

An ERP system for ophthalmology using AI & ML

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Abstract - Enterprise Resource Planning (ERP) systems are a type of software that attempts to integrate and unify all departments and processes across a company into a single system. The project demonstrates an effective Enterprise Resource Planning (ERP) system for Ophthalmology. Basically ophthalmology is the branch of medical science that is concerned with the diagnosis and treatment of disorder of eye. In the world of increasing business, there is a need of better reporting tools with real time information, better access to customer information, faster response times, improved on-time delivery and improved order accuracy. Boosted cash flow, better invoicing and better collections tools, cost savings and better supply chain management can only be provided through an Enterprise Resource Planning system. An effective ERP system for ophthalmology is emerging need of the business world that can improve customer satisfaction, thereby building good customer relation. Our project consists of various modules such as customer management, staff, appointment management, customer report, product detail, customer feedback, billing, equipments used and inventory. It will deal with functionalities such as accounting, purchasing, sales and customers interaction with the system. Additionally, the project consists of an app for the user convenience where user can select frames among several, user will also be provided with the suggestion of the frames depending upon the face shape and several other parameters. An ERP system consisting of an app will not only drive customer attraction but also provide them the satisfactory and convenient platform.

Key Words: ERP system, ophthalmology, sales, cash flow, billing, inventory .

1.INTRODUCTION

Globally, efforts to improve eye care services have increased and the role of information technology (IT) in finding solutions to various health problems is increasing. The purpose of this study is to identify how enterprise resource planning (ERP) systems were used in the eye care and how these systems could be used to improve health services. The IT sector now encompasses all industries, including the healthcare sector, which is currently undergoing fundamental changes. Based on the literature reviewed in this study, the use of ERP systems in the healthcare sector has not been widely reported. However, some findings

suggested that ERP systems can be used to improve the quality of healthcare services. Based on these findings, if ERP systems were successfully implemented in eye care organizations, they would facilitate significant changes in certain areas such as finance, human resources and capacity, revenue, and access resources. ERP systems can also improve both the profitability and services of eye care organizations. Due to the lack of research in this area, further research should investigate the use of ERP in eye care organizations. Information is an important part of the ophthalmology industry. Knowledge sharing has become essential to reduce costs and improve customer service. Therefore, a eye care system must be able to collect and share information between many parties, such as clinics and clients. It must also provide information on billing and medical information within the eye care organization and to stakeholders. In addition, the increased use of IT is driven by the desire to reduce costs, increase the competitiveness of the health sector and improve personal health. This study analyzes the healthcare ERP system and looks for ways to improve healthcare services through the implementation of ERP systems. The implementation of today's business environments have taken various forms and ERP systems are important in improving organizational efficiency and strategic decision-making. Therefore, healthcare organizations are no exception on going new business changes. In fact many business problems today can be solved by implementing ERP.

2. LITERATURE SURVEY

A literature survey on ERP systems involves a comprehensive review and analysis of existing scholarly articles and other relevant sources. A systematic literature review is a means of evaluating and interpreting all available research relevant to a particular research question, topic or phenomenon of interest. The scientific databases with full text paper, and the other available scientific articles in the field of social sciences were used in the research. All scientific and other papers and works written in the time span from 2009 to March 2020 are taken into account.

2.1. Existing Papers

An overview of the current state of the ERP systems – their functionalities, the technologies that were used to

develop them, the databases that were used for storing the data was presented. Sixteen open-source systems have been reviewed. Their functionalities have been analyzed and a list with the most common ones was created. Additional attention is paid to the functionalities that are uncommon and are present in some of the systems. The most preferred programming languages have been acknowledged and an observation about the used databases has been made. A list with several future improvement has been created, based on the available software and hardware today. The list is not complete and option for adding more functionalities remains.

The key steps that are used in the implementation of an ERP system was examined. From the discussion, it is evident that different organization have varied requirements, hence the steps followed might differ. However, the discussion gives a general overview of these steps which might be applied for all sizes of an organization. The paper has further examined some of the critical factors that determine the success of an ERP system in any organization. By understanding these factors, the organization can fully evaluate its capacity in adopting and implementing ERP systems successfully. Finally, the research has outlined some of the benefits that are associated with the use of these systems. The paper has focused on the positive side of ERP systems, there are negative aspects of these systems. It is important that future research examines some of the negative aspects associated with these systems.

ERP systems have been introduced in the areas of education, health care, defense, and municipalities, regions and states to support the public administration activities. There were no articles related to non-economic public services in the field of culture, social services, justice, libraries, public safety and urban planning. With regard to the ERP systems classification, it is evident that there is a full agreement between classifications and systems implemented in practice, and ERP systems are often introduced in the areas of education, public administration, defense and health. As seen from the analyzed articles, despite the fact that European legal regulations recognize some other non-economic public services, the implementation of ERP systems in those hasn't been accomplished yet. In addition, even ERP software manufacturers haven't classified such systems.

3. SYSTEM ARCHITECTURE

An ERP system is a software that is used by big businesses to manage their day to day business activities such as financing, procurement, sales and more. The system architecture of our project includes various components playing their own specific roles. The main target of the project is the admin panel through which all the activities are managed and recorded. The system architecture includes end user interaction with the system. The admin interface in the

system consists of various modules such as sales, billing, customer, staff and inventory. Number of products sold, number of products purchased, the most selling product, the least selling products etc. everything gets updated in the system on regular basis.

3.1. Design

From a bird's eye view, designing a business product is not much different from building a basic application. However, when we look more closely, we find that business applications have many layers of complexity. Fortunately, the basic process of designing an ERP is still a bit like designing any other product. — One major difference is that you often have multiple processes running at the same time. Here in our project we have designed the interface in such a way that increases user's experience and results in smooth running of all the complex processes.

3.2. Requirement Analysis

In software development lifecycle, requirement analysis is one of the most important phase. For any software project there are different kinds of requirements to be fulfilled in order to ensure smooth running of the processes. Clearly defined requirements are important markers on the road to a successful project. They establish a formal agreement between the customer and the service provider that both are working towards the same goal. High detail requirements also help reduce financial risks and keep the project on schedule. The following are the different kinds of requirement for our project:

Table-1: Requirements of ERP system

Software Requirements	Hardware Requirements
Python	Windows 10 Pro
SQL	Intel(R) Core(TM) i5 1.60GHz 1.80 GHz Processor
Tkinter	8 GB RAM
HTML, CSS	100GB free Hard Disk

3.3. Proposed System

An ERP system is a centralized software platform designed to streamline and integrate business processes across an organization. It serves as a comprehensive solution for managing various functions such as finance, human resources, manufacturing, supply chain, customer

relationship management (CRM), and more. The primary goal of an ERP system is to provide real-time visibility into key business operations and facilitate data-driven decision-making. Overall, an ERP system acts as a central nervous system for the organization, enabling seamless coordination and collaboration across departments, improving operational efficiency, and driving business growth. A proposed system means a new or improved system offered as a solution to a specific problem or to meet specific requirements of a project. Basically the below proposed system depicts the interaction between admin and the user. The ERP interface includes all the modules which would be displayed to the admin panel. The modules are like inventory, staff, billing, customer and sales. These modules ensure the overall running of all kinds of processes simultaneously. The proposed ERP system encompasses modules for patient management, electronic health records, inventory management, scheduling, billing, and analytics. Through the application of AI and ML algorithms, the system enables automated patient triaging, personalized treatment recommendations based on historical records. The figure describes the dynamic aspects of the ERP system. It is an enhanced version of a flowchart that models the flow from one activity to another.

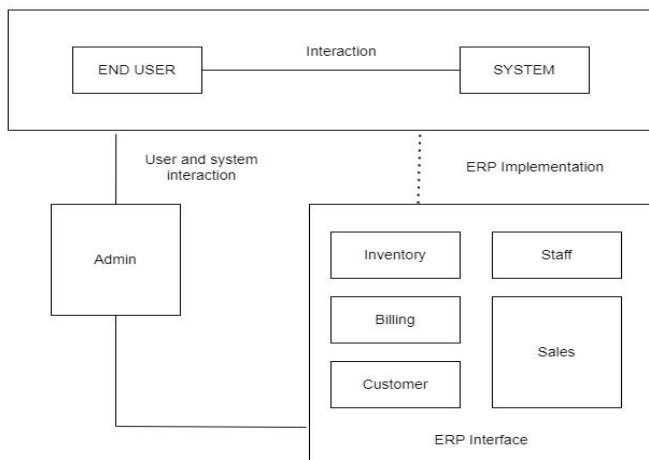


Fig-1: Proposed System of ERP system

At the very first the admin logs in into the system and checks the inventory, sales and bills. The admin also manages the staff and monitors overall activity of the system. The important thing to be noted here is that the admin gets logged in only when his/her login credentials are valid otherwise the activity stops at the first stage.

3.4. System Process

The above figure describes the dynamic aspects of the ERP system. It is an enhanced version of a flowchart that models the flow from one activity to another. At the very first, the

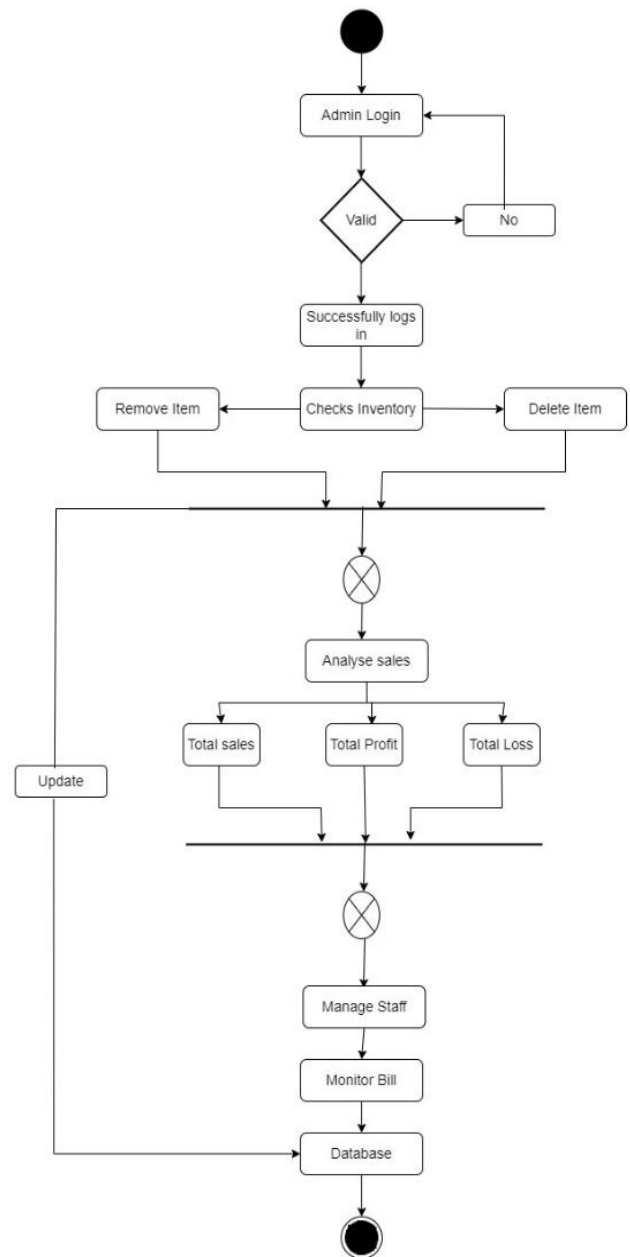


Fig-2: Flow of the ERP system

Admin logs in into the system and checks the inventory, sales and bills. The admin also manages the staff and monitors overall activity of the system. The important thing to be noted here is that the admin gets logged in only when his/her login credentials are valid otherwise the activity stops at the first stage.

3.5. Data Flow

A data flow diagram represents the data flow of a process or system and usually an information system and ; through The DFD also provides information about the revenue and profit of each unit and the process itself. A data flow diagram has no control flow - it has no decision rules and no loops. A data

flow diagram (DFD) is a graphic or visual representation that uses a standardized set of symbols and notations to describe the operation of a business through the transmission of information. It gives more clear idea of our project. It expands on each process to give detailed information of the process.

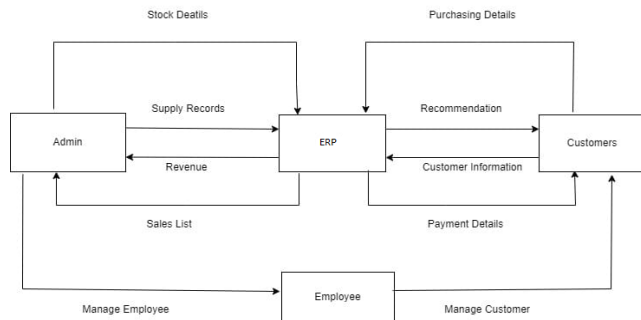


Fig-3: Data Flow of ERP system

4. DATA VISUALISATION

Data visualization plays a crucial role within the context of an ERP system for ophthalmology utilizing AI and ML. Graphical representations, such as line charts or scatter plots, can provide ophthalmologists with a clear understanding of patient responses to treatment and help identify trends or patterns in disease management. Data visualization serves as a powerful tool for translating complex healthcare data into meaningful visual representations, empowering ophthalmologists, healthcare providers, and administrators to extract insights, make informed decisions, and enhance patient care within the context of an ERP system for ophthalmology using AI and ML. Dynamic charts, gauges, and alerts can provide healthcare providers with instant insights into patient health status, enabling timely interventions and proactive management of critical conditions. The visualization depicts the different customer categories on the ERP system. The categories are first class second class standard class and more. Standard class customers typically receive standard levels of service and may have access to essential healthcare amenities within the clinic. First class customers may receive priority scheduling, expedited appointments, access to leading specialists, and additional amenities such as private consultation rooms or concierge services.

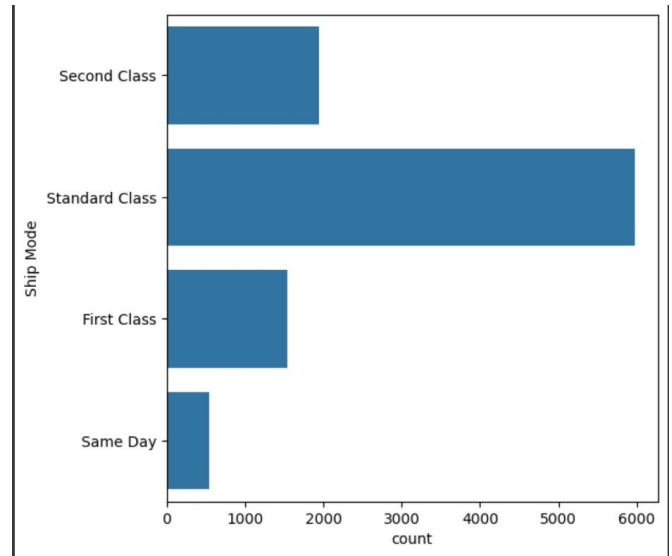


Fig-4: Customer Category

Second class customers may receive timely appointments, access to a broader range of diagnostic tests or treatment options compared to standard class, but without the premium features associated with first class.

5. RESULTS

The figure shows the top 10 highest selling products on the ERP software. The implementation of this ERP system entails

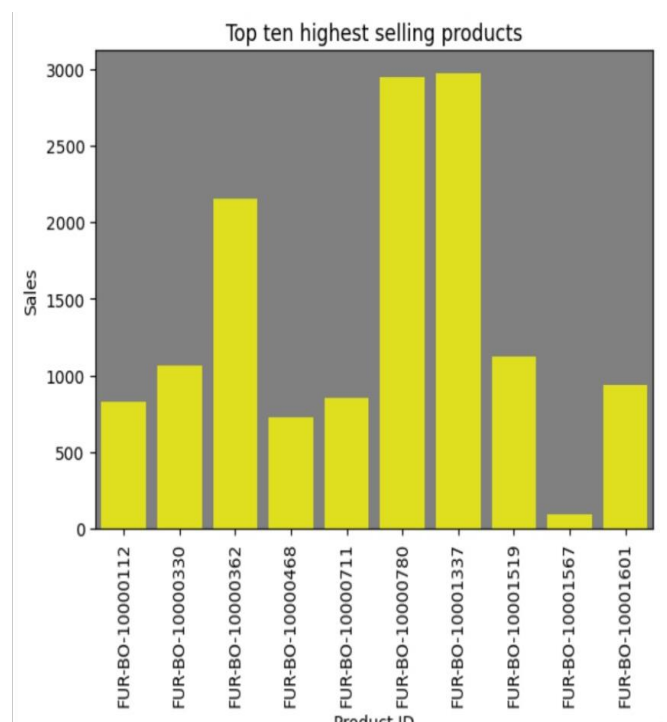


Fig-5: Sales report

Collaboration between interdisciplinary teams comprising ophthalmologists, software engineers, data scientists, and healthcare administrators. Rigorous testing and validation procedures are conducted to ensure compliance with regulatory standards, data security protocols, and interoperability requirements with existing healthcare infrastructure. Additionally, user feedback and iterative improvements are essential to refine the system's functionality, usability, and scalability over time. The implementation of an ERP system yield various results that positively impact an organization's operations, efficiency, and overall performance. the results of implementing an ERP system are transformative, driving improvements in operational efficiency, decision-making, customer satisfaction, and financial performance, ultimately contributing to the organization's long-term success.

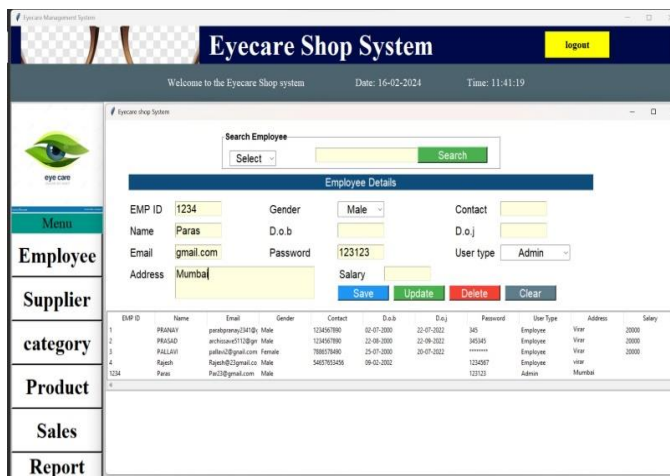


Fig-6: The ERP system

Continuous monitoring, evaluation, and improvement are necessary to maintain high levels of accuracy and effectiveness in delivering healthcare services.



Fig-7: Accuracy of ERP system

The accuracy of the project is 89.99 % and it relies on the precision of data, functionality, integration, clinical decision support, user inputs, and quality assurance measures implemented within the system.

6. CONCLUSIONS

The main steps used in this project are reviewed implementation of an ERP system in eye care. It is clear from the discussion that different organizations have different requirements, so the steps may vary. However, the above

discussion provides an overview of the matter these steps, which can be applied to any size an organization This project explores some of them in more detail critical factors that determine the success of an ERP system, especially in the field of ophthalmology in any organization. By understanding these factors, an organization can fully assess its ability to successfully adopt and implement ERP systems. Finally, the project has highlighted some of the benefits associated with using these systems. Although this project focused on the positive aspects of ERP systems, these systems also have negative aspects. It is important that future studies investigate some of the negative aspects associated with these systems.

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