



Development of a Maternity Clinic Information Management System

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ABSTRACT

The developed web-based information management system is designed to improve the quality of maternal health care services and working conditions in a maternity clinic. Most of the maternity clinics in the Philippines still follow manual processes and utilize paper-based records. In Robles Maternity Clinic, the clinic encounters several problems like file duplication, file misplacement, unanswered inquiries, long process of appointment scheduling, unused and expired medicines. The researchers utilized Agile Scrum methodology for the development of the system. The researchers used mixed methods research to incorporate user feedback into the built solution. The data were collected through survey questionnaires which are distributed to IT professionals, College of Information and Communications Technology faculty, patients, and Robles Maternity Clinic staff and from semi-structured video interviews with a Robles Maternity Clinic representative. The findings of the study showed that the system is fully functioning and suitable to implement for a maternity clinic. The integrated functionalities in the system answer the problems that a maternity clinic encounters in its daily operation. prescriptions, and pending appointments.

Key words: Information Management; Management Information System,

1. INTRODUCTION

Information management systems are vital in healthcare and several industries. In addition, the purpose of this kind of system is to create, develop, manage, and utilize the storage and information in an organization with innovation and awareness. During the early years at the Robles Maternity Clinic, Dr. Arnel Robles and Dr. Marilou Esperanza Robles managed all the patient records during the check-up appointments. Currently, the employees use an old method of recording in actual

envelopes and record books to access and modify the information within the patient records.

In 2005, Robles Maternity Clinic became more extensive and became one of the well-known maternity clinics around Apalit, Pampanga. However, there have been several problems in the operation of the maternity clinic due to their current traditional file system. Traditional file management systems are time-consuming, expensive, and prone to errors. Patient records that are kept in this kind of system are vulnerable to misplacement, duplication, and human errors. The current system also lacks security because there are no built-in version histories. It makes it difficult for the employees because it is impossible to locate new changes and determine who modified the information within the patient records. Lastly, the traditional file system is also at risk during catastrophic events like natural disasters. Once physical files are lost, it is impossible to recover. Data loss will disrupt the operation of the clinic and damage the reputation of the Robles Maternity Clinic.

Converting a traditional file system to a 'paperless' system is a significant achievement that may help an organization enhance its operational efficiency and delivery [1]. Currently, the internet has been helpful in several industries. For example, it has become a stage for many organizations to enhance their advertising force in the market. In line with The Journal of Medical Internet Research, "The internet has recently emerged as another means to form appointments." Converting and transferring all patient records into a digitalized system helps to eliminate expensive and time-consuming processes, which leads to the clinic's increase in accessibility, office space, communication, and collaboration within the employees of Robles Maternity Clinic [2]. In addition, digitalizing the patient records would help the maternity clinic eliminate misfiling, losing, and duplicating records.

Additionally, it would allow the employees of the maternity clinic to specialize in their core competencies. The system promotes convenience for both patients and employees in the maternity clinic. Patients can schedule

an appointment online and know the services offered in the maternity clinic. The system helps the maternity clinic to lessen desk work and eliminate time-consuming tasks that employees work on regularly. The system includes a medicine inventory feature where they can add, remove, keep track of the stocks and prescribe. The staff will also be able to manage pending appointments and generate medical reports online. Doctors and midwives are going to have full access to patients' information within the system. The information kept in the system is an authorized record that might be utilized more efficiently, for example, when needed by DOH or PhilHealth.

Observation in utilizing electronic medical record audit logs can perceive various clinical activities. Moreover, the study consists of the examination of the utilization EMR (electronic medical record) and clinical functions in which the audit log focuses on monitoring actions made to the system, the activities often made to the system, duration of the activity, sequences of the activity, and cluster of activities. With that, EMR audit logs are capable of aiding the quality development of clinics [3].

Combining inventory management strategies with competitive advantages, effective inventory management provides a feasible mechanism for improving performance [4]. Organizations view logistics networks, supply chain activities, and inventory management procedures as survival and competitive advantage. According to the research undertaken in inventory management methods, incorrect management occurs through various factors, including the level of management commitment, expenditures incurred, and worker skill levels. Inventory management across the supply chain is a significant barrier to enhancing value chain coordination in enterprises. Controlling inventory is essential since it shapes an organization's future in terms of its success or failure.

1.1 Objectives of the Study

In this section, the researchers introduce the general objective and the specific objectives of the study that must be met to check the system in order to meet the study's goal.

General Objective

The aim of this study is to develop a web-based Information Management System for Robles Maternity Clinic.

Specific Objectives:

- To identify the problems encountered with the existing system;
- To integrate the following significant functionalities of the system:
 - Electronic Medical Records (EMR);
 - Patient Medical History; and
 - Medical Report & Prescriptions.
 - Medicine Inventory;
 - Stock Level Notification; and
 - Expiration Notification.
 - Online Appointment Scheduling;
 - Audit Log;
 - Messenger Chatbot; and
 - Generic Functions

- 3. To evaluate the quality of the developed system using the ISO/IEC 25010:
 - 3.1. Functional Suitability;
 - 3.2. Performance Efficiency;
 - 3.3. Usability;
 - 3.4. Reliability;
 - 3.5. Security; and
 - 3.6. Maintainability.

2. METHODS AND DESIGN

The software development methodology is the abstract representation method that serves as the foundation for planning, organizing, coordinating, and guiding software development. The majority of the models have found their way into software development, but only a few are appropriate and suitable to use in a web-based information management system [5]. Therefore, the agile model will be used for developing the information management system for Robles Maternity Clinic.

The researchers utilized Jira Software because it has several features and comprehensive tools that are useful for the chosen methodology of the study which is the Agile Scrum methodology. The software has the ability to create scrum boards which includes sprint planning and time estimation. The status of a project may be viewed on a scrum board by team members and it is also customizable to fit the workflow of the team.

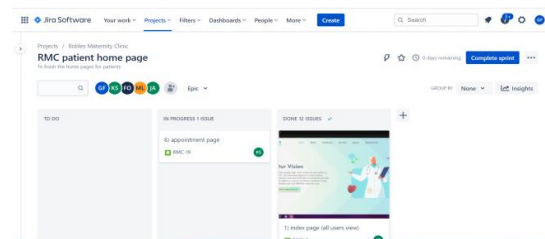


Figure 1: Jira Software (Agile Project Management Tool)

The Agile model splits the project into small iterations, each with its own set of deliverable features. Scrum is distinct from other agile processes. Scrum processes enable organizations to adapt quickly and fulfill the needs of the business [6]. The software development process like Agile is capable of following a continuous improvement cycle, exposing problems faster and eliminating waste[7]. With that, it helped the researchers in working with the system together, being organized while encountering a problem, and learning from mistakes made in the system.

Planning Phase. At the initial stage, the researchers gathered information by conducting an interview with the owner of the Robles Maternity Clinic. The researchers ensured to identify the problems faced with the traditional filing system of the Robles Maternity Clinic. The researchers also come up with significant features that should be implemented on the system. The proponents constructed a project schedule with detailed plans as well as designating tasks to the team members.

Requirement Analysis Phase. In this phase, the researchers defined and set the operational capabilities and the resources needed for the system before proceeding with the system development. The researchers gathered necessary information from Robles Maternity Clinic to determine the exact needs for implementing the system for the clinic. The information served as a foundation for the researchers to design the system for the next phase. The requirements created in this phase acts as a framework for the rest of the development process.

System Design Phase. In the course of the design phase, the researchers developed a system that converts the existing traditional file management system of Robles Maternity Clinic into a digital maternity management system. The researchers applied all the gathered information and the identified requirements from the previous phases wherein these are used to come up with the design and features for the system.

Development Phase. In the course of this phase, the researchers created a web page design for each web page. The researchers constructed the database using MySQL. For the front-end of the website, the programmer used JavaScript, HTML, CSS, and jQuery. Whilst, for the back-end of the website, the programmer used PHP and jQuery Ajax.

Testing Phase. During this phase, the proponents tested the system's input and output capability to see if it served its intended purpose. The researchers identified the number of respondents which includes the personnel at the Robles Maternity Clinic and IT experts. The received feedback and suggestions will be used for improving the developed system.

Evaluation Phase. The researchers and the proprietor of the Robles Maternity Clinic go through this process to analyze and evaluate the system to see if it fits all of the standards. The researchers looked at everything to see if there were any ways to improve the system.

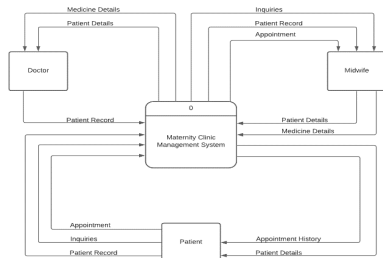


Figure 2: Data Flow Diagram Level 0

Figure 2 presents all the information inputted to the system and what information that system returns to each entity.

3. RESULTS AND DISCUSSION

The information gathered from the respondents are categorized in four parts to answer the stated objectives. The first part identifies and describes the problems in the existing system of Robles Maternity Clinic. The second

part explains the integrated functionalities in the system that will aid the maternal health care services of the clinic. The last part discusses the satisfaction level of the developed web-based information and management system concerning its functional suitability, performance efficiency, usability, reliability, security, and maintainability, as measured by ISO 25010, the Software Quality Assurance Model. In order to provide a complete interpretation and analysis of the findings, all gathered information from the respondents have been arranged in tabular form.

Part I. The Problems Encountered in the Existing System

Robles Maternity Clinic and a lot of other maternity clinics in the Philippines utilize manual processes and paper-based records until now. Through a video call with Robles Maternity Clinic owner and employees, the specific problems encountered in the services of the maternity clinic are identified. The main problem in the maternity clinic is managing patient records. Paper based records are susceptible to errors and misplacement. Patients are also complaining about the current process of appointment scheduling especially during the pandemic and because of long appointment waiting time. The employees in the maternity clinic are also unsuccessful in managing the medicine inventory since there are several cases of unused and expired medicines. The employees in the maternity clinic have difficulty in replying with the patient and potential patients inquiries. All of the identified problems in the maternity clinic daily operations are the reason why the clinic is unable to deliver quality services and cause loss in the clinic’s reputation and revenue.

Part II. Integration of Significant Functionalities of the System

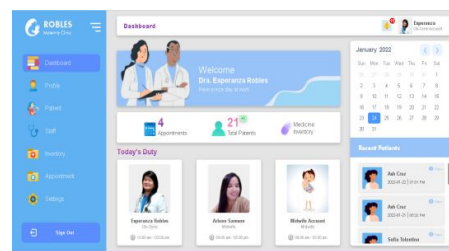


Figure 3:Dashboard (Obstetrician-gynecologist's Account)

One of the useful functionalities in the system is the employee’s dashboard where other significant functionalities of the system can be managed by the employees of the maternity clinic.

Dashboards are a tool used to summarize and integrate critical performance data from a company into a visual display to aid operational decision-making [8]. A clinical dashboard is intended to provide clinicians with the timely and relevant data they require to make daily alternatives that enhance the quality of patient care.

The following functionalities are integrated in the maternity clinic information management system are described below:

Electronic Medical Records. Patient Records. The maternity clinic can use a paperless file management system with the help of this functionality. It allows the employees to add new patients in the clinic's records and easily search for certain patient records by searching or using the filtering feature. The system also generates patient ID and date when the patient is created in the records. Aside from displaying basic information of the patient, the employees can also view the patient's appointment history, generate medical reports and export patient records as .pdf and.xlsx to have a digital and printable copy. With that, the utilization of a web-based information management system flaunts that the findings aid clinic staff in providing healthcare services to patients with more efficiency[9].

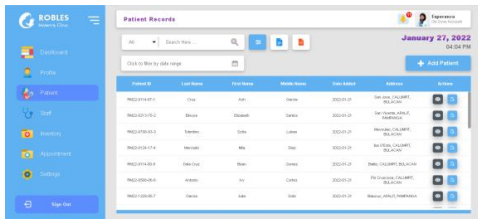


Figure 4: Patient Records

Patient Medical History. The maternity clinic information management system included a medical and treatment history of the patients. This is useful for the obstetrician-gynaecologists in the clinic in monitoring the condition. of the patients.

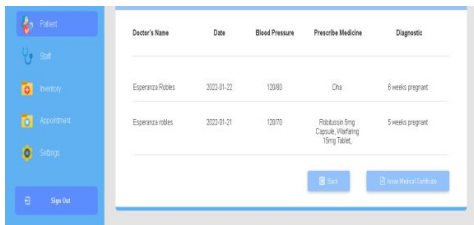


Figure 5: Medical History

Medical Report & Prescriptions. Obstetrician-gynaecologists in the maternity clinic are allowed to generate medical reports and prescribe medicine/s to a certain patient. When prescribing a medicine to a patient, the system records the number of medicine prescriptions, medicine name, patient's name, the ob-gyne who prescribed the medicine and the date when the prescription is issued. An inventory management was also integrated in the system thus the clinic would be easily noticed when it is already at critical stock. Also, by combining inventory management strategies with competitive advantages, effective inventory management provides a feasible mechanism for improving performance[10].

Part III. Software Quality Evaluation Criteria

To evaluate the developed information management system for maternity clinic using ISO/IEC 25010 instrument

Part IV. Evaluation of the Developed Web-Based System using the ISO/IEC 25010 Product Quality Instrument

Table 1: Evaluators of the System

Evaluators	Frequency (f)	%
IT Expert	5	30%
CICT Faculty	5	30%
Patient	5	30%
Client	2	10%
	17	100%

Table 1 indicates the respondents for the evaluation of the web-based information management system consisting of five (5) IT Experts, five (5) Professors from the CICT Faculty, five (5) Patients and two (2) clients from Robles Maternity Clinic.

Table 2: Results of Evaluation

Criteria	Weighted Mean	Descriptive Interpretation
Functional Sustainability	4.94	Strongly Agree
Performance Efficiency	4.94	Strongly Agree
Usability	4.92	Strongly Agree
Reliability	4.90	Strongly Agree
Security	4.97	Strongly Agree
Maintainability	4.88	Strongly Agree

The Functional Suitability criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub criteria under functional suitability, its functional appropriateness had the highest overall score, since the functions of the developed system aid in the completion of tasks and objectives.

The Performance Efficiency criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub-criteria under performance efficiency, its resource utilization had the highest overall score, since the resources can carry out its functions to fulfill the requirements.

The Usability criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub-criteria under usability, learnability had the highest overall score, since users are able to accomplish tasks easily and efficiently.

The Reliability criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub-criteria under reliability, its maturity and availability had the highest overall score, since the developed system is able to perform functions successfully in a specified environment.

The Security criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub-criteria under security, its confidentiality, integrity and authenticity had the highest overall score, since the functions of the developed system are able to secure important data, strictly follow user access levels and prevent access to unauthorized users.

The Maintainability criteria obtained a high score because the respondents "Strongly Agree" that the developed system is functionally suitable for a maternity clinic. Among the several sub-criteria under maintainability, its reusability and testability had the highest overall score, since the functions of the developed system can adapt to changes in environment and requirements.

4. CONCLUSION

Based on the data, the proponents conclude that the system is totally functional and usable. Defined as easy to do fundamental activities quickly, clients firmly agree that the system's development and operation deliver usability to the user.

The allocated maternity care will be able to monitor the patient better if they have accurate pregnancy records. The records help reduce pregnancy difficulties and risks for both mother and baby. Record keeping must be accurate and reliable. The designed Maternity Clinic Information Management System met the needs of the study's respondents and intended users. The respondents saw the system's potential to help maternity clinics manage maternal records. The system will improve the management of maternity records. They found that using the Maternity Clinic Information Management System will greatly improve record management at Robles maternity clinic. The system will eliminate any manual process issues. The designed solution will facilitate maternity record maintenance.

5. RECOMMENDATIONS

The Maternity Clinic Information Management System is highly recommended by the study's researchers for use at Robles maternity clinic. The system will simplify the process of accurately capturing pregnancy information while eliminating the possibility of human error. The system will make it easier for the employees in charge to capture accurate patient information. The system is highly recommended because of the efficiency and dependability it may provide to users. In order to properly use the

developed system, the intended users of the system need to be equipped with knowledge.

As flaunted by the study's findings and inferences, the ensuing recommendations were made, which can be used by future researchers who desire to construct a similar web system:

- Robles Maternity clinic should use the system to efficiently handle their patients' records and securely store them.
- It is strongly advised that the designed Maternity Clinic Information Management System be implemented since it ensures information accuracy and security.
- To ensure that the developed system is deployed, sustained, and maintained, the College of Information and Communications Technology may consider the current capstone project as part of the College's research and extension program.
- Based on the assessment, research relevant to the current study may be undertaken to stimulate the addition of more functions and features, or to employ other technology in the creation of the system.

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