

Operations Research Design and Implementation of Pharmacy Management Information System

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Abstract— This Paper presented to the readers the implementation of Operations Research for Pharmacy Management Information System (PMIS) in the Pharmacy business to streamline such business management to help the owners thrive without difficulty monitoring their business. The scope of the study covers Sales Inventory, Stocks Inventory, Purchases (Orders, Receipts), Payroll, Accounting, Financial Management, Sales Reports (Daily, Monthly, Yearly), and Pharmacy prescription book (Senior Citizen, Persons with Disability). In addition, and above all, a built-in Point of Sale (POS) for a single and multi-user environment. PMIS is a Windows-based operating system application that significantly assists the Pharmacy business operations that automates the entire process that the owner is helpful because of the installed inventory and others. More complex fields in Pharmacy business operations.

Keywords— Accounting, Inventory Management, Operations Research, PMIS.

I. INTRODUCTION

Recent years have seen a complete revolution in how information is gathered, archived, and used in business and government worldwide. The workplace has changed from one based on paper documents, full of mistakes and delays, to one based on information technology (IT). While IT can bring vast improvements in accuracy and timeliness, IT, on its own, does not change the significant problems of personnel capability or administrative inertia. Information technology is integrated into every fast-moving field of this world. IT deals with using electronic computers and computer software to convert, store, protect, process, transmit and obtain information safely [1].

The clinical pharmacy management system is developed according to the actual situation. The pharmacists take the prescription of the patient review in the general operations department as an example. The work efficiency of clinical pharmacists' quality and qualified rates of prescription drugs before and after using the clinical pharmacy management system were compared [2].

The pharmacy management information systems (PMIS) software is currently implemented in the Australian Department of Veterans Affairs (DVA). It focuses on the drug management program's objectives and information management design [3].

They are designing and implementing a web-based Pharmacy management system to centralize business management and monitoring. The primary goal is to improve accuracy and enhance safety and efficiency in the pharmaceutical store by minimizing issues that occur in day-

to-day operations. They currently use a manual system that is very difficult to handle.

Managing the stock using paper records based on expiration dates and the quantity available is the critical problem identified in the problem domain. In addition, the system aims to reduce the staff's workload and increase the value of the business to gain a competitive advantage in the pharmaceutical industry [4].

It is challenging to control inventory when there is an increase in product items. It needs product grouping analysis to determine product priorities. Therefore, an inventory management information system that supports the inventory planning process becomes essential to discuss [5] [6][10].

One of the influencing factors includes the imbalance in demand and pharmacy availability in the supply of medicines and medical equipment. But, more so, it is the cause of poor implementation of pharmacy accounting information systems. Therefore, accounting information systems are beneficial in the pharmaceutical management of the pharmacy business [9].

The same problem is experienced by most pharmacy businesses that acquire stocks that nearly 1500 product items are controlled by a conventional-based stock and inventory recording system. Based on the observations, pharmacy planning is currently done based on the subjectivity of the owner. However, expired goods often become a problem because the control system is still conventional, and the number of products is relatively large [6].

Pharmasoft is a type of software wherein the application is based only on the pharmacy management system. It is a web-based system mainly implemented that focuses on small and medium-sized pharmacies to reduce their issues occurring in day-to-day operation. Furthermore, the scheme aims to increase the value of the business to gain competitive advantages in the pharmaceutical industry. The system operates not only on pharmaceutical drugs but also on grocery items. So, it is designed to define and manage them accurately and efficiently for the people running the system. The current pharmacy process has four main actors [7]. The current pharmacy process has four main areas: Pharmacy Managers, Pharmacy Employees, Suppliers, and Customers. The developed system can log in as different user roles and perform their functions. The administrator role will create the user, and the user's rights can generate reports for administrative decisions, salary management, and removal of employees. The pharmacy employee mainly operates the maintenance of stocks and order management in the systems. So, the system will reduce the waiting time of customers. In

addition, the system can check the availability of items and order them. The pharmacy employee can generate a Purchase Order for that low item availability.

In addition, they can search for items by expiration date. So, things that will expire at close dates are noticed [7][11].

The Pharmacy Management Information System software is a unified system that manages products and medications and works automatically, such as stock control, medicine, billing management, and reporting. This software gives pharmacies a big picture of business performance and an overview of costs, revenue, and sales [12].

The researcher gathered all the necessary requisites for the development of the PMIS to be essential to the pharmacy owner when implementing the system in their pharmacy business. Also, the operations research of small and big pharmacies may reflect a successful implementation and monitor all the incoming and outgoing stocks of drugs, including cash flows of the entire pharmacy business internationally. Figure 1 below shows the operations research conceptual framework of the pharmacy business.

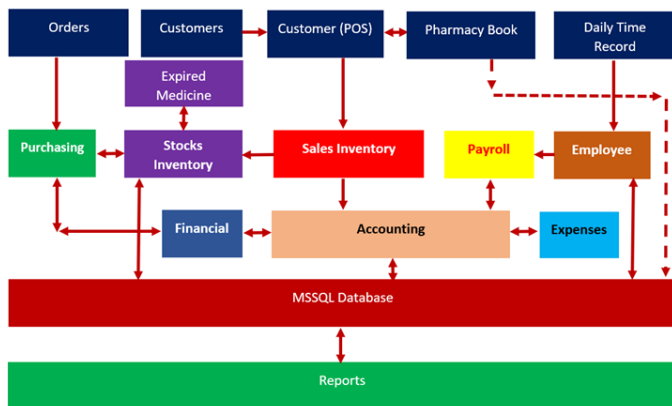


Fig. 1. Operations Research Framework

Objective of the study

The primary purpose of this study is to guide the future pharmacy owners by implementing the PMIS of the pharmacy business instead of using it manually managed by the pharmacy owner. Specifically, it aims to design and implement the operations research on computerized pharmacy management information systems using the MSSQL database server as the back-end and Visual Basic .net as the front-end.

1. Design the whole processes of the pharmacy business, including orders, customers, sales and stock inventory, daily time records for employees, payroll, drug expiry, pharmacy book, expenses, accounting, and financials.
2. Develop a windows-based application using Visual Basic.net as the front-end and MSSQL as a back-end desktop application to cater to the desired areas of the entire pharmacy business process.
3. Implement the system in the pharmacy store to test the integrity of the output system in the operations research on the pharmacy management information system.

II. METHODOLOGY

The method used in this study is deductive because it is experimental based on Random Application Development. Rapid application development alleviates complications over traditional software development methods, focusing on customer satisfaction through early and seamless delivery of essential, functional software [26]. See Figure 2 for the model of the study.

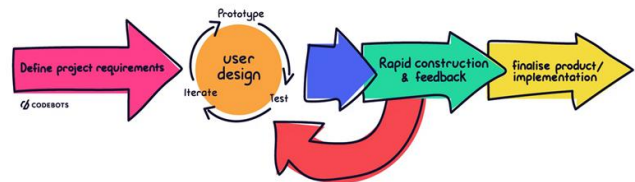


Fig. 2. Random Application Development Model

A. Project Requirements

The researcher gathered information from the different pharmacy store-operated manually and operated using their developed PMIS software. Some pharmacies implement PMIS, but the functions are limited to sales and stock inventory only. Others are complicated, including other parts not much related to the pharmacy-related operations functions.

Front-End. Visual Basic.net is a Productive, multi-purpose, type-safe, object-oriented, open-source. Visual Basic are programming languages designed for creating various applications running on NET. These languages are robust, safe in kind, and object-oriented. It is Built on the .NET Compiler Platform "Roslyn," which provides rich code analysis APIs, and it is all open source available on GitHub. It is a desktop application programming that caters functionality of the pharmacy automation implementation. The system is capable of a multi-user environment that caters to multiple pharmacy attendants that caters to customers in an automated manner.

Back-end. The back-end of the system uses an MSSQL database server wherein it serves as the central storage of the transaction of the entire system. The storage size configures as the size of the hard-disk drive of the installed storage of the desktop PC. The Microsoft SQL Server is a relational database management system (RDMS) developed by Microsoft to be used as a database server. It is software that has the primary function to store and retrieve data as required by other software applications — which can run on the same computer or on another computer on a network.

Operating Systems. A Windows 10 is recommended for the implementation because it is easy to configure in a multi-user or network environment.

Hardware. The recommended hardware requirements of the system are at least an Intel i3 or higher processor with 8Gb of RAM, 512 Gb of (Solid-State Drive) as primary storage, and 1Tb or higher for the secondary storage as the central storage of the MSSQL database server.

Network. Ethernet cards are needed for every computer connected to the system. It is also possible to connect wireless connectivity.

B. User Design

The researcher considered the graphical user interface (GUI) simple as possible and easy to manipulate by the end-user. For example, figures 3 and 4 below show the system's main command button running after completing the user login screen.



Fig. 3. Functional Button



Fig. 4. Sub Functional Button

In the figures 3 and 4, the buttons are functional according to the desired output in the implementation of the systems. The startup screen when running is reflected in the figure 5 below before the login screen prompted as shown in figure 6.



Fig. 5. Startup Screen of the PMIS

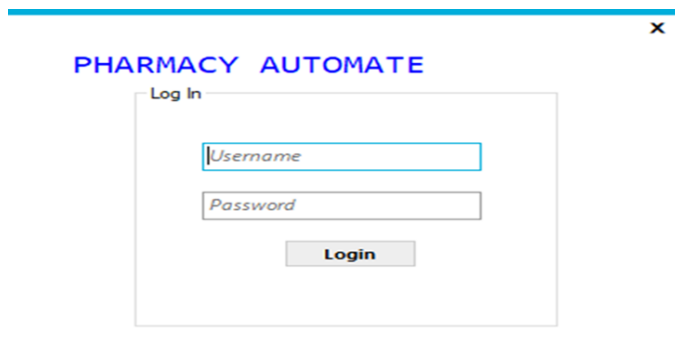


Fig. 6. User Login of the PMIS

In the user design phase, the researcher considers the vital part of securing the system by implementing login security, including monitoring the users while they are in the system to ensure the system's integrity will not deprive. The following input areas that the system implements as follows:

Orders

Here the researcher developed an interface wherein the pharmacist can search for the actual inventory of the drugs as the basis for ordering prescriptions. Essential functions of ordering drugs are embedded in the system to ensure

simplicity. After finishing the orders, a purchased order (P.O.) can print for payment processing. Figure 7 below reflects the order screen when the INVOICE function button on the main screen is selected. Figure 8 deflected the orders screen for ordering drugs transaction.



Fig. 7. Invoice Screen Buttons

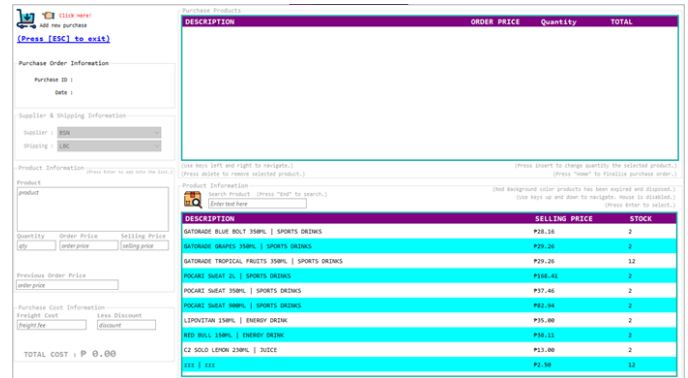


Fig. 8. Orders Screen

Customers (POS)

In this phase, the researcher developed a vital function of the SALES INVENTORY to monitor the stocks and daily sales of the entire system implementation. This function plays an essential role in the system because it will scan all the transactions from stores to sales inventory, including the business's financial activity. For example, figure 9 below deflected the Sales Inventory Screen.

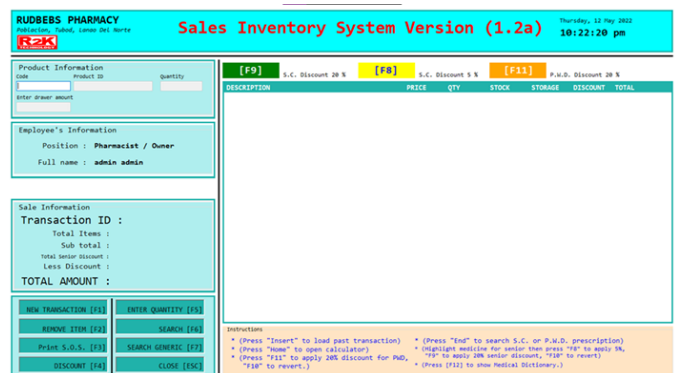


Fig. 9. Sales Inventory Screen of the PMIS

The functions of sales inventory are vital because this will serve as the point of sale (POS) of the system that can directly compute the discounts of Senior citizens and persons with disabilities (PWD) when pressing the functions keys for discounted customers. In addition, the system assigns function keys to open a new screen instantly when pressing it. For example, by pressing F6, the attendant can type medication to search for the availability and prices, including the location of the medicine.

Pharmacy Book

This function is also part of important aspects of pharmacy operations because the Foods and Drugs Administration will require prescription drugs to be tracked and recorded in the pharmacy book. These functions are embedded in the system. When the FDA inspects it, customer prescriptions will be taken a screenshot and automatically stored in the database for future use. The Pharmacist file button will display a screen similar to the display below as deflected in Figure 10, the pharmacy book screen.



Fig. 10. Pharmacy Book Screen

Daily Time Record (DTR)

This function is also vital for the pharmacy operation because the employee’s payroll needs a daily time record of each employee. Since all function of the pharmacy operation are being automated. The daily time record uses RFID reader to scan with the employee’s RFID tag for the attendance record as basis for the salary in the payroll systems. Figure 11 below shows the attendance screen.



Fig. 11. Attendance Screen

C. Rapid Construction Feedback

Researcher consider the development of operational processing, which involves complex computing and structural interactions of systems — for example, Inventory of Stocks, Inventory of Sales, Payroll, Employees, Accounting, and financials. Operations research plays a vital role at this application development stage as it will systematically require thorough analysis to complete the entire application. The researchers describe each of the functions:

Stocks Inventory

Stock items are the goods you sell to customers. Stocks inventory includes the products you sell and the materials and equipment needed in the operations. Inventory clarifies the pharmacy business so that it is easy to oversee the consumed items. And for the purchased equipment where it is, or it is already used or damaged. Figure 12 below shows the stock inventory screen with various functions to complete the inventory systems. Also, the colors in the items represent the expired and nearly expired medicine.



Fig. 12. Stocks Inventory Screen

Customers and Sales Inventory

Daily sales inventory (DSI) is a financial ratio that denotes the average time in days a company spends to make sales of its inventory, including goods currently in production. Point of Sale (POS) describes the best sales inventory implementation because it instantly can provide an accurate report at the right time and in the correct format. For example, figure 13 below shows the sales invoice after the customer's order is stored. This screen prompts in a multi-user environment.



Fig. 13. Sales Invoice Screen

Payroll

Payroll is the compensation that a business must pay to its employees for a fixed period or on a selected date. It is usually managed by the company's accounting or human resources department. However, small business payrolls can be managed directly by the owner. This system simplifies the work of the human resource and the pharmacy owner. Figure 14 below shows the payroll screen of the system.

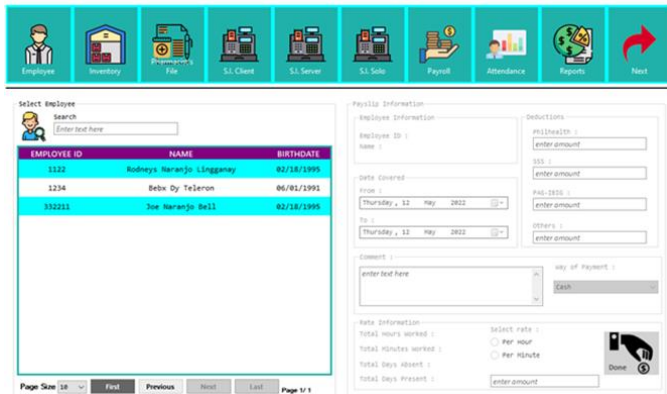


Fig. 14. Payroll Screen

Accounting

The accounting process includes briefing, scrutinizing, and reporting these transactions to regulatory agencies, regulators, and tax collection entities. These are the following SSS, PAG-IBIG Fund, Philhealth, and the Bureau of Internal Revenue. Figure 17 diverts the financial report with monthly and annual options.

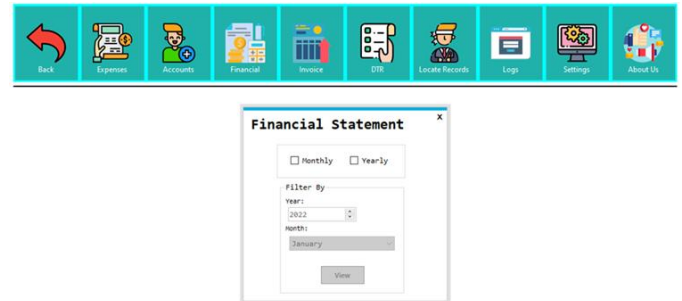


Fig. 17. Financial Report Options

Employee

The employee's database, also known as the company staff database, is a digital storage of all relevant employee information, including their name, address, contact information, and start date. Also, it is appropriate to the pharmacy operation, especially in the PMIS implementation, because the system can assign user rights. Figure 15 below shows the employee database screen.

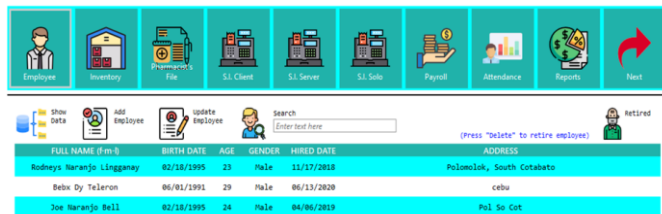


Fig. 15. Employees Database Screen

Financial Statement

The essential part of the system is the financial statement reports, wherein the owners/pharmacists can view/print financial statements monthly and yearly as shown in the option button in the date range of information. More so, this will allow owners/managers/pharmacists to view the status of the income, either LOSS or PROFITABLE. Figure 18 shows the financial report of the PMIS system.

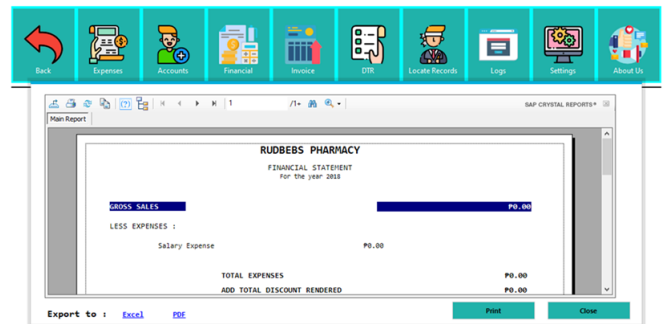


Fig. 18. Financial Statement Report

Expenses

The system can compute expenses in the financial statement if the system detects entry from the expenses form/screen like; Electricity Bills, Rentals, cash advances, Etc.

In addition, payables like SSS, PHILHEALTH, and PAG-IBIG are also entered and encoded in the system. Furthermore, the payroll, SSS, PAG-IBIG, and PHILHEALTH are deducted from the employee's monthly salary. Therefore, it is classified as PAYABLES because the owner will regularly pay mandatory dues to these institutions. Figure 16 deflected the expenses option button.

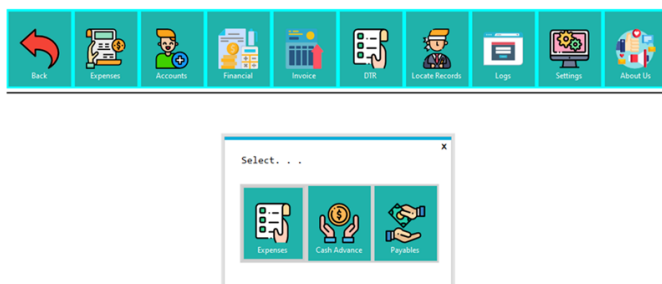


Fig. 16. Expenses Option Button

Product Implementation

The researcher implemented the system in a newly started pharmacy to test its integrity and functionality. The pharmacy assistant caters to customer transactions in the network environment implementation using Figure 19 below. This sales inventory screen will serve as the point of sale (POS) system.

The implementation phase of the PMIS is a crucial part of pharmacy operation because all the purchases are encoded in this phase so that the system can create a proper reporting of the entire capital of the business operation.

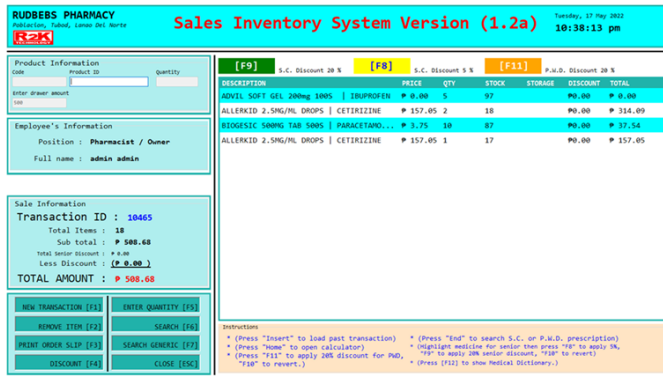


Fig. 19. Point of Sale from Sales Inventory

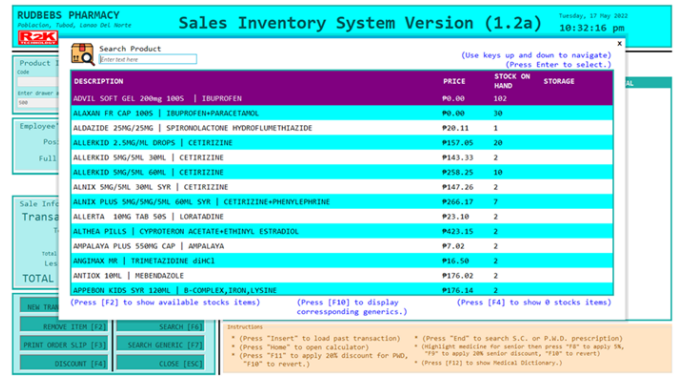


Fig. 21. Point of Sale customer transaction

Figure 20 shows a cashier screen wherein a selected medicine is recorded in the server database. The cashier will input the transaction code to trace the current ordered medication to pay for purchased items.

As a result, the usefulness of the PMIS implementation, the reports can be viewed and printed instantly by clicking the desired function keys. For example, figure 22 below shows the report's function buttons.

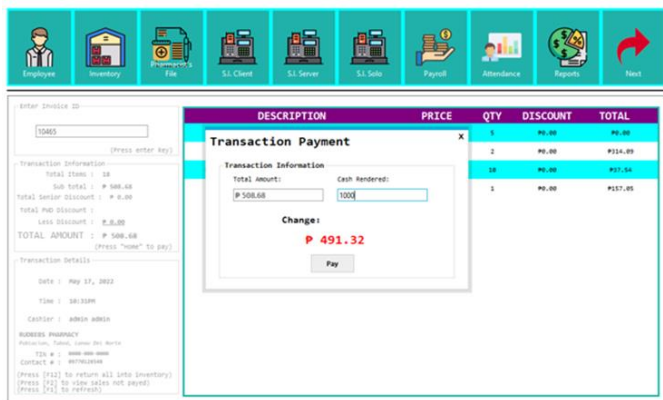


Fig. 20. Cashiers Screen

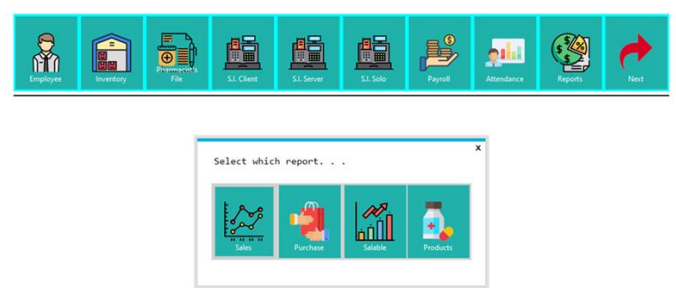


Fig. 22. Sales Report Option Button

Furthermore, in the SALES report button, the report presents the capital and the profit. Figure 23 shows the daily sales reports below with details for the day's sales. While in figure 24 is a closer look at the daily sales report that displays the details of the day's sales.

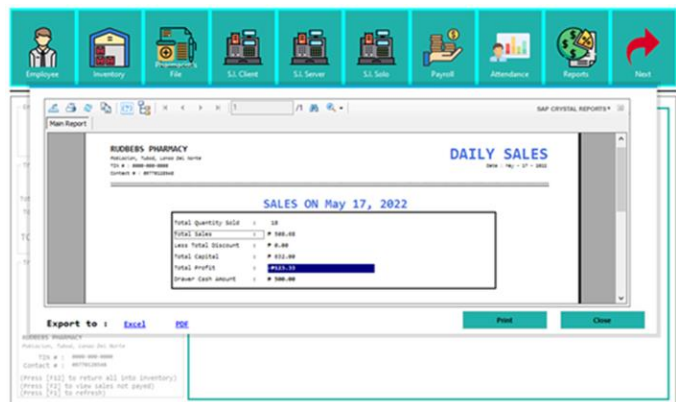


Fig. 23. Daily Sales Report

III. RESULTS AND DISCUSSION

The researcher finally came up with the desired output based on the operations research of the business process of the pharmacy business operation. These will minimize the complexity of the business process because they will automate the entire business process. The pharmacy owner can concentrate more on expanding the branches because overseeing the business activity is not an issue if the PMIS adequately implemented. Figure 21 below deflected the pharmacy attendant catering to customers searching for medicine in the database. Here, upon searching for the medication, the price can be viewed on the screen, including the inventory and the storage location of the drug. Various function keys are active for transacting customers, including the customers' discounts that include Senior Citizen, PWD, and variable discount entry for promotional products. Also, a medical dictionary is an essential function because this will give the attendant to respond to the said medication's details. The records of the medical dictionary are pre-loaded because this is not an online platform.

The authors are very grateful for the support in making this research successful to the author's family for unwavering support. And finally, our more powerful Lord Jesus Christ, who is on a high, always protects and gives good judgment when doing this study.

SALES ON May 17, 2022

| | |
|-----------------------|----------|
| Total Quantity Sold : | 18 |
| Total Sales : | P 588.68 |
| Less Total Discount : | P 0.00 |
| Total Capital : | P 632.00 |
| Total Profit : | P123.33 |
| Drawer Cash Amount : | P 580.00 |

REFERENCES

| QTY | PRODUCT | ORDER PRICE | SELLING PRICE | CAPITAL | SC/PMO DISC | TOTAL |
|-----|--|-------------|---------------|----------|-------------|----------|
| 18 | BIODESIC 30MG TAB 30MG PARACETAMOL+IBUPROFEN | P 32.00 | P 32.75 | P 720.00 | P 0.00 | P 57.54 |
| 5 | ADVEL SOFT GEL 200MG 18MG IBUPROFEN | P 21.00 | P 0.00 | P 105.00 | P 0.00 | P 0.00 |
| 2 | ALLERKID 2.5MG/ML DROPS CETIRIZINE | P 145.00 | P 157.85 | P 295.00 | P 0.00 | P 334.89 |
| 1 | ALLERKID 2.5MG/ML DROPS CETIRIZINE | P 145.00 | P 157.85 | P 145.00 | P 0.00 | P 157.85 |

Prepared by: _____
 Signature Over Printed Name

Fig. 24. Closer Look of the Daily Sales Report

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Data analytics is also included in the implementation because it will display the top 20 most salable medications as the basis for the pharmacist and pharmacy manager to order more medicine based on the reported top 20 salable medications. Figure 25 below shows the ascending order of most salable medication.

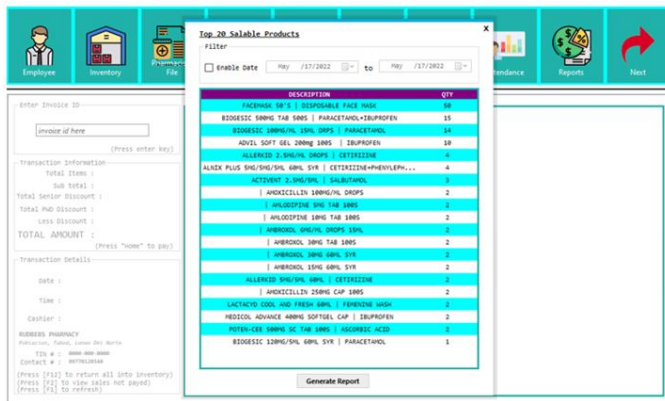


Fig. 25. Top 20 Salable Medication

IV. CONCLUSION

The researcher concluded that in the pharmacy business operation implementing a PMIS software that caters to all the transactions in the entire business is not productive and advisable because it gives the employees an avenue for cheating. Automation is the key to becoming productive and lifelong in operation in most companies. It also shows that reporting is easy, especially in the financial aspects of the owner, because instantly, they can view the total expenditure of the business, the profit, payables, and receivables. More so, the system can view the analytics of salable medicine in a second for the basis of ordering new medication. Lastly, operations research clearly emphasizes a scientific approach for making the basis of complex decisions and business success.

Recommendation

Implementing the system at the opening of the pharmacy business is recommended so that the pharmacy manager and pharmacy attendant know that it is easy to trace the discrepancy of collections in the financial management. Then, all the transactions or activities in the PMIS can be overseen and traced right away.



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