

Development of the Pharmacy Module

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Abstract

This article aims to present the methodology and technological tools employed in creating the pharmacy module integrated into the computer system known as the Comprehensive Hospital System Rovirosa (SIHR), currently in use at the Dr. Gustavo A. Rovirosa Pérez Hospital in Villahermosa, Tabasco, in the southern region of Mexico. The article provides a detailed description of the methodologies, including a brief comparison to select the appropriate technologies for developing this module. The technological tools utilized align with those employed in the hospital's existing system. The results include showcasing the tables of the pharmacy module integrated into the hospital's database, along with the location where the module will be housed in the system.

Resumen

El objetivo de este artículo es dar a conocer la metodología y herramientas tecnológicas utilizadas en el desarrollo del módulo de farmacia que será integrado en el sistema informático denominado Sistema Integral del Hospital Rovirosa (SIHR) usado actualmente dentro del hospital Dr. Gustavo A. Rovirosa Pérez, ubicado en la ciudad de Villahermosa, en el estado de Tabasco, en la región sur de México. En detalle se describen los tipos de metodologías y una breve comparación con el fin de seleccionar las adecuadas tecnologías utilizados en el desarrollo de este módulo. Las herramientas tecnológicas que se usan son acordes a las herramientas usadas en el sistema del hospital. Como resultados se muestran las tablas del módulo de farmacia que se integran en la base de datos del hospital, además se muestra la ubicación donde estará alojado el módulo en el sistema.

Keywords: Yii, SCRUM, Framework, Software Engineering

Palabras Clave: Yii, SCRUM, Framework, Ingeniería de Software

1. INTRODUCTION

Times change, and so do needs. Technological demand has become one of the primary requirements within healthcare facilities. The Regional High Specialty Hospital, "Dr. Gustavo A. Rovirosa Pérez," is in the city of Villahermosa, Tabasco state, in the southern region of Mexico. It operates with a computer system called the Rovirosa Hospital Integrated System (SIHR), which includes emergency services and outpatient consultation modules. This system has significantly benefited staff and patients, providing streamlined processes and enhanced information security. Despite the utility of this system, the hospital has not yet automated other critical processes in different essential areas.

Technological advancements in healthcare have enabled the timely detection of illnesses. Various devices assist people, allowing mobility for those who may struggle with it independently or helping individuals to hear, among other functionalities. Similarly, information systems contribute valuable benefits to managing information within hospitals. The data collected guides decision-making at the patient level (medical care and treatment), hospital establishment level (inventory and resource management, equipment purchase, and supply of supplies and medications), and also the health surveillance level (emphasizing the definition of problems and timely action to resolve them, crucial for obtaining urgent responses, as in the case of

epidemics). Hospital information systems enhance patient safety and care, along with organizational efficiency in document management and operational savings.

Throughout this article, we will present the methodology, the technological tools used, and the results obtained in developing the pharmacy module, which will be fully integrated into the SIHR system. This module is divided into two sections: The Pharmacy Department and the External Consultation Pharmacy.

In the Pharmacy Department, tasks include medication requests for various services, medication entries (using entry vouchers), medication dispensing (using exit vouchers), and generating reports. The External Consultation Pharmacy section includes inventory management, dispensing medications to patients, reports on fulfilled prescriptions, and a medication expiry status indicator.

2. METHODOLOGY

A methodology is defined as the way of interpreting reality. The objective is to establish each requirement of a software system accurately, provide a systematic development method to control the process, construct a software system within an appropriate time frame and acceptable costs, facilitate the timely identification of any necessary changes during the development process, and ensure that the system meets the needs of those affected by it [1].

There are two groups of development methodologies: traditional and agile. Traditional methodologies ensure discipline based on the documentation generated in the software development process, especially in planning and aggregating all work to be done. Once everything is documented, the software development cycle begins. On the other hand, agile methodologies focus on the work, seeking a balance between processes and efforts. The advantage of following an agile methodology is that it helps achieve a level of quality, and potential risks come to light early in the process, allowing for timely solutions and avoiding possible extra costs and timeline deviations. The following table provides a brief comparison of these two methodologies.

Table 1. Comparison of Traditional and Agile Methodologies [2]

Traditional	Agile
Predictive	Adaptative
Oriented to process	Oriented to peoples
rigid Process	flex Process
Understood as a single project	A project is divided into several small projects.
Limited communication with the client	Continuous communication with the client
One deliverable at the end	Constant software deliveries.
Extensive documentation	Limited documentation

To better understand the working approach of both methodologies, the following image illustrates the processes each one carries out. We will notice that the working team engages more with the client in agile methodologies, as depicted in Figure 1.

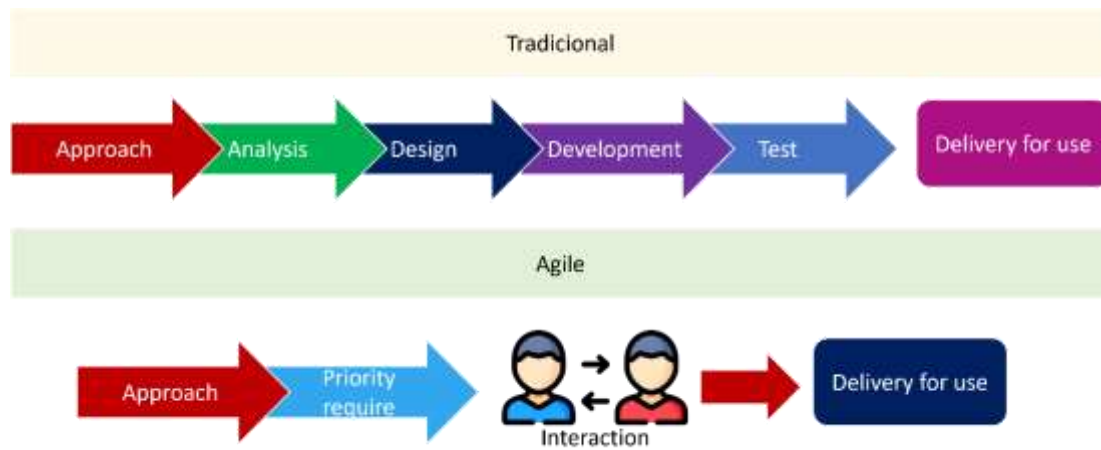


Figure 1. Processes of traditional and agile methodologies

2.1 SCRUM

After analyzing the types of methodologies, their advantages and disadvantages, and their way of working, we opted to use the SCRUM methodology, chosen for the following reasons: it aids in time and cost savings, promotes teamwork, maintains constant communication with the company to prevent potential risks, and is easy to manage.

SCRUM is an agile development model characterized by:

- The incremental development strategy considers the complete planning and execution of the product.
- We focus the quality of the result more on the knowledge gathered from people in organized teams than the quality of the processes employed.
- We are conducting different phases of development rather than performing them one after another in a sequential or waterfall cycle.

It is suitable for projects with unstable requirements and those requiring speed and flexibility in everyday situations in developing specific software systems [3].

SCRUM is an agile and flexible methodology that proposes continuous adaptation according to the project plan, categorizing the plan into interactions or sprints. As the sprints are completed, new product versions with additional features are obtained [4]. The illustration in Figure 2 shows the flow of the Scrum methodology.



Figure 2. Flow of methodology SCRUM [5]

2.2 MVC

Yii employs the MVC (Model-View-Controller) methodology primarily focused on web programming. MVC aims to separate business logic from the user interface, allowing developers to make modifications easily without the concern of affecting others. This methodology represents information and business rules; the view includes user interface elements like texts and input forms. The controller's task is to manage communication between the view and the model.

Additionally, Yii incorporates a front controller known as an application. The application represents the execution environment of the request process. The application generates the user's request result and dispatches it to the appropriate controller for further processing [6].

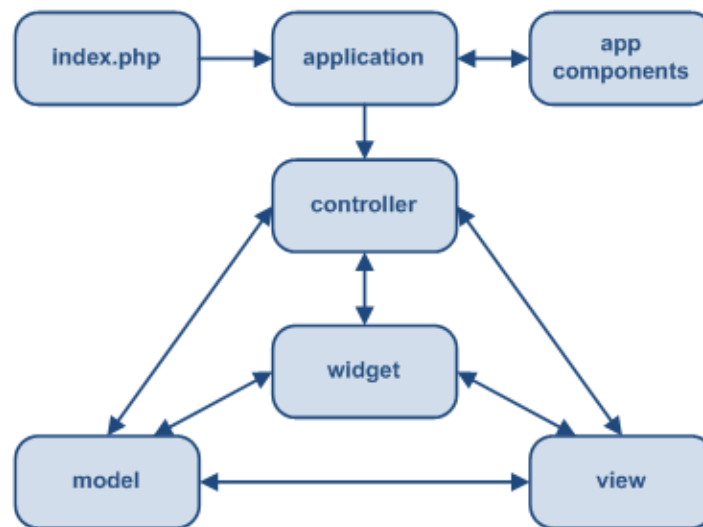


Figure 3. MVC applies in Yii [6]

2.3 POO

The object-oriented methodology proves productive when the system closely mirrors reality, facilitating high-level design. This allows programmers to identify the role of each part of the program and the data, streamlining system creation and maintenance. Noteworthy is its promotion of code reuse. It is essential to highlight that maintenance is easier because the software becomes organized and protected. An important aspect is its enhancement of large-scale software development. Team members work on different objects, and upon completing their tasks, the work is integrated using object interfaces [7].

3. TECHNOLOGICAL TOOLS

The tools required for the development of the pharmacy module within the Rovirosa hospital, as requested by the systems department, are the following: PHP (version 7.2), Yii, and MariaDB. This is to achieve a seamless integration with the SIHR system.

3.1 PHP

PHP is an open-source programming language suitable for web development, embeddable in HTML. Unlike client-side languages such as JavaScript, PHP's code is executed on the server, generating HTML sent to the client. The client receives the script's execution result, and it is crucial to note that the underlying code cannot be discerned. Even the web server can be configured for all HTML files with PHP. PHP stands out for its remarkable simplicity for novice programmers while offering advanced features for those with prior knowledge [8].

3.2 MariaDB

It is an open-source relational database management system, widely regarded as one of the most popular globally. Significant users of this technology include Wikipedia, WordPress.com, and Google. This database management system is released under the GPLv2 open-source license, ensuring its continued openness. It is utilized for high-availability data exchange and analysis and as an integrated server. A wide range of tools and applications supports MariaDB Server.

One of its significant advantages lies in its excellent compatibility with MySQL. Consequently, most well-known applications that use MySQL will function seamlessly with MariaDB. The system strives not to lose backward compatibility for its users. Due to this compatibility, upgrades from older versions of MySQL to newer versions are supported with an in-place update [9].

3.3 Yii

Yii is a high-performance PHP framework that focuses on components for the rapid development of web applications. This approach brings significant benefits both for the client and the development team. The name Yii is derived from the Chinese phrase "simple and evolutionary." Additionally, it is considered an acronym for "Yes It Is" in English, emphasizing its straightforward nature. Yii is a versatile web programming framework that can be used to develop various types of PHP web applications. The hospital system chose this framework for development precisely due to its component-based architecture and sophisticated caching compatibility. It

is suitable for building large-scale applications such as websites, forums, content management systems (CMS), and RESTful web services [10].

Yii incorporates web programming language technologies, featuring a structure with two templates depending on the project's characteristics. It operates based on modules and extensions and offers easy configuration in development and production environments [11].

The advantage of using Yii lies in the thriving community that continually shares knowledge about the framework, contributing to its growing strength over time.

3.4 WINNMP

It is a development stack comprising Nginx, MariaDB, MongoDB, Redis, and PHP for Windows. This server stack is lightweight, fast, and stable for PHP and MySQL application development on Windows, based on the Nginx web server. It has emerged as a lightweight alternative to XAMPP and WAMP, featuring Composer, Adminer, LetsEncrypt certificates, WinSCP, wp-cli, multiple PHP versions, projects, and virtual servers.

Some characteristics of WINNMP include ease of updating with a single installer for x86 and x64 systems and support for 32 and 64-bit versions of MariaDB, PHP, and WinNMP Manager. It is a fast, portable web server with all configuration files stored in one place, WinNMP\conf, and all log files stored in a folder: WinNMP\log. It allows for multiple PHP versions [12].

4. RESULTS

Automating tasks within the pharmacy department and external consultation pharmacy aims to streamline the processes carried out by staff and reduce patient waiting times for medication. The goals include safeguarding information handled in the processes, generating timely requested reports, and essential management of medication expiry reports. While controlling medication expiry reports is crucial, the primary task is the management of medication inventory.

To broadly understand the activities conducted in the pharmacy area, it is necessary to outline how each member involved in these processes interacts. The most effective approach is through a general use case. This simple diagram provides precise information on the tasks performed by each participant in the hospital's pharmacy area, as depicted in Figure 3, with five actors involved.

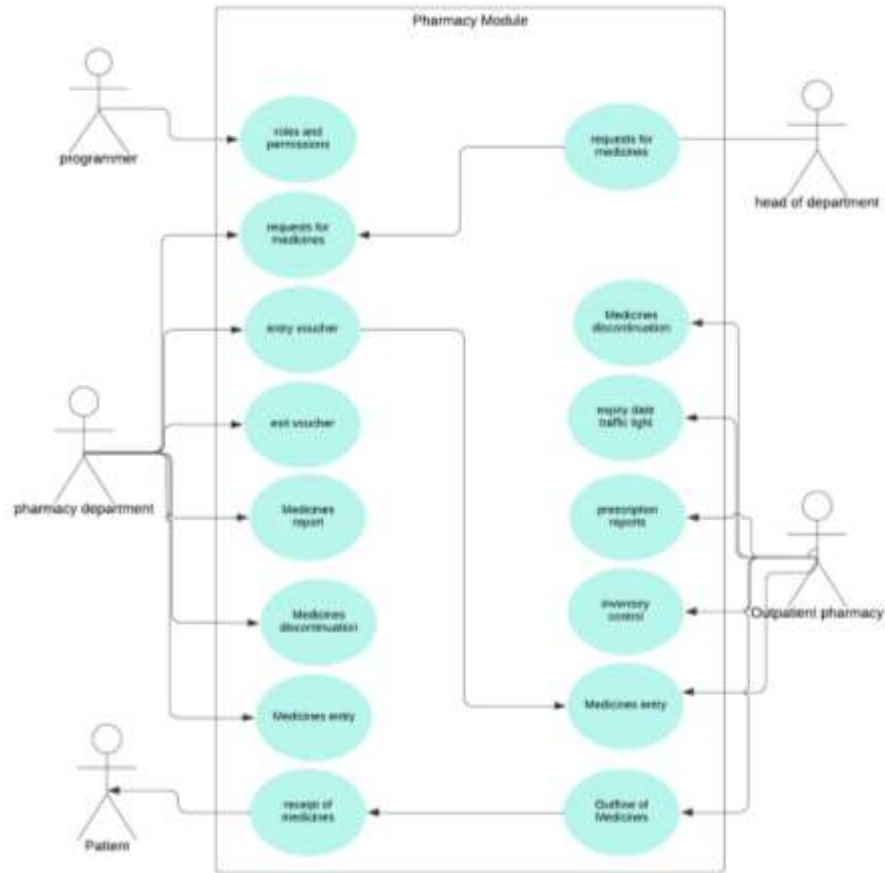


Figure 4. Use Case Diagram for the Pharmacy Module

After identifying the activities of each participant, the analysis and design of the database were carried out. This resulted in the addition of 11 tables for the pharmacy module to the existing hospital database. These tables were strictly tailored according to the data dictionary provided by the hospital, as depicted in Figure 4. It is worth mentioning that they were related to tables belonging to a crucial module for the external consultation pharmacy, namely, the external consultation module, which provides relevant information for the medication delivery process to patients.

Thanks to the capabilities provided by Yii, the hospital's systems area developer is responsible for managing user roles and permissions. Therefore, a login feature was not added for the pharmacy module.

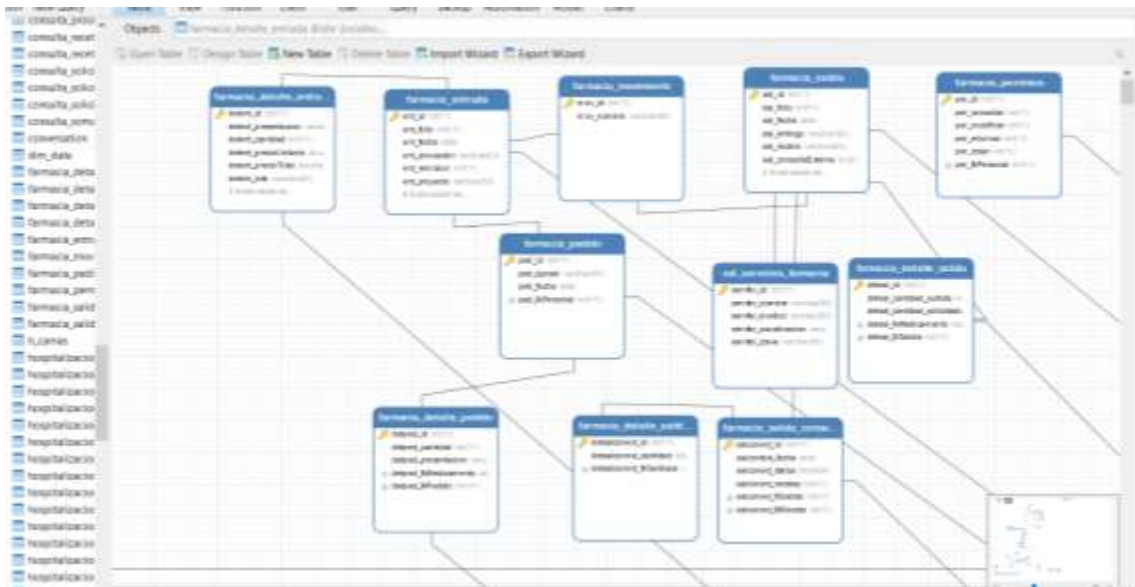


Figure 5. Tables Added to the SIHR System Database

In Figure 5, we can observe the menu where the pharmacy module is located, along with its two sections. When expanded, each section will provide a list of tasks. For the departmental section, options will include entry vouchers, exit vouchers, medication requests, and medication reports. In the external consultation section, the following options will be available: expiry status indicator, medication supply, prescription reports, and medication reports. Reports, requests, and vouchers are intended to be generated in PDF format.

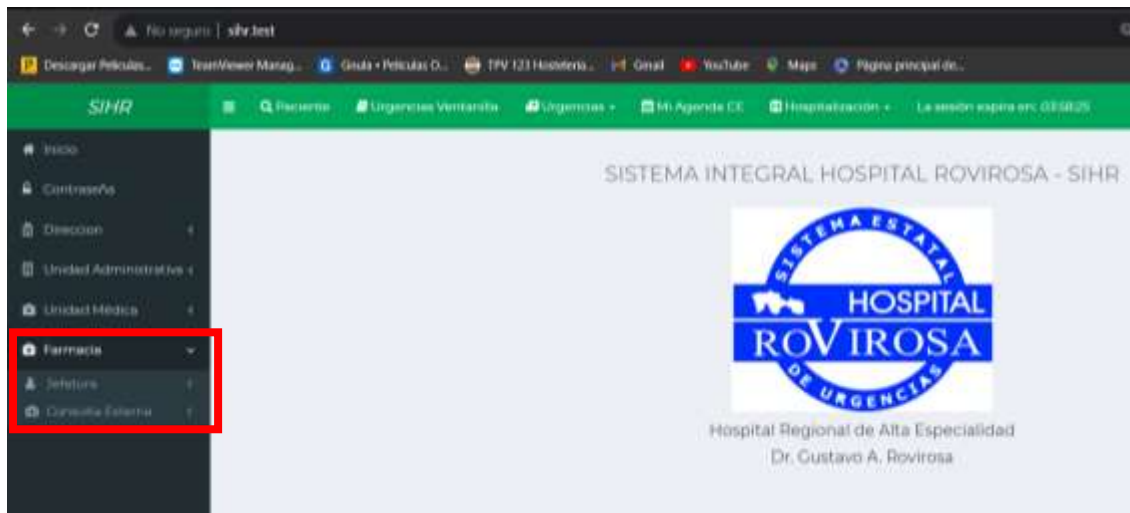


Figure 6. The Pharmacy Module is located within the SIHR System

5. DISCUSSION AND CONCLUSIONS

Choosing the appropriate methodology for developing each project stage is crucial. Given the nature of a system with different modules, opting for an agile methodology was the most suitable. The Scrum methodology offers significant benefits, the two most important being reduced time and costs while promptly identifying potential future errors. Constant interaction with the client allows for a deeper understanding of the module's evolving needs and direction.

Another crucial advantage of adhering to the SCRUM methodology, besides risk detection, is the enhanced assurance of quality, which is ultimately paramount in a system.

Despite the technological tools being a requirement from the hospital's systems managers, we endorse the excellent choice of tools. PHP is a very user-friendly programming language, and coupled with the Yii framework, they form a perfect set of technologies, providing significant tools for organized, agile, and understandable programming.

The pharmacy module will deliver substantial benefits for both the staff and the patients. It could provide valuable feedback for new module projects. If the warehouse module is developed, it could seamlessly connect to the pharmacy module, further streamlining processes such as medication entry and requests.

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