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MediCord: A Web-Based Health Record Management System

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Abstract: ***Information technology (IT) is vital in managing data for effective and timely decision-making. IT also allows the sharing of data and information more securely and efficiently. Since the coronavirus 2019 (COVID-19) has caused a significant impact on the way people perform tasks and processes in the "new normal," IT solutions have become key to continuing performing and administering different tasks and activities. Information technology applications ensure the safety of every individual in a community through an electronic process that replaces the manual activities of recording and sharing data. This study aimed to design and develop an information technology-based application called MediCord: A Web-Based Health Record Management System. Developmental research was utilized in this study. MediCord has been developed for a health center in one of the municipalities in Nueva Ecija, Philippines. Results showed that proponents successfully designed and developed the system by following the software development life cycle (SDLC) stages. Furthermore, following the SDLC has allowed the proponents to develop several diagrams that have served as vital tools for project construction. Proponents suggested that after the design and development of the system, the remaining stages of SDLC be conducted, and the actual assessment of the project be based on industry-accepted and widely used appropriate standards. This opens opportunities for future studies as a result of the current project.***

Keyword: -Software Design, Software Development. Software Development Life Cycle

1. INTRODUCTION

The coronavirus disease 2019, or COVID-19, is a severe threat to the Philippines' health system because it significantly influences the nation's growth. Consequently, this pandemic worsens the Philippines' existing public health system's flaws and inequities [1]. Additionally, [1] added that the country was anticipated to be overwhelmed by the spike of COVID-19 cases,

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just like every other nation whose healthcare infrastructure has been put to the test. The enormous surge in confirmed COVID-19 infections puts national and local authorities under pressure to develop a clear strategy to stop the virus' spread. One immediate response to mitigate the increasing number of active cases was community lockdowns. Community lockdown aims to stop the rising number of active cases and spread of the virus, safeguard the populace, and develop strategies and plans to decrease the pandemic's harmful effects. Crafting innovative ideas and programs is vital in difficult times like a pandemic.

Improvisation, local efforts, and inventive solutions are needed to deal with the quickly developing COVID-19 situation. In healthcare records management, the need to come up with innovative solutions for handling records while ensuring safety is much needed. In order to reduce the time spent on adding, updating, and maintaining medical information, the proponents developed a web-based solution to address the problems and difficulties encountered in recording files and records using a manual process.

In the past, several studies have been conducted related to medical records management, such as [2], which deals with designing electronic medical records management systems for continuous patient care, and [3], which focuses on monitoring residents' medical information. These studies related to medical record management systems provide necessary information for developing the project. Further, it is essential to consider that in the design and development of the system, the application must be able to dynamically respond to the user's actions to provide a more engaging experience [4]. These features, included in a web-based solution, are not present in the manual way of recording files and records. What is typically presented includes the problems in handling these records.

Problems may include record and data redundancy and inconsistency; unauthorized access of medical files and records; security and storage of the files; and the timely generation of reports for decision-making purposes. Also, the need to come up with an innovative solution to share medical clearances with other communities as a prerequisite for traveling from communities under lockdown was necessary. The developed solution also prevents the spread of the virus while ensuring a more efficient and effective way of managing records.

As mentioned, one of the prerequisites for leaving the neighborhood in locations under community lockdown is to undergo a medical examination that serves as a clearance. Health centers provide a clearance to ensure receiving communities that individuals who wish to travel are safe, healthy, and virus-free. The developed system has the feature of safely managing and storing every person's medical record in conformance with the data privacy act of the country. Further, the developed system guarantees a more secure means of sharing medical clearances with other communities.

In order to handle the files and data in the community health centers effectively, this project, entitled "MediCord: A Web-Based Health Record Management System for Local Communities," aims to offer an information technology-based solution. It also seeks to record

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and evaluate data necessary for decision-making correctly. Additionally, it aimed to raise the standard of procedures followed while obtaining and issuing medical records and approvals.

1.1 Objectives of the Study

In general, this study aimed to design and develop a web-based health record management system for local communities. Specifically, it intended to present the Software Development Lifecycle stages and activities undertaken by the proponents in the design and development of MediCord in terms of:

1.1.1. Planning and Requirements Analysis;
1.1.2. Design;
1.1.3. Development;
1.1.4. Testing.

1.2 Scope and Limitations

MediCord was created to offer a quick and easy solution to capture medical information used in community health centers. It was designed to address problems associated with manual information recording, including data duplication, illegal access to files and records, and the generation of timely and pertinent reports. It also intends to address the challenges associated with ensuring that people leaving their communities are secure, healthy, and COVID-19-free. The technology was particularly created for use in a medical facility. The system did not cover complex medical records and information. The system took individual data security and privacy into account. As a result, only a limited amount of data is stored with each person's permission.

In the design and development of MediCord, typical stages of the Software Development Life Cycle (SDLC) were followed. However, this study did not cover deployment and maintenance stages due to uncontrollable challenges and constraints.

1.3 Significance of the Study

Due to the developed system's ability to manage files and records electronically more securely, effectively, and efficiently, community health centers may find it useful. Additionally, because data is safeguarded by utilizing a database, it reduces the workload of community health center staff who record, update, and search for records. Individuals can also benefit from MediCord since it makes it simple to acquire medical data and clearance quickly and more securely.

2. MATERIALS AND METHODS

Developmental research was used in the system's design and development. The "systematic study of creating, producing, and assessing educational programs, processes, and products that must fulfill the criteria of internal consistency and effectiveness" is the main emphasis of developmental research [5]. Several software development projects were undertaken using the developmental model to construct computerized systems [6] [7]. These studies conducted have efficiently used time and available resources for the project. In this

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study, proponents carefully followed and executed the Software Development Life Cycle (SDLC) stages to design and develop the system. The processes were based on the activities undertaken in the community health center in one of the barangays in the municipality of San Antonio, Nueva Ecija, Philippines. Furthermore, several data gathering techniques were employed, including observation following strict health protocols; online and onsite interviews with the health care center personnel; and extensive review of related literature and systems using available resources.

The studies of [8] [9] and [10] applied developmental research design in designing information systems and were able to come up with a relevant application that addressed identified problems and provided significant solutions. Thus, applying this design can aid the proponents in the attainment of the identified objectives of this study.

3. RESULTS AND DISCUSSION

3.1 Planning and Requirements Analysis Stage

Planning is the process that helps project proponents choose how to use the resources (people, time, money, information, and equipment) at their disposal in the most efficient way possible to achieve their objectives. Several things were done at the planning stage. The construction of a Gantt chart is a crucial task. The Gantt chart is a reference for the project's proponents on the time invested in its development. The ability to track their progress and determine whether they are on schedule or not, as well as how well they are doing the project, is helpful to the project's proponents. The results of constructing the Gantt chart allowed the proponents to visualize and deeply understand the relevant times for the development of the project.

Requirements are also examined throughout the planning phase. These are based on the data collection efforts made by the proponents. The system's end users and other beneficiaries provide the requirements. These are in line with the features, operations, and crucial tasks carried out at the health facility. As a result, requirements analysis gives system proponents a better grasp of how to build the system. Proponents gathered requirements through observation in the health center with strict compliance to protocols, onsite and online interviews, and extensive review of documents available, which helped them in the conduct of the project.

3.2. Design Stage

Software design is the process of creating software methods, functions, objects, and the general structure and interaction of code. The goal is to provide functionality that satisfies user needs. At this lifecycle stage, representations of the complete system components and behaviors are presented. Design principles must be carefully followed and implemented to achieve a robust, maintainable software system. At this stage, the proponents designed the components that make up the system's back-end and front-end.

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The use-case diagram is relevant in the project because it provides a better description of the high-level functions and scope of the system. Also, the use-case diagram enables the proponents to understand the activities to be undertaken by each user in the system. Meanwhile, the Data Flow Diagram (DFD) graphically presents complex processes in a more detailed way. By understanding the DFD, the proponents were able to efficiently construct the relevant procedures for the system. The Use-Case Diagram and Data Flow Diagram are all necessary tools in conducting this stage of the software development life cycle. Figures 1, 2, and 3 present the use-case scenario and the data flow diagram of the developed system, respectively.

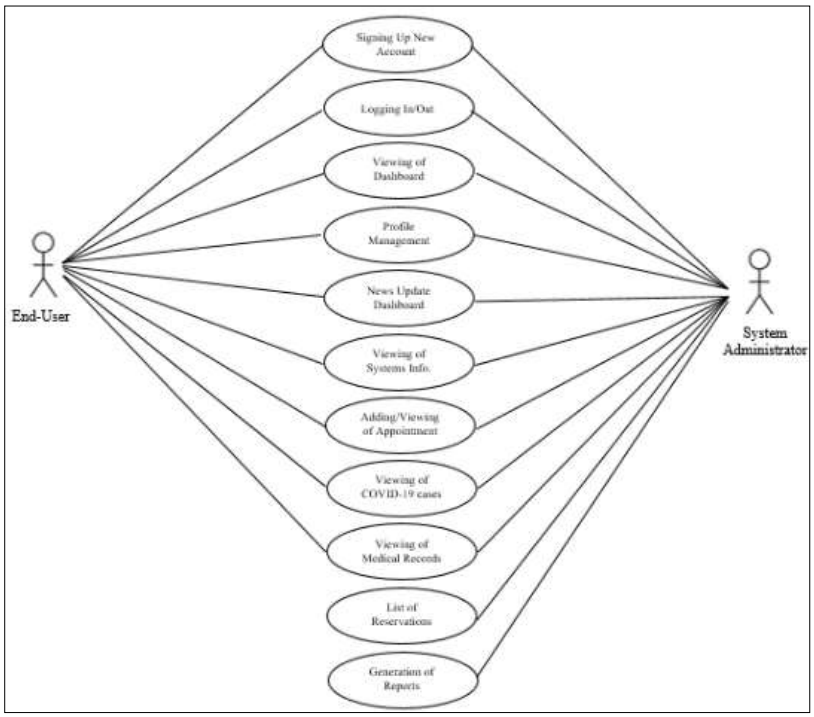

Fig. 1. MediCord Use-Case Diagram

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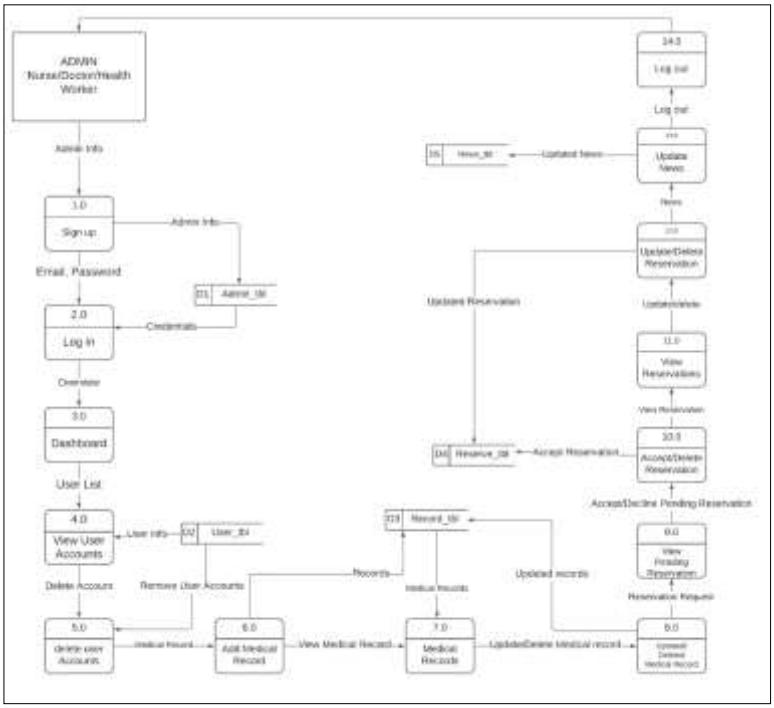

Fig. 2. MediCord Data Flow Diagram (L1) – System Administrator

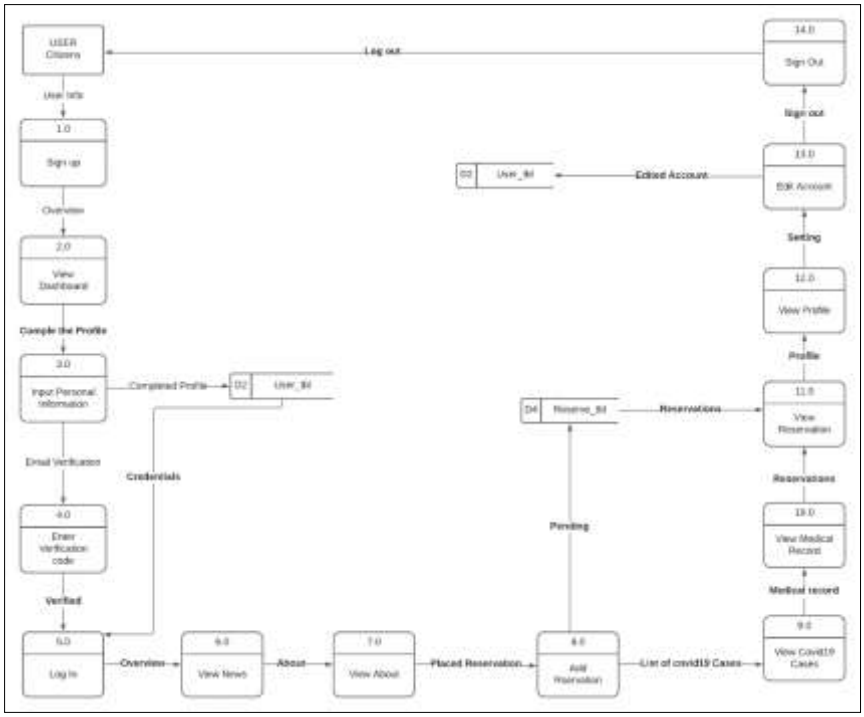

Fig. 3. MediCord Data Flow Diagram (L1) – System Users

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For database design, entity-relationship diagrams (ERD) and database normalization aid the proponents in understanding how variables will interact. Meanwhile, software was utilized to present an engaging Graphical User Interface (GUI) for the front-end of the system.



Fig 4. Normalization for MediCord

Figures 4 presents the result of creating normalization while figure 5 shows the entity-relationship diagram of MediCord

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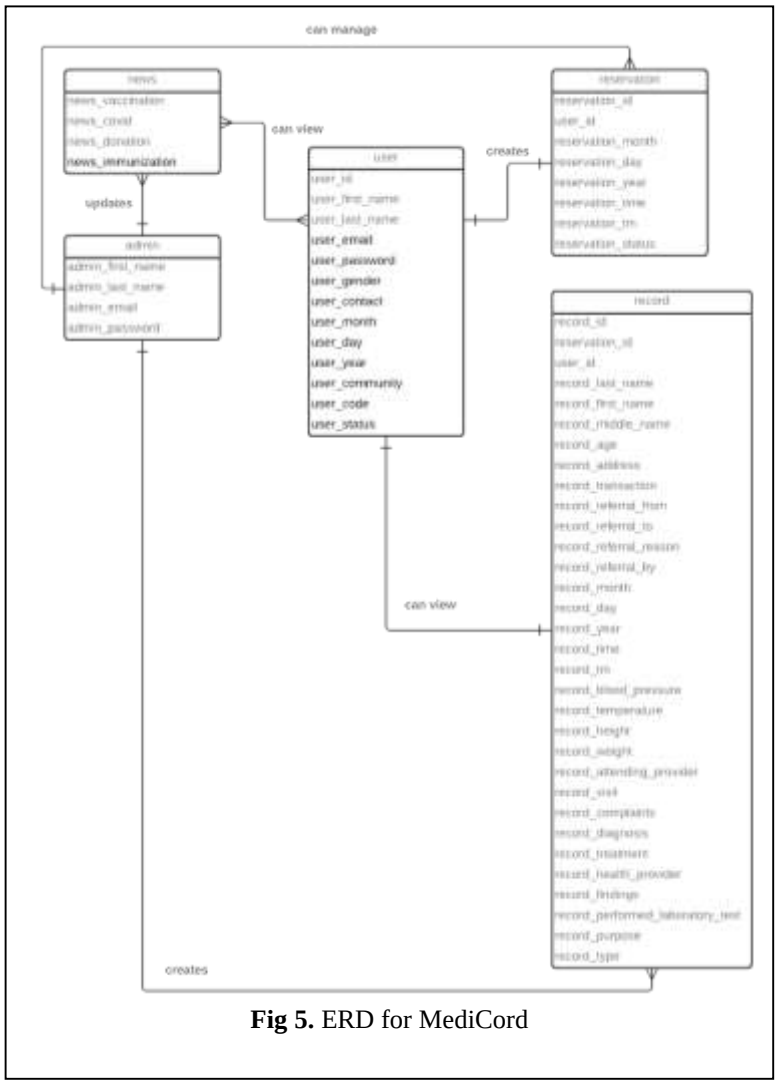

Fig 5. ERD for MediCord

3.3. Development Stage

At this stage of the SDLC, the proponents carry out the system development activities. Specifications were based on the result of the requirements analysis following the design developed in the previous stage. Also, the use of an integrated development environment (IDE) for developing the project was utilized in this stage. The proponents of programming languages such as PHP and Javascript For the database, proponents use Structure Query Language (SQL). Figure 6 shows XAMPP as the IDE for manipulating the database. Meanwhile, Figure 7 presents Sublime as the text editor used for the actual programming activity.

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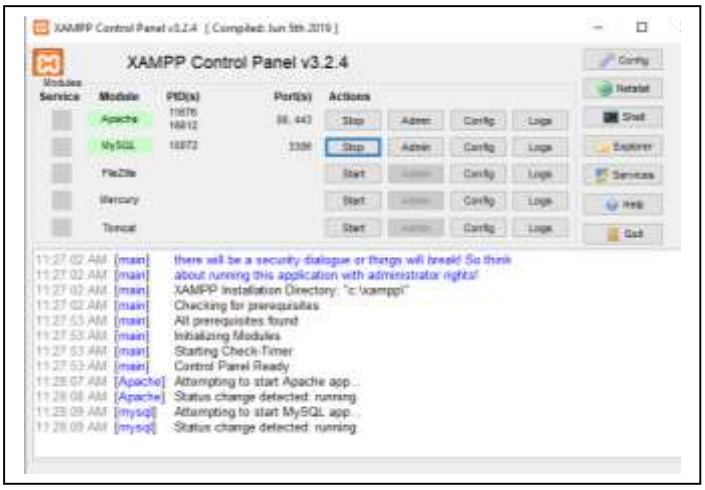


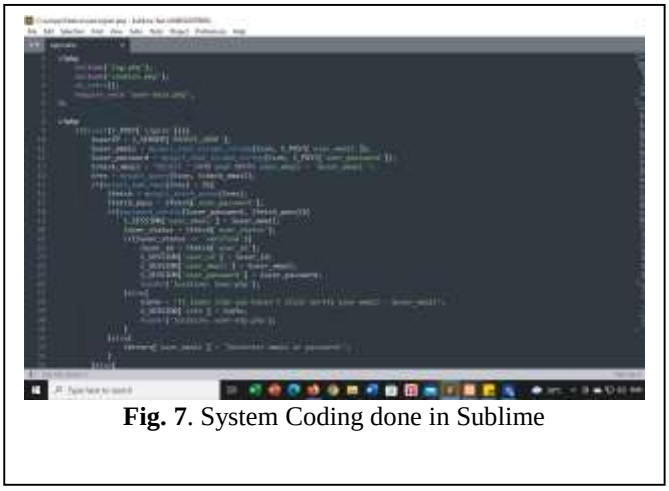
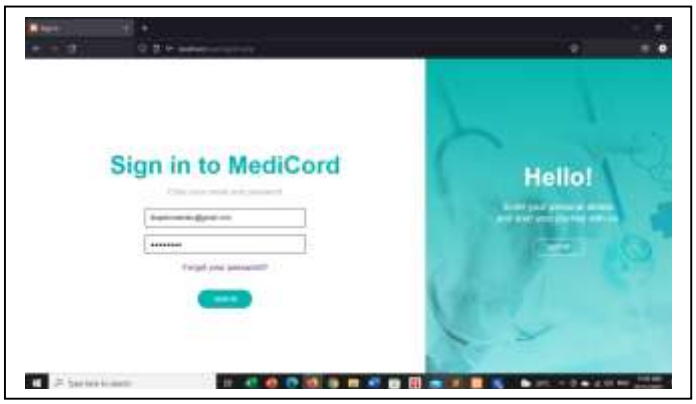


Fig. 7. System Coding done in Sublime

3.4 Testing Stage

The testing stage is a vital activity that must be performed when developing systems like MediCord to ensure the product's quality. At this stage, the proponents conducted functional testing activities. User Interface testing was done to ensure that all of the components manipulated by the end-users were appropriately placed and working. Components or modules were also tested to ensure they performed the expected actions. Test cases were utilized by the proponents, which served as a guide for them to check the overall performance of MediCord. This stage of the development was done from the proponents' viewpoint only. Several testing activities must involve end-users to ensure that MediCord will effectively perform its intended function.



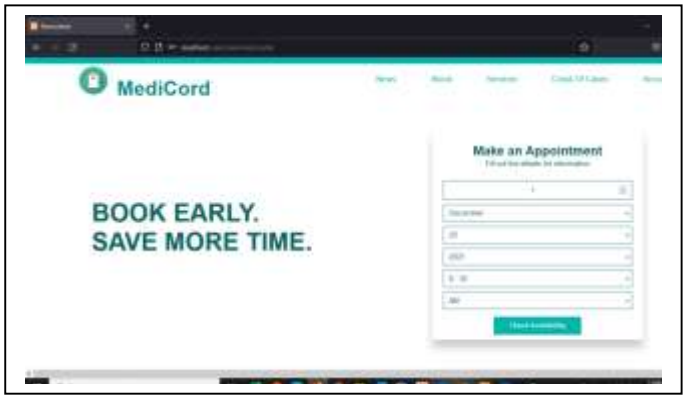


Figure 8 and 9 shows the UI of MediCord during the conduct of the testing stage.

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4. CONCLUSION

This study aimed to design and develop a web-based health record management system. It followed the typical stages of the software development lifecycle, including planning and requirements analysis, design, development, and testing. The deployment and maintenance stages were not covered in this study. Proponents have found that the system's design becomes more manageable by carefully planning and analyzing requirements. Further, the development of the system can be efficiently performed when necessary diagrams are made, which serve as a tool for the project's construction. Lastly, testing activities ensure that the developed system is performing activities as expected.

Recommendations

Based on the findings and conclusions of this study, the proponents recommend the following:

1. Future proponents of the same concept may use a more specific software development model such as waterfall, spiral, agile, and so on to determine which of these models produces a more efficient output;
2. Proponents may extend this study by employing the remaining stages of SDLC, which were not covered by the current study;
3. IT professionals can assess the quality of the developed system using widely accepted software development quality standards; and
4. The end-users can make an assessment of the functionality and quality of use to validate if the system performs the intended functions.

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