the before and after the results of the procedure and upload it on the database”. |
| Doctor 3 | “As a doctor, I want to know if my patients were able to pay the bills in the time said”. |
| Doctor 4 | “As a doctor, I want to know the procedure I have to do to my patient’s teeth”. |
| Secretary | “As the secretary, I want to search the information of the patient to see if they have a record in the clinic. I also want to send the patient’s information to the doctors ”. |

Figure 5 User stories

#### User Classes and Characteristics

|  |  |
| --- | --- |
| Roles | Description |
| Doctor | This user can modify medical and personal information of a patient, upload pictures and other files, access payment information, and input payment details during a procedure. |
| Website Visitor | This user is a web visitor who can see the general information of the clinic, services, contacts and can register through the website to become a patient user. |
| Patient | This user has the description of the *website visitor,* but he/she can make an appointment, modify personal info, request an information, and access necessary information about him/ her at the clinic. |
| Front-desk Staff/ Secretary | This user can access patients’ information and can perform Create, Read, Update and Delete (CRUD). She can also modify the schedule of the doctor in the appointment page and sends the necessary notification via SMS through the system. |
| Accounting Staff | This user can access payment records, and update information like amount paid, balance, credit, etc. She can also generate a sales report through day/ month/ year depending on time constraints. |

Figure 6 Roles and Description

#### Release Plan

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 3rd week of June 2022 | 2nd week of August 2022 | 3rd week of August 2022 | 4th week …… | 1st week of March 2023 |
| Release of prototype for application program. | Start of Application development | Continuous delivery of MVP (Minimum Viable Product) | Client, Adviser and Consultant Meeting. Product modifications | Release of Final Web Application in SCSPROJ. |

Fig. 7. Release plan for Application

# Conclusion

The group had their first meeting with their client where initial plan and the features are discussed. There will still be ongoing requirement analysis for the hardware, software, network, and other important components for the development of the project.

At the end of this paper, prototype for the application in PC and tablet are aimed to be achieved.

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## Appendix A: Teams Meetings

1st Meeting with the client:

A group of people wearing masks

Description automatically generated with medium confidence

Figure 8 1st Meeting with the Client dated April 25, 2022

Minutes:

* Implementation of database management application for patient’s information instead of web development for appointment system.
* Using tablets in-place of index card.
* Schedule and frequency of meeting with the development team and the client.
* Some business processes.
* General overview for timeframe from release of prototype, product development and full implementation of the software to be developed.