



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

**CENTRALIZED PATIENT DENTAL HISTORY AND INFORMATION
SYSTEM UTILIZING QUICK RESPONSE (QR) TECHNOLOGY IN
SELECTED DENTAL CLINICS AT QUEZON CITY**

A Thesis
Presented to the Faculty of Computer Engineering
Polytechnic University of the Philippines
Sta.Mesa, Manila

In Partial Fulfilment of the Requirements for the Degree
Bachelor of Science in Computer Engineering

by

**Agoncillo, Guia Angela C.
Alejo, Alvin Dale G.
Almonte, Hillary Mae L.
Sandig, Reina Ivanna Camille B.**

July 2021



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

TABLE OF CONTENTS

	Page
Title Page	i
Table of Contents	ii
List of Figures	iii
Chapter 1: The Problem and its Setting	1
Introduction	1
Theoretical Framework	2
Conceptual Framework	3
Statement of the Problem	4
Hypothesis	5
Scope and Limitations of the Study	5
Significance of the Study	6
Definition of Terms	7
Chapter 2: Review of Literature and Studies	7
Thematic Organization of Literature and Studies	7
Synthesis of the Reviewed Literature and Studies	15
Chapter 3: Methodology	17
Research Design	17
Flowchart of Research Design/Process Flowchart	18
Description of Research Instrument Used	18
Design Project Flow	19



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

List of Figures

Figure 1: Conceptual Framework	3
Figure 2: Process Flowchart	18
Figure 3: Block Diagram	19
Figure 4: System Flow	19



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Chapter 1

THE PROBLEM AND ITS SETTING

This chapter outlined the problem and its setting, specifically the independent and dependent variables, scope and limitation, and significance of the study.

Introduction

One of the most effective solutions in running healthcare facilities and services is implementing a centralized information system. Numerous forms of information systems are created solely for healthcare services, like the National Hospital System in Indonesia. Having a centralized system is very helpful in handling a large number of patients every day and helps the healthcare industry in terms of file management, record keeping, and convenience. This ensures that healthcare facilities handle patient history information with validity and saves a lot of effort and time whenever the data is urgently requested.

This research will create a centralized patient dental history and information system utilizing Quick Response (QR) technology in selected dental clinics at Quezon City. Using a card with a QR code, patients can register in dental clinics, and the clinic will receive their dental history and information. All clinics involved in this study will be utilizing a centralized information system where data from the patients are stored. The researchers chose this study to implement a starting information system for dental



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

clinics. Patients who have dental check-ups regularly will experience the benefits of having a centralized information system and make dental check-ups easier.

Theoretical Framework

Modern Management Theory (Quantitative Theory)

The goal of modern management theory is to integrate technology and organizations. While enterprises must negotiate continual change and exponential complications, technology is a factor that may transform and upend firms extremely quickly. One significant theory that compromises this is the Quantitative Theory, which was established by utilizing specialists from many scientific fields to solve the issues around integrating systems of people, materials and systems.

The SDLC V-shaped model

The researchers will use the V model of software development, commonly known as the verification and validation model, in this study. According to studies, this approach is comparable to the waterfall model, but with minor changes to the testing phase, which is put at various stages. According to this methodology, the developer scheduled the testing and development phases in tandem. So, on one side of the V-shaped model, there are Verification stages, and on the other side, there are Validation phases, and finally, there is coding.

The researchers chose this model because it requires verification and validation phases at each step, and by the time we get to the last part, coding, the researchers



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

have already planned all of the requirements needed, which will aid them in setting their goals and anticipating what to expect in the output system.

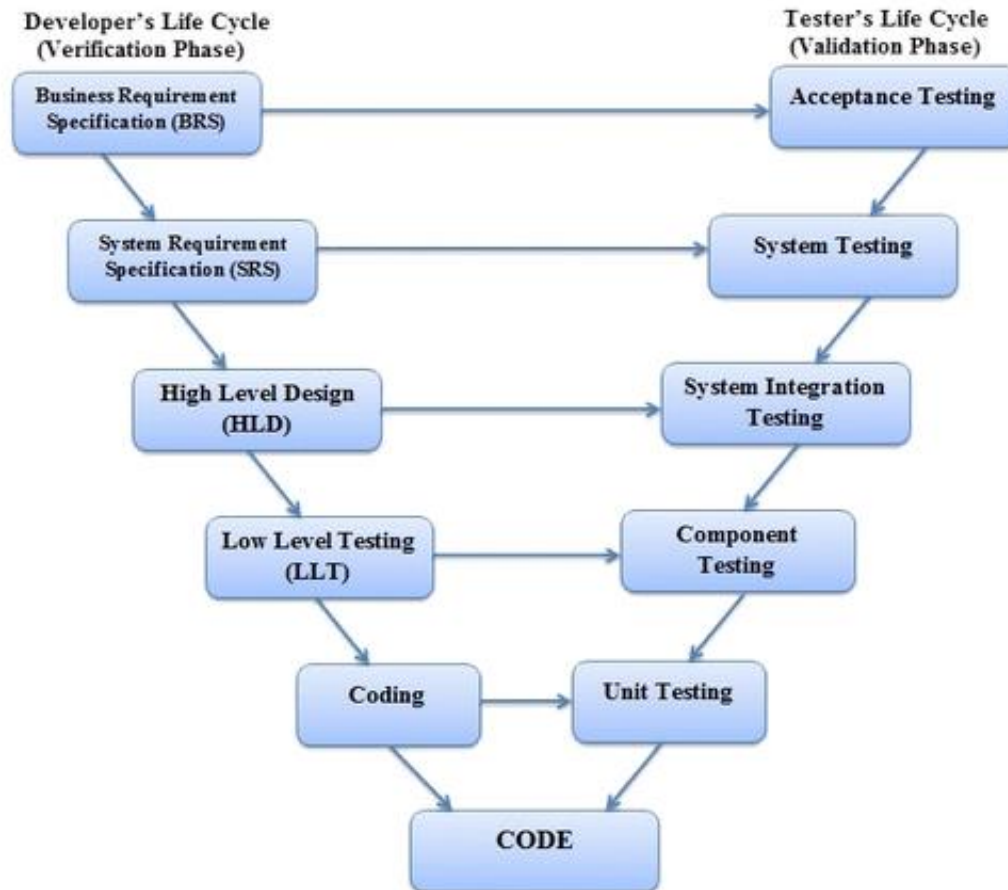


Figure 1. Design phase of sdlc V-shaped model



Conceptual Framework

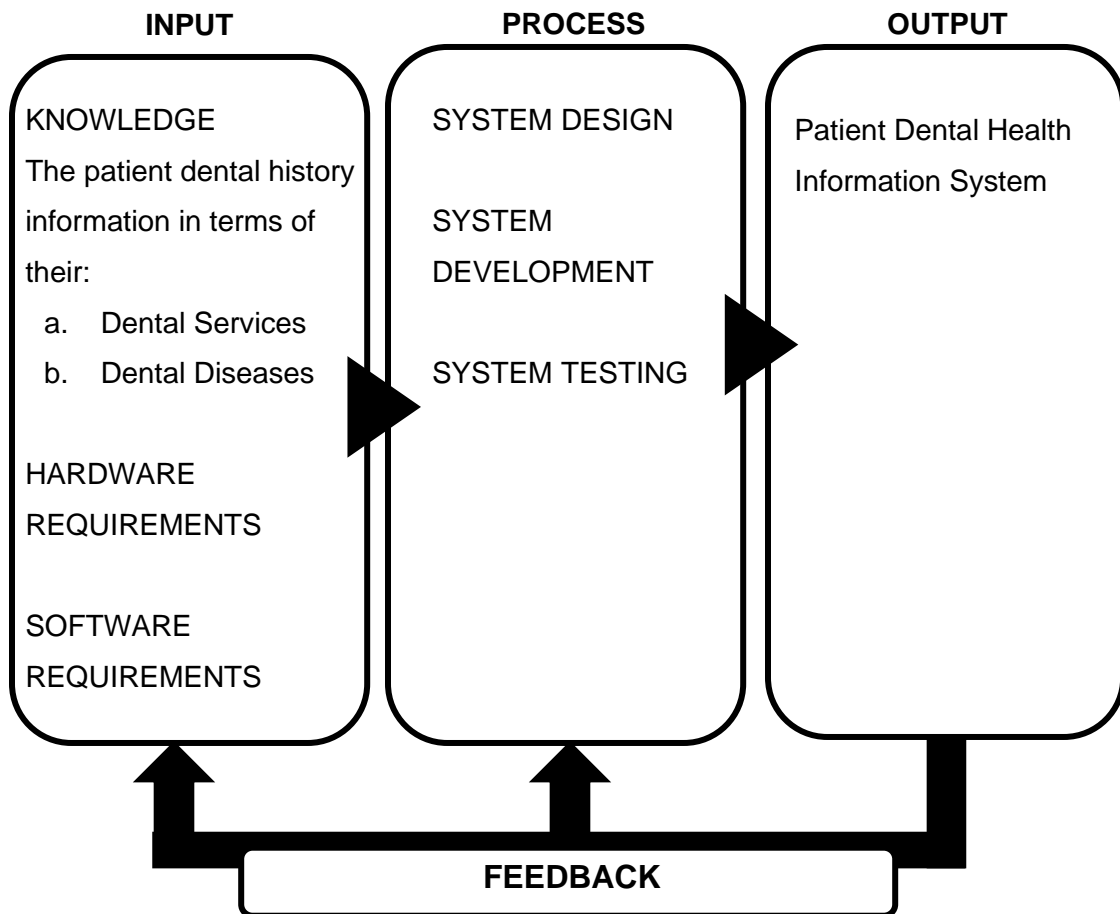


Figure 2. Conceptual Framework

Statement of the Problem

This research aims to centralize Patient Dental History and Information System. Furthermore, this research intends to answer the following questions:

1. What is the significant difference between digitizing patient dental records as opposed to hardcopy record keeping in terms of:
 - 1.1. Preservation of records?



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

- 1.2. Efficiency?
- 1.3. Financial aspect?
2. What is the significant difference of using QR Technology as opposed to hard copy forms in terms of:
 - 2.1. Time Constraint?
 - 2.2. Promotions?
 - 2.3. Contact Tracing?
3. What is the performance of the patient dental history and information system in terms of:
 - 3.1. Response Time between patient QR Reading and Dental History Notification
 - 3.2. Accuracy of QR Reading and Dental History Notification
4. How effective is the centralized patient dental history and information system in selected Dental Clinics at Quezon City based on the opinion of the following:
 - 4.1. Patients
 - 4.2. Dental Physicians
 - 4.3. Dental Clinics

Hypothesis

This research assumed the following hypotheses of centralized patient dental history and information system utilizing quick response (QR) technology:

1. The findings in terms of digitizing patient records as opposed to hardcopy record keeping with regards to preservation of records, over time, storage media can



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

degrade, resulting in corrupted files. Modern computers and the software that recognizes and provides access to storage media may become outdated and obsolete. Bits could be ignored, abandoned, erased by accident, or purposefully destroyed. The findings in terms of digitizing patient records as opposed to hardcopy record keeping with regards to efficiency, include issues such as voluminous records, records from multiple sources, preventing damage to original documents, designing search and retrieval tools, and transforming digital content to meet the needs of end-users. The findings in terms of digitizing patient records as opposed to hardcopy record keeping with regards to financial aspects, include issues such as high cost in project administration, and producing reproductions of the highest quality.

2. The significant difference of using QR Technology as opposed to hard copy forms in terms of time constraint is typically around 2-3 seconds, considering that the scanner is pointed steadily towards the QR code, otherwise the scanning process will take a lot of tries. The significant difference of using QR Technology as opposed to hard copy forms in terms of promotions, it turns out QR code are still a useful marketing tool. In fact, between 2018 and 2019, QR usage increased by 28%. However, QR codes are not suitable for every company. The significant difference of using QR Technology as opposed to hard copy forms in terms of contact tracing can help people recognize their risk and prevent viruses, such as COVID-19, from spreading further. QR codes are a kind of location-based digital contract tracing solution that can be scanned by smartphones.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

3. The performance of the patient dental history and information system in terms of response time between patient QR reading and dental history notification would have a rate of 65% and the accuracy of QR reading and dental history information would have a rate of 70%.

4. The effectiveness of using centralized patient dental history and information system with regards to patient's opinions, dental physician's opinions, and dental clinic's opinions, show to be ineffective.

Scope and Limitations of the Study

The researchers will use the data obtained from patients of chosen Dental Clinics in Quezon City to create a centralized patient dental history and information system. Patients who visit the above-mentioned Dental Clinics on a regular basis will be included in this research. All the patient's information will be treated with care, which means it will not be available to the general public but only to those with permission. The researchers will not use any information obtained from the respondents to damage them, nor will they use this information for their personal benefit.

Significance of the Study

The findings of this study will redound to the benefit of the following:

To the Patients

The researchers' proposed system will provide the convenience of contactless check-ins, check-ups, and easy access to their dental information with the use of QR technology. QR codes have become extremely prevalent as a sign that a clinic is



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

following COVID-19 guidelines. The presence of a QR code on your door, which can be scanned, indicates that the clinic has taken into consideration each patient's safety and well-being.

To the Dental Physicians

This study seeks to give dental practitioners the advantage of using QR technology and digitized record keeping, assuring a fast and smooth transaction with every patient they deal with. As good record-keeping aids in the maintenance of best practice, facilitates easy communication between specialists, and proves that best practice has been followed. Dental records that are complete and well-organized are critical for good medical practice and care continuity. They can be used to assess the quality of care provided.

To the Dental Clinics

This study intends to provide dental clinics with the benefit of long term cost-savings. Digitization promotes productivity, secures your information in the event of a natural disaster, theft, or loss, and makes record retrieval simple while bringing your company up to date with industry standards.

To the Future Researchers

This study can be used as their reference since it will aid in uncovering crucial areas in dental care that the researchers of this study were able to explore. Future researchers can contribute additional information for the benefit of their own research paper.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Definition of Terms

1. **Contact Tracing** - the process of determining people who were exposed to a certain disease, and tracing the people whom these people had contact with in order to delay the spread of the disease.
2. **Dental Activities** - any task/operation that a dental expert performs on a patient with teeth and oral cavity problems.
3. **Dental Clinic** - medical institute mainly for dental activities; provides services in preventing and treatment of any dental problem.
4. **Dental History** - refers to documentation of all oral health related information of a person.
5. **Dental Physicians** - licensed medical experts who specialize in oral health disease diagnosis, treatment, prevention, and many more.
6. **Healthcare Practitioner** - any licensed figure who is legally permitted to conduct health care assistance.
7. **Information System** - an organized collection of data from a specific field used for acquisition and distribution.
8. **Patient Unique Identification** – A three-digit code that serves as the card personal identification number (PIN) asked for verification.
9. **Record keeping** - involves maintaining a continuing copy of any data to ensure distribution and acquisition of primary source.
10. **QR Technology** - form of technology that utilizes a barcode made from pixels drawn inside a square grid that stores information and is obtained through scanning of devices.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Chapter 2

REVIEW OF LITERATURE AND STUDIES

The digitalization of dental records utilized for forensic science

As we enter the twenty-first century, computer technology has become an essential aspect of dentistry's clinical practice. Dental practitioners should be well-versed in dental records since they have legal and forensic implications in the identification of missing and deceased individuals, as well as the payment of insurance claims. In the United States and Europe, dental record maintenance is required by law, but in India, dentists are unaware of this requirement, with the majority of them maintaining a low quality or no dental record at all. With the growth of digitization in dentistry, the "digital dental record" can be beneficial with a paperless charting system done on an odontogram, as well as proper diagnostic, correspondence, and financial records, along with future scheduling. The physician or employees can later examine the recorded and saved data from any workstation. (Kundu, A. et al., 2020)

As argued by Shanbhag, V. K. L. (2016), Forensic odontology is a field of dentistry that bridges the gap between dentistry and the legal profession. A dental physician is one of the members of the forensic investigation team. Dentists have a crucial and significant part in several areas of human identification in forensic situations. Several dentists and legal professionals, on the other hand, are completely unaware of this fascinating element of forensic dentistry. There was a desire to fill this void. The



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

dentist's dental record is a legal document that comprises both subjective and objective information about the patient.

Forensic dentistry deals with proper handling, examination, and evaluation of dental records, which are then presented in the interest of law for justice. It plays a major role in identification of deceased individuals who cannot be identified visually or by other means after mass disasters or crimes. Digital forensics has revolutionized the traditional forensic investigations in terms of acquisition, analysis, and reporting of forensic evidence and its application is becoming common in the mass disasters, earthquakes, and terrorism. Sophistication of software and advent of digital technologies such as computers, computer-aided design computer-aided manufacturing systems, digital records, facial reconstruction, touch-free autopsy, and virtopsy has resulted in quick identification and extraction of a large amount of data with reduced sampling bias. This paper focuses on the evolution of forensic dentistry for effective detection and resolution of medico-legal matters and also highlights the use of comparison microscopes and new robotic tools by few forensic laboratories for automation of deoxyribonucleic acid sampling processes for human identification, as contested by Nagi, R. et al. (2019)

Oral Health as a worldwide disease

Oral health is an essential component of overall health, and it is also a major indicator of well-being and quality of life, according to the World Health Organization (WHO, 2016). A recent definition from the World Dental Federation (FDI) highlights that 'oral health is multifaceted and includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey a range of emotions through facial expressions with



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

confidence and without pain, discomfort, and disease of the craniofacial complex' (Glick et al., 2016). The WHO also promote a worldwide increase in awareness towards it as the former can have a significant impact on people's lives, causing pain, discomfort, disfigurement, and even death because it affects physiological functions like mastication and pronunciation, and is also linked to cardiovascular (heart disease), endocrine (diabetes), respiratory (chronic obstructive pulmonary disease, COPD), and other systemic diseases.

According to the systematic review of the global burden of oral disease in 2010 written by Marcenas (2013), it shows that 3.9 billion people worldwide suffer from oral diseases, of which the most common is untreated caries of permanent teeth. In addition, the global burden of oral disease has gradually changed from tooth loss to periodontal disease and untreated dental caries, which was agreed by the Global Burden of Disease Study 2017 (Afshin, A. et al.) Therefore, oral diseases are widespread worldwide (Reda, S. et al., 2018)

Oral health of child and adult

Dental caries or tooth decay is the most common condition worldwide. Despite advances in recent decades, there is still a substantial disease burden in childhood. This was shown in a study made by Wang et al., (2021), that focused on the distribution of dental caries in 12- and 15-year-olds in England, Wales, and Northern Ireland, by severity threshold, at the surface, tooth, and child level, and the relationship between socioeconomic, psychological, and behavioral factor. In accordance with this, there has also been a growing number of studies about the oral health of adults. According to Ortiz-Barrios et al. (2019), a major factor that affects this concern is that adults, more



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

than any member of the population, do not regularly have their oral health checked. This leads to more cases in oral cavity deficits, and possibly chronic diseases that result in them losing their teeth, along with other circumstances.

In another study, as stated by Manski et al. (2016), the 2008 Health and Retirement Study (HRS) gathered data on patterns of dental care use and oral health from people aged 55 and up in the United States. Fillings, inlays, or bonding were the most typically used service type, reported by 43.6 percent of patients with any utilization. A little more than a third of those who had any utilization reported a visit for a crown, implant, or prosthesis, and a quarter reported gum treatment or tooth extraction. Denture, dentate, and oral health condition, as well as dental insurance coverage and wealth, are the most consistent determinants of use type.

Advancement of Technology in Dentistry

Information Technology advancement has helped in improving a lot of fields, including dentistry. According to a research conducted by Handayani et al. (2016), the integration of information technology (IT) in hospitals and health facilities has become an increasing trend nowadays. The continuous improvement has helped professionals in creating a new trend in the field, particularly digital dental solutions and the respective educational field, which can test the performance of traditional methods.

According to a study conducted by Huang et al. (2018), one of the most used forms of dentistry technology is the image-Guided therapy (IGT), and image-guided interventions (IGI), image recognition, and tracking system that helps in giving accurate locations, as well as tracking surgical instruments instantly. Another advancement in



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

dentistry technology is medical imaging. An example is CT scan technology, one that has a good tracking system and prevents surgery risks and mistakes.

Due to the advancement in our technology, files and records can also be stored digitally in order to preserve them for later use. One of popular online storage is the cloud. The use of cloud-based practice management software isn't going away anytime soon. It contributes to a more flexible work-life balance for employees, improves security for confidential patient information, and enables major DSOs to centralize, standardize, and develop by delivering enhanced reporting.

The improvement of technology in this field certainly shows that it has the potential to create more systems and other types of inventions that can bridge gaps in certain situations in the dentistry field. There are more and more situations in dental clinics that technology can resolve, for instance trend analysis, if the resources and knowledge are adequate to create a functioning system.

Centralized Health System in Indonesia and Its data

In Indonesia, according to Petroudi and Giannakakis, (2011), information systems that are categorized as e-health in the IT field (Rawabdeh, 2007) is called Hospital Information System (HIS) or Clinical Information System (CIS), and these are designed to provide users with an effective solutional process. Along with the needed data, this system guides patients on all the activities in the hospital, starting from the registration to the facility, up to the payment of bills. The HIS is vital not only to the citizens, but also to the government. It gives them access to the health information of a certain patient and lets them be able to decide for specific situations, such as healthcare



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

facility management, financial constraints, and many more (World Health Organization, 2001).

Added to this and as the latest information, according to Handayani et al. (2019), there is also a centralized, developed system for all citizens called the National Health System (NHS). It is an implementation of a health program called the National Health Insurance (NHI) which helps citizens get the best of their healthcare access given by the government. NHS aims to provide citizens with low-cost but efficient health services using a referral system that assigns uniform tasks for health facilities. This system is highly convenient as well, as stated by the Ministry of Health of the Republic of Indonesia (MOH), because it helps the patients be settled and taken care of by the first health facility, which prevents individuals from shifting from one hospital to another. Furthermore, it also saves citizens a lot of time from other unnecessary businesses. It is stated in the MOH Regulation 001/2012 that the system assigns uniform duties among health facilities on a corresponding basis, and that all citizens must undergo the NHI process in terms of health insurance.

Furthermore, Law Number 14/2008 on the Public Information Disclosure states that all healthcare facilities must provide valid and appropriate health information to relevant stakeholders when needed. This ensures that the system not only focuses on efficient healthcare service, but also providing the necessary data in a professional approach. This literature helps in emphasizing how healthcare data must be handled by information systems. It must be accurate and can be provided anytime by the proponents and the facility. It must also be transparent to the authorized personnel, and only to them, in order to comply with the Data Privacy Act of 2012.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Added to this, according to Benning et al. (2020), data must be classified and organized clearly. There must also be analysis of application components since these can be changed through time. Finally, there must be an analysis for the physical components of the system. Examples are networks, servers, and workstations. This analysis can help in mapping out strategic plans of the system for longer periods of time and help in managing the information to guarantee the longevity and efficiency of the system.

The information found in this literature can help the researchers in ensuring the efficiency of the system. All aspects regarding the creation of the system are tackled and must be met accordingly to comply with the standards of existing hospital information systems. This way, the dental experts, personnel, and patients can be reliant on the operation of the system and be guaranteed of its function.

SYNTHESIS OF THE REVIEWED LITERATURE AND STUDIES

According to Dalanon, J., and Matsuka, Y. (2020) in their 10-year analysis of the behavior of Filipinos in internet search about the trends in Oral Health from October 2009 to 2019, dentures, dental braces, and tooth decay are the top search terms in the Philippines. As a conclusion to the analysis, the most common health problems in the Philippines are dental caries and edentulousness.

Ong (2016) indicated that law enforcement and dentists have revived a 38-year-old project to establish a centralized dental record system that can assist in crime solving and disaster response. Presidential Decree 1575, signed in 1978, required all practicing dentists to "keep and maintain an accurate and full record of all their patients'



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

dentition, which shall include a history and description of the patient's dentition and the treatments done." After ten years, dentists were also compelled to send dental records to the National Bureau of Investigation (NBI) for record purposes.

The NBI convened over 300 dentists and forensics practitioners for a discussion on the institutionalization of a standard dental data record system. During the discussion, NBI Director Virgilio Mendez stated that the agency's dental records would be extremely useful in identifying victims of disasters and crimes, and that dental records are more practical to utilize than DNA testing.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Chapter 3

METHODOLOGY

This chapter described precisely the methodology used and the structure of the research specifically the research design, flowchart of research design, research instrument used, and design project flow.

Research Design

This study will use a quantitative experimental research approach. This approach focuses on the number of people that are deemed relevant to the study. It is also best used for studies with large sample sizes, which is applicable to patients of dental clinics. For this research, the proponents will apply a quantitative approach by utilizing surveys to determine the effectiveness of the centralized system. Responses will be represented by numerical data to illustrate how effective the system is according to the patients and dental clinic associates. At the same time, the same approach shall be used in computing the response time between patient QR reading and dental history notification. The researchers will also select a total of five (5) dental clinics in Quezon City for this study. According to the Philippine News Agency, this area is the biggest city in Metro Manila with a territorial jurisdiction of 171.71 square kilometers and a population of 2,960,048 as of 2020, ensuring that a lot of individuals regularly check-up in varying clinics.

Flowchart of Research Design

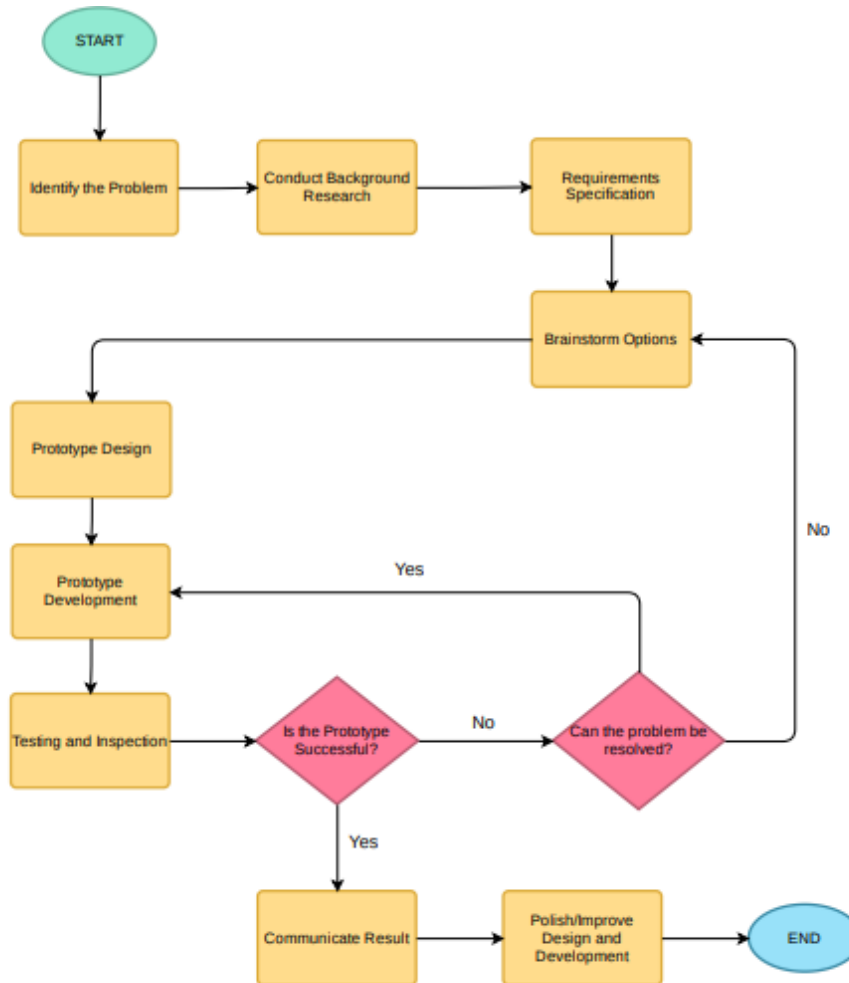


Figure 3. Process Flowchart

Figure 3 Depicts the flowchart of research design, an oval is shown to symbolize the start of the process, next is to identify the problem of our research, then conduct background research wherein we, the researchers, will find solutions to aid the problems we want to resolve. Next is requirements specifications which will be enforced on the device's design and implementation, where brainstorming options will be essential. After the prototype design has been completed, the prototype development



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

will be created. Subsequent to the development of the prototype, the testing and application will commence. If the prototype is successful, the researchers will communicate the result, polish the prototype design and development, and end the process. Otherwise, if the problem can be resolved, it will repeat the prototype development. If not, the last resort would be to brainstorm other options, leading to a new approach to prototype design and so on, until the result exhibits success.

Description of Research Instrument Used

The researchers will use t-test for the comparison of the data in order to interpret the results. The t-test is a statistical test for comparing the means of two groups. It's frequently used in hypothesis testing to see if a method or treatment has an effect on the population of interest, or if two groups differ from one another.

Design Project Flow

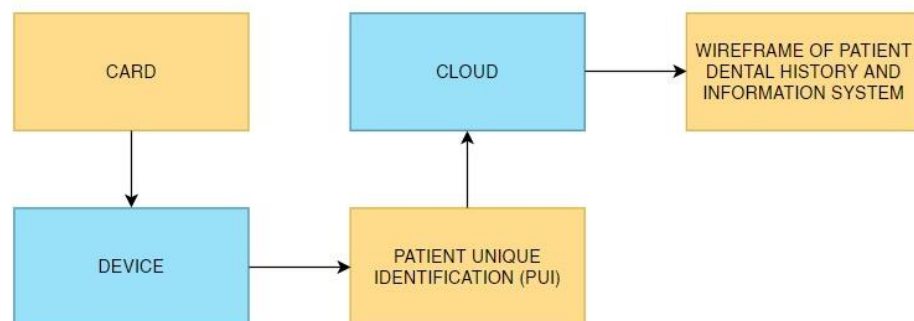


Figure 4. Block Diagram

Figure 4 depicts the complete research process in this section of the paper. It begins with a card, which is one of the results of our study, it will be inserted into a device that scans the QR code on the card and, if the QR code



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

is read correctly, it will prompt the user to provide their own Patient Unique Identification Number (PUI). The PUI is the patient's four-digit password, which he or she must enter here. Once validated, it will ask for or gather information from the cloud, and then display the Wireframe of the Patient Dental History and Information System.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

References

- Access GBDH, Quality C. Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016. *Lancet*. 2018;391(10136):2236-2271
- Afshin, A. et al. Health effects of dietary risks in 195 countries, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 393, 1958–1972 (2019).
- Benning, N. H., & Knaup, P. (2020). Hospital Information Systems. *Studies in health technology and informatics*, 274, 159–173. <https://doi.org/10.3233/SHTI200675>
- Bridges, S. M. et al. Development of functional oral health literacy assessment instruments: application of literacy and cognitive theories. *J. Public Health Dent*. 74, 110–119 (2014).
- Dalanon J, Diano LM, Esguerra R, et al. The Cebuano mothers' willingness to pay for dental healthcare. *The Journal of the Philippine Dental Association*. 2018;65(2):33-37
- Dalanon, J., & Matsuka, Y. (2020). A 10-YEAR analysis of internet search trends of the Oral Health–Seeking behavior of Filipinos. *Poverty & Public Policy*, 12(2), 175-187. doi:10.1002/pop4.280
- Definitions. (n.d.). Retrieved from <https://www.npdb.hrsa.gov/guidebook/CDefinitions.jsp>
- Glick, M., Williams, D. M., Kleinman, D. V., Vujcic, M., Watt, R. G., & Weyant, R. J. (2016). A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *British dental journal*, 221(12), 792-793.
- Handayani, P. W., Sandhyaduhita, P. I., Hidayanto, A. N., Pinem, A. A., Fajrina, H. R., Junus, K. M., Budi, I., & Ayuningtyas, D. (2016). Integrated Hospital Information System Architecture Design in Indonesia. In T. Iyamu, & A. Tatnall (Ed.), *Maximizing Healthcare Delivery and Management through Technology*



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

- Integration (pp. 207-236). IGI Global. <http://doi:10.4018/978-1-4666-9446-0.ch013>
- Huang, T. K., Yang, C. H., Hsieh, Y. H., Wang, J. C., & Hung, C. C. (2018, April 1). Augmented reality (AR) and virtual reality (VR) applied in dentistry. *Kaohsiung Journal of Medical Sciences*. Elsevier (Singapore) Pte Ltd. <https://doi.org/10.1016/j.kjms.2018.01.009>
- Information system. (n.d.). Retrieved from <https://www.britannica.com/topic/information-system>
- Kundu, A., Nedunuri, L. S. S., Chand, A., & Johnson, A. (2020). Digitization Of Dental Records And Its Application In Forensic & Legal Perspective: Knowledge, Attitude And Practice Among The Dentists In West Bengal. *National Journal of Integrated Research in Medicine*, 11(2).
- Le, H. et al. Oral health disparities and inequities in Asian Americans and Pacific Islanders. *Am. J. Public Health*. 107, S34–S35 (2017).
- Manski, R. J., Hyde, J. S., Chen, H., & Moeller, J. F. (2016). Differences among older adults in the types of dental services used in the United States. *INQUIRY: The Journal of Health Care Organization, Provision, and Financing*, 53, 0046958016652523.
- Nagi, R., Aravinda, K., Rakesh, N., Jain, S., Kaur, N., & Mann, A. K. (2019). Digitization in forensic odontology: A paradigm shift in forensic investigations. *Journal of forensic dental sciences*, 11(1), 5.
- Ong, G. (2016) Government revives centralized dental record system. *The Philippine Star*.
- Ortíz-Barrios, L. B., Granados-García, V., Cruz-Hervert, P., Moreno-Tamayo, K., Heredia-Ponce, E., & Sánchez-García, S. (2019). The impact of poor oral health on the oral health-related quality of life (OHRQoL) in older adults: The oral health status through a latent class analysis. *BMC Oral Health*, 19(1). <https://doi.org/10.1186/s12903-019-0840-3>
- Petersen, P. E. (2003). The World Oral Health Report 2003: continuous improvement of oral health in the 21st century—the approach of the WHO Global Oral Health Programme. *Community Dentistry and oral epidemiology*, 31, 3-24.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

- Putu Wuri Handayani, Ave Adriana Pinem, Fatimah Azzahro, Achmad Nizar Hidayanto, Dumilah Ayuningtyas. The Information System/Information Technology (IS/IT) practices in the Indonesia health referral system, *Informatics in Medicine Unlocked*, Volume 17, 2019, 100263, ISSN 2352-9148, <https://doi.org/10.1016/j.imu.2019.100263>.
(<https://www.sciencedirect.com/science/article/pii/S2352914819302527>)
- Recordkeeping. (n.d.). Retrieved from <https://www.dictionary.com/browse/record-keeping>
- Shanbhag, V. K. L. (2016). Significance of dental records in personal identification in forensic sciences. *Journal of Forensic Science and Medicine*, 2(1), 39.
- Si, Y., Tai, B., Hu, D., Lin, H., Wang, B., Wang, C., . . . Wang, X. (2019, June). Oral health status of Chinese residents and suggestions for prevention and treatment strategies. *Global Health Journal*, 3(2), 50-54. doi:10.1016/j.glohj.2019.06.004
- Sophie F. Reda, Seif M. Reda, W. Murray Thomson, Falk Schwendicke, "Inequality in Utilization of Dental Services: A Systematic Review and Meta-analysis", *American Journal of Public Health* 108, no. 2 (February 1, 2018): pp. E1-e7.
- Tooth Disorders. (2021, April 12). Retrieved from <https://medlineplus.gov/toothdisorders.html>
- W. Marcenes, N.J. Kassebaum, E. Bernabé, et al. Global burden of oral conditions in 1990–2010: a systematic analysis *J Dent Res*, 92 (7) (2013), pp. 592-597 ----- original link (1)
- Wang, X., Bernabe, E., Pitts, N., Zheng, S., & Gallagher, J. E. (2021). Dental caries thresholds among adolescents in England, Wales, and Northern Ireland, 2013 at 12, and 15 years: implications for epidemiology and clinical care. *BMC oral health*, 21(1), 1-14.
- What Is Dentistry? (n.d.). Retrieved from <https://www.allseasonsdentalkent.com/contents/for-patients/dental-faqs>
- What Is the Difference Between a Dental Clinic and a Dental Office? (2015, August 27). Retrieved from <https://karengordondmd.com/what-is-the-difference-between-a-dental-clinic-and-a-dental-office/>



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

WHO Centre for Health Development (Kobe, Japan). (2002). Global review on oral health in ageing societies. Kobe, Japan : WHO Centre for Health Development.
<https://apps.who.int/iris/handle/10665/67584>



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

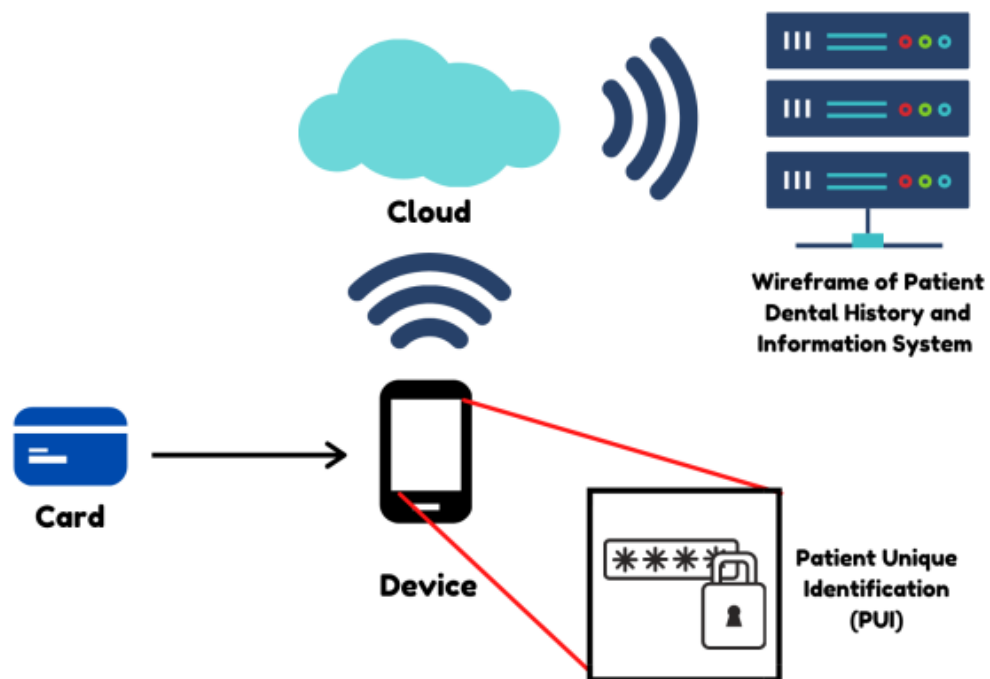
APPENDICES



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Appendix 1

DESIGN PROJECT PROPOSAL PROTOTYPE DESIGN





POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Appendix 2

DESIGN PROJECT PROPOSAL DEFENSE 2021 SUMMARY OF COMMENTS REPORT

NO.: CPERC-2021-PROP-POE-R-000067

GROUP CODE	3702	ADVISER	Engr. John R. Dela Cruz
SECTION	BSCpE 3-7P		

THESIS TITLE	Trend Analysis of Dental Activities utilizing the Patient Dental History Information System (PDIS) in selected dental clinics at Quezon City
---------------------	--

	NAME OF PANEL
PANEL CHAIR	Dr. Antonio Y. Velasco
PANEL MEMBER 1	Engr. Arlene B. Canlas
PANEL MEMBER 2	Engr. Jan Reuelle P. Teña

	COMMENTS	RECOMMENDATIONS
PANEL CHAIR	-	-
PANEL MEMBER 1	Change the title of the proposal according to the suggestion given	Strictly consider the following: No trend analysis system Change your proposal to centralize the database of 5 selected dental clinics, Use QR code reader and card for regular patients
PANEL MEMBER 2	-	Check References, it should be data from the current year minus 5 years. Centralized the dental clinics database for the 5 mentioned. Check where the 5 QR code's will be place it could either be on the phone or the card that will be used by the patient.

NOTE: The data shown above are acquired from the filled-out Panel Evaluation Form in Google Forms. Should there be any error on this report, please notify the CpE Research Committee for verification.



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Appendix 3

LIST OF DENTAL CLINICS IN QUEZON CITY

Smile Factory Dental Clinic

Facebook Account: <https://www.facebook.com/smilefactorydc/>

Contact Number: (02)7907-4769 / 0917-6215121

Email Address: smilefactorydentalclinic@yahoo.com

Clinic Address: Lot10 Block 83, 2nd flr., Regalado Hwy (near SM Fairview in front of STI College), North Fairview, Quezon City, 1424 Quezon City, Philippines

SJS Dental Suite / Dr. Sara Singian

Facebook Account: <https://www.facebook.com/SjsDentalSuite/>

Contact Number: 0917 677 2170

Email Address: sjs.dental@yahoo.com

Clinic Address: UP Wet and Dry Market (Philcoa) Commonwealth Ave. 1101 Quezon City, Philippines

Urban Smiles Dental Clinic

Facebook Account: <https://www.facebook.com/urbansmilesph/>

Contact Number: 0939 - 9382271 / 0917 - 1680289 / (02) 795 - 4758

Clinic Address: Ground Floor, Intrepid Plaza, Eastwood City, Libis, Quezon City

North Smiles Dental Office

Contact Number: (02) 8374 1467

Clinic Address: 160 ENC5 Tower Mother Ignacia Ave. cor. Samar Ave., Room 206, Quezon City, 1103 Metro Manila

Smile Solutions Anonas

Facebook Account: <https://www.facebook.com/smilesolutionsanonas/>

Contact Number: 0966 328 2455

Email Address: smilesolutionsdoctors@gmail.com

Clinic Address: 1 Ground Floor Manahan Building, Anonas Street Corner Aurora Blvd. Barangay Quirino, Project 2-3 Quezon City 1102 Quezon City

Symmetry Dental Center (Proj 4, QC)

Facebook Account: <https://www.facebook.com/pages/category/Dentist---Dental-Office/Symmetry-Dental-Center-2270295833190698/>

Contact Number: 0977 632 8194

Clinic Address: #3 J.P. Rizal corner Malong street., Brgy. Marilag, Proj. 4, Quezon City, Philippines, 1109

Bacho Dental Center

Facebook Account: <https://www.facebook.com/bachodc/>

Contact Number: 277997420



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Email Address: *bachodentalclinic@gmail.com*

Clinic Address: *361 P. Tuazon Blvd. Project 4 1109 Quezon City, Philippines*

Partida Dental Clinic

Facebook Account: *<https://www.facebook.com/partidadentalclinic/>*

Contact Number: *0977 049 0184 / 02-72150478*

Email Address: *partidadentalclinic@gmail.com*

Clinic Address: *377 P. Tuazon Street Project 4, Quezon City Brgy. Marilag*

Smile Creations Dental Clinic QC

Facebook Account: *<https://www.facebook.com/SmileCreationsDentalQC/>*

Contact Number: *+63-917-319-80-13 / (02) 7617-05-80*

Email Address: *smilecreationsdental.qc@gmail.com*

Clinic Address: *Unit 101 G/F Tomasca Bldg., #273 Col. Bonny Serrano Ave. (almost corner 20th Ave.) Murphy Cubao, Quezon City*



POLYTECHNIC UNIVERSITY OF THE PHILIPPINES

Appendix 3

DRAFT OF LETTER OF INTENT



REPUBLIC OF THE PHILIPPINES
POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
COLLEGE OF ENGINEERING
COMPUTER ENGINEERING DEPARTMENT

March __, 2022

Dr/ Dra

Position

Dental Clinic

Clinic Address

Dear _____:

Greeting in unvarying pursuit of academic excellence.

We, Guia Angela C. Agoncillo, Alvin Dale G. Alejo, Hillary Mae L. Almonte and Reina Ivanna Camille B. Sandig, are bonafide 4th year Computer Engineering student from the Polytechnic University of the Philippines, Sta. Mesa and currently enrolled in Computer Engineering Practice and Design 1. The major requirement of this course is to identify possible research problems within the area and propose a solution to the identified problems.

On this note, we want to humbly ask for your participation to be the beneficiary of our study. The researchers will develop a Centralized Patient Dental History and Information System Utilizing Quick Response (Qr) Technology which aims to help in handling large number of patients every day and helps the healthcare industry in terms of file management, record keeping, and convenience. We are also respectfully requesting your assistance by allowing us to deploy our prototype in your respective clinics. In addition to that, we would also conduct interviews and or questionnaires if needed.

Should this request merit your considerate approval, be assured that any information shared by your institution will be treated with strict confidentiality.

We are hoping for your appropriate action and favorable response upon this matter.

Respectfully Yours,

Guia Angela C. Agoncillo
Researcher, Computer Engineering Student

Alvin Dale G. Alejo
Researcher, Computer Engineering Student

Hillary Mae L. Almonte
Researcher, Computer Engineering Student

Reina Ivanna Camille B. Sandig
Researcher, Computer Engineering Student

Noted By:

Engr. Florinda H. Oquindo
Adviser, Computer Engineering Practice and Design 1