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(Original Article)

Adoption and use of new medical management Technology at the hospital level

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ABSTRACT

Background: In today's digital era, healthcare management has increasingly embraced technology. Hospitals have recently adopted new clinical IT systems, with healthcare professionals playing a pivotal and valued role in their implementation. The success of healthcare relies on seamlessly collecting, analyzing, and exchanging clinical, billing, and utilization data among hospitals. This exchange aims to improve knowledge sharing, cut administrative costs, and enhance care quality. A significant challenge is the enormous storage space that data requires to preserve and transfer between hospitals and insurance companies, as well as the lack of standardized protocols for hospital management and delivering high-quality patient services. Sudan, in particular, faces technology underutilization in hospitals and non-compliance with medical coding regulations. Addressing these issues requires implementing internationally recognized standards and specifications.

Objectives: This project aims to effectively leverage technology, offering healthcare practitioners and researchers a more efficient approach to adopting information management systems.

Materials and Methods: This includes utilizing the Open ERP (ODOO) system's Medical Code On Demand (SaaS) service to streamline the handling and transfer of extensive healthcare information.

Results: This system can enhance the efficiency and productivity of hospital staff. It is capable of generating reports that offered an overview of hospital transactions within a specific timeframe. Additionally, the system allowed users to search for patient details through the receptionist module. By reducing workloads, the system contributed to improved management and performance within the hospital. Overall, the study led to significant improvements in hospital operations and transactions.

Conclusions: Odoo Hospital Management is a groundbreaking solution for healthcare institutions. Its all-inclusive features, smooth integration, and emphasis on enhancing the patient experience make it a transformative tool in the industry. With Odoo, healthcare providers can optimize their operations, cut costs. By incorporating medical coding with Odoo, it creates an exceptional system that supports managers in effectively running their hospitals.

1. INTRODUCTION

Healthcare management systems must effectively meet the needs of three key stakeholders: physicians, administrators, and patients. Physicians prioritize performance metrics such as speed, reliability, and adherence to clinical best practices. At the enterprise level, healthcare management is evaluated based on work, patient satisfaction, and profitability.

Healthcare management systems must not only provide a robust technical infrastructure to support diverse applications (Figure 1) but must also integrate these systems to ensure that data is accurately collected in incompatible formats (Ginter and others., 2018).

Healthcare management involves overseeing the strategic direction of healthcare facilities. Professionals in these roles enhance treatment options, establish organizational policies, and optimize operational procedures. While not directly involved in patient care, they ensure services benefit patients, empower staff, and maximize operational efficiency within budget constraints (Coursera ,2024).

Managing hospitals and clinics is intricate due to their diverse departments, specialties, schedules, teams, and data types. Moreover, there is increasing patient demand for greater control over their data, scheduling, and access to medical records, underscoring the complexity of hospital management (Katie Brownley, 2020).

Classification of diseases refers to a structured system where morbid conditions are categorized based on predefined criteria. The International Classification of Diseases (ICD) serves the purpose of systematically recording, analyzing, interpreting, and comparing data on mortality and morbidity across different regions and periods. It translates diagnoses of diseases and health issues into alphanumeric codes, facilitating the easy storage, retrieval, and analysis of health data. (International statistical classification of diseases and related health problems,2016).

Medical coding involves converting detailed medical reports into concise codes used in the healthcare industry. This process condenses complex medical information into streamlined codes that are crucial for billing and insurance purposes. These codes ensure accurate communication of medical procedures and services provided to patients. Medical coders play a vital role in ensuring that this information is conveyed efficiently and accurately to insurance companies.(,[website].,2021)

An Electronic Health Record (EHR) is a digital record of a patient's medical history maintained by healthcare providers over time. It encompasses essential administrative and clinical data pertinent to the individual's care, including demographics, progress notes, medical problems, medications, vital signs, past medical history, immunizations, laboratory results, and radiology reports. EHRs automate access to information and have the potential to streamline clinician workflows. Additionally, they support various care-related activities through interfaces such as evidence-based decision support, quality management, and outcomes reporting.(Centers for Medicare & Medicaid Services,2023)

Enterprise Resource Planning (ERP) is a strategy used by companies to enhance operational efficiency by electronically integrating information across key business processes. (Wijaya, Widyaningrum and others, 2019) ERP systems automate business processes by consolidating them into a unified database, enabling companies to manage and coordinate operations effectively. Modern ERP systems are modular, offering integrated functionalities tailored to meet specific business needs such as accounting, logistics, and sales.(Tarhini, and R. Masa'deh,2015)

In summary, ERP systems aim to automate and optimize core business processes within companies.

Automation aims to streamline company operations by enabling real-time management of business processes. This efficiency is achieved through the ERP system's single database concept, consolidating data from all core company processes into one database. This integration facilitates seamless information exchange across various business functions. (Dickson Perdanakusuma, Warih Puspitasari and Muhardi Saputra, 2020)

ODOO offers both a free open-source community version and a paid enterprise version, which provides enhanced features and services at a cost. The open-source nature of Odoo has fostered a vibrant ecosystem, drawing thousands of developers and business experts who have collectively developed numerous applications. Currently, Odoo boasts 850 partners and has amassed over 3 million users (Li Zhao, 2018).

This project aims to effectively leverage technology, offering healthcare practitioners and researchers a more efficient approach to adopting information management systems.

Fig 1. Benefits of the hospital management system

2. MATERIALS AND METHODS

The hospital-level medical management technology is based on the ODOO system, with the proposed methodology depicted in Figure 2. The hospital management system design utilizes ODOO and is developed using PyCharm, a dedicated Python Integrated Development Environment (IDE) that offers essential tools for productive Python, web, and data science development.

The ODOO management software offers several benefits to users:

- Comprehensive and modular: ODOO integrates CRM, e-commerce, billing, accounting, manufacturing, warehouse management, project management, and inventory functionalities. Its core components include the Open Object framework, around 30 core modules, and over 3000 community modules.
- Low cost of ownership and no lock-in: There are no license fees for the Odoo Community version, reducing implementation and customization costs. As open-source software, Odoo can be downloaded, tested, and used free of charge.
- Customizable: ODOO is highly flexible, allowing customization to align with specific business needs. Users can select modules that best suit their operational requirements.

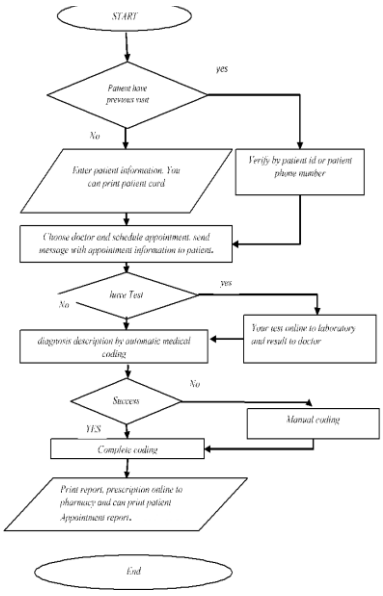

Fig 2. Flow Chart of Proposed Method

ODOO utilizes the PostgreSQL database as its backend. Its server component is implemented in Python, and functionalities are modularized. Each module defines the framework for data structures, forms, reports, procedures, etc., and includes both Python and XML files.

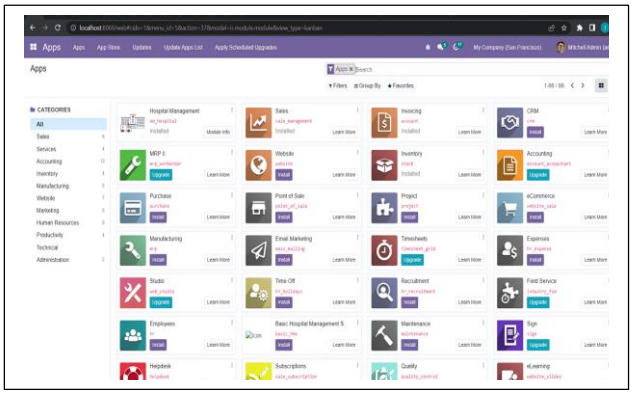

Fig 3. ODOO 15 community app

Updated technology: Odoo is based on a technology stack that is modern and up-to-date. In addition, with its open-source community, it is actively maintained by a large base of developers to meet customers' needs and provide new applications.(Saman Sakib,2023)

RESULTS AND DISCUSSION:

The services and products offered in the healthcare industry aim to alleviate pain, prevent illness, and potentially save lives. Effective leadership is essential to ensure proper execution and maintain safety for everyone involved. In this project, I developed a hospital management system using Odoo 15, an open-source ERP system that utilizes the Python programming language and PostgreSQL database. The ERP system employs a unified database approach, consolidating data from all hospital processes into a single database for seamless information exchange between departments.(. Joana Ferreira Marques and Jorge Bernardino, 2024) This system incorporates numerous features to support both management and patients, from patient registration through the entire hospital process, including necessary tests, medication dispensation from the pharmacy, and precise diagnosis by the doctor.

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3.1 Creation of the first patients:

An electronic version of a paper chart in a doctor's office is not an Electronic Health Record (EHR). It is a vast digital database that provides a wealth of patient health information. EHR systems are made to make it easier for healthcare organizations and providers—such as labs, specialists, medical imaging centers, pharmacies, emergency rooms, and clinics at schools and workplaces—to share information. This guarantees that data from several sources is included in EHRs.(Naisha Sultana, Gandikota Ramu and Eswara Reddy, 2014).

To create the new patients' , the user have to press the Create button in the patient module. After that enter information of the patient and display it in many view modes. In each view, the user can determine what field can appear.

3.1.1 Form view

There are many ways to display patient information such as form view, tree view, Kanban view, and calendar view. The first mode form mode is as in Fig (4-a).

The second type of view is the tree view Fig (4-b) and the programmer can determine which field can appear in this mode. Mechanical tree view means the field that appears in the tree view is not constant you can choose what field appears in the tree view at any time you want and change the appearance of the view.

3.1.2. Print patient card

The user can print patient cards for every patient as in Fig (5). The user can look for any patient by his name, reference number, or mobile number.

3.1.3 Create appointment:

After registering patients then the user can make an appointment by going to the appointment module as in Fig (6). The user can choose a patient from the patient model or create a new record of the new patient. If you choose the patient's name from the patient model, then the data entered in the patient model is updated directly. The user can send mail and WhatsApp messages for the patient to memorize his appointment

3.2. Laboratory

When the doctor writes the test, he presses the Lab Button, as appears in the previous appointment module (Fig. 6). Then, a record is created with the patient's reference number, name, and laboratory test results. After the patient is tested, the doctor can see the patient's result in the laboratory module by pressing the button "View lab result" in the appointment form view. The patient's record is in the laboratory section. The doctor redirected to see the result of his patient, as in Fig (7)

3.2.1 Lab report

The user can get a report from the form view and tree view by pressing the report button, and it gives you a pdf report as in Fig (8)

3.3. Image creation and result:

When a doctor needs to create an image, they initiate the process by pressing the 'create image' button in the appointment module. This action generates a record in the image module, containing the patient's reference number, name, and the type of image required. Once the patient's test is complete, the doctor can easily view the results by pressing the 'view' button. The result will be displayed in a form view, similar to a laboratory form.

3.3.1 Image report:

If the patient wants the report, he can easily get it by pressing the report button and it will be in the form in Fig (9)

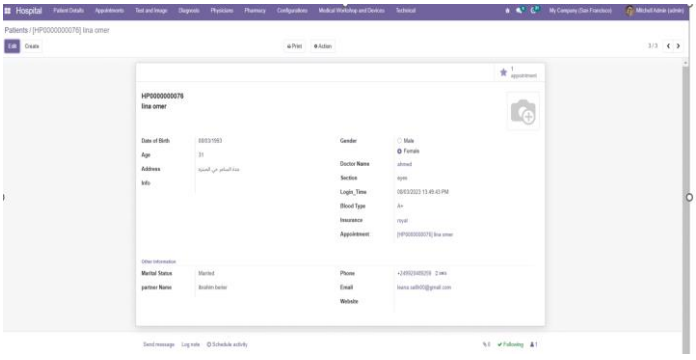

Fig 4-a. Form view of patient model

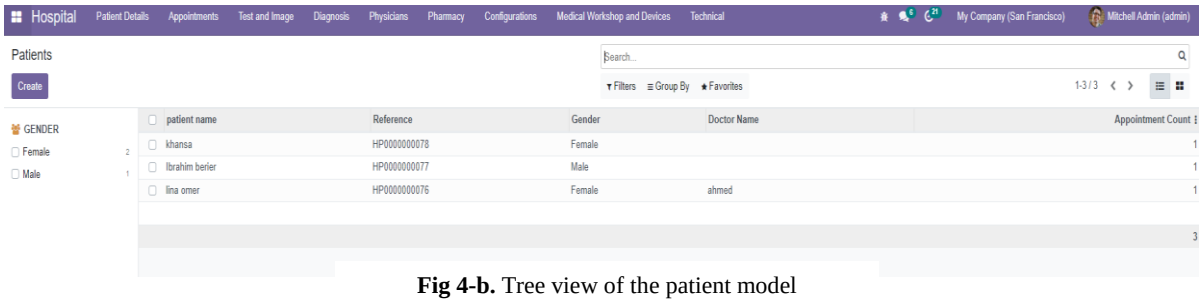

Fig 4-b. Tree view of the patient model

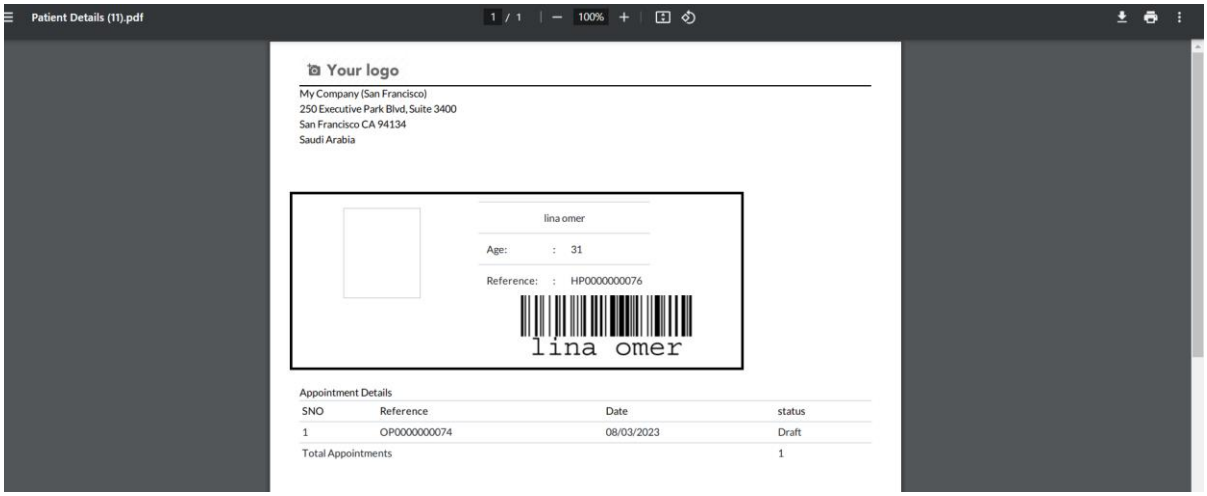

Fig 5. Patient detail

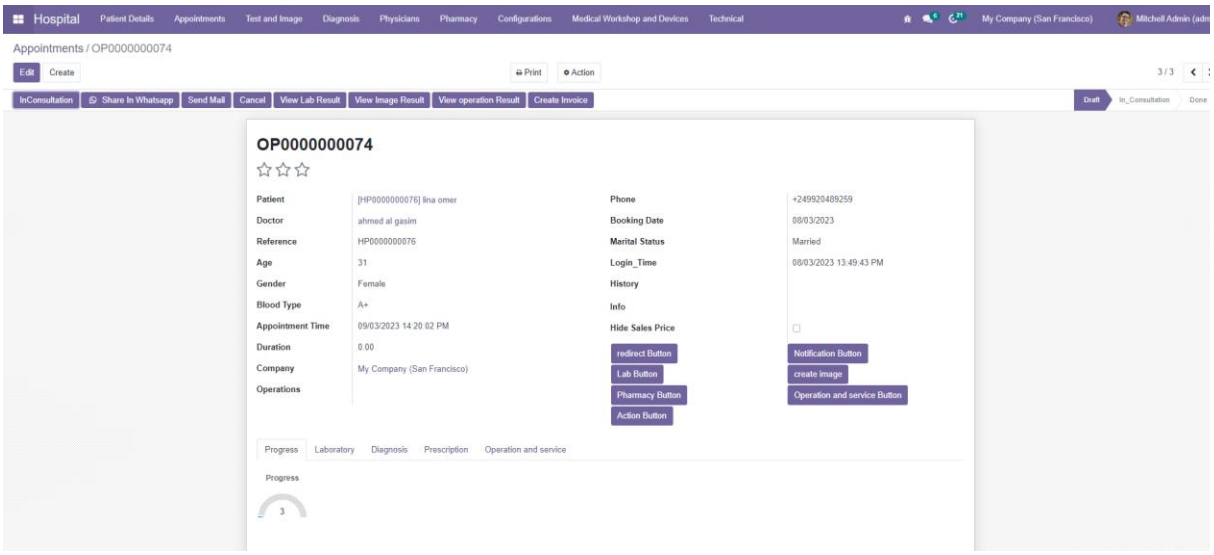

Fig 6. Form view of appointment model

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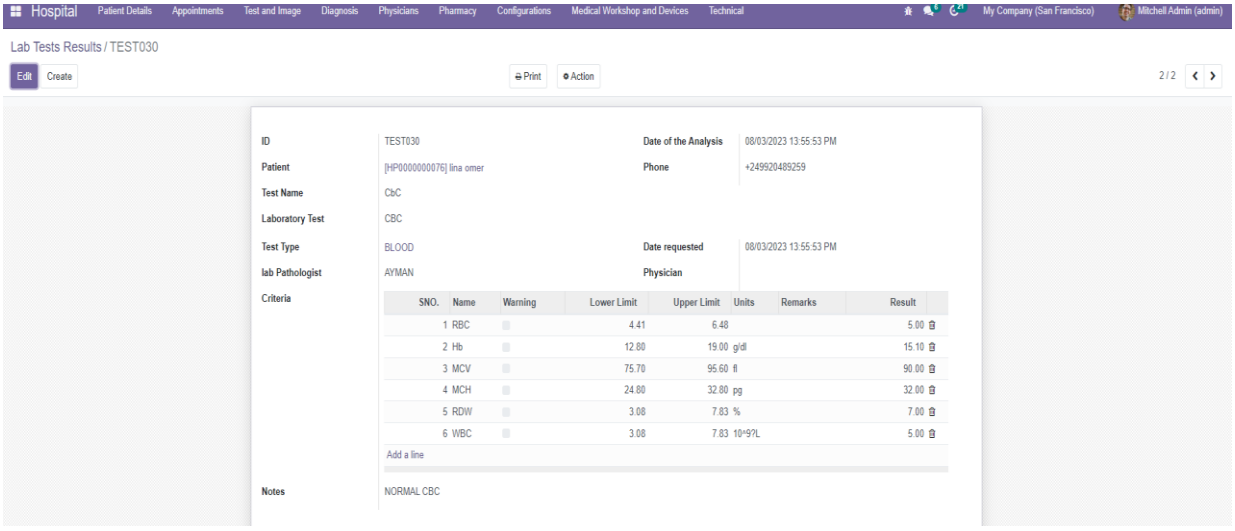

Fig 7. Form view of test result

Your logo

My Company (San Francisco)
250 Executive Park Blvd, Suite 3400
San Francisco CA 94134
Saudi Arabia

Date: 2024-07-23

LABORATORY REPORT

Patient Name: [HP0000000076] lina omer Test: TEST030 Age : 31

Gender : Female Doctor:

BLOOD

Analyte	Result	Lower Limit	Upper Limit	Units
RBC	5.0	4.41	6.48	
Hb	15.1	12.8	19.0	g/dl
MCV	90.0	75.7	95.6	fl
MCH	32.0	24.8	32.8	pg
RDW	7.0	3.08	7.83	%
WBC	5.0	3.08	7.83	10^9?L

Fig 8. Report form

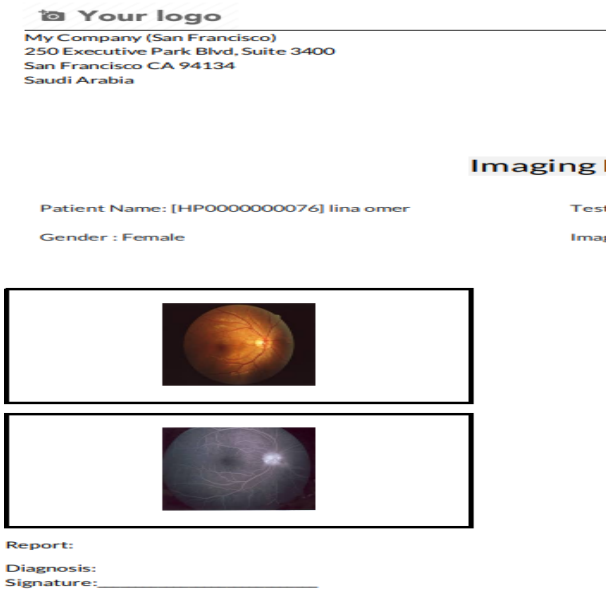

Fig 9. Form of image report

4. Diagnosis

The medical coding in this system sets it apart, as it reduces the storage space we need to save data; so, from the book of ICD10, there are many sections of disease. I chose the eye section and wrote it as a data file inside Pycharm. It appears as a module in the system Fig (10). The doctor will find many types of eye diseases, and he decides on the disease after tests. Then he can choose the disease name from the list, and the code comes automatically. Moreover, he can quickly write a new one that will be saved directly in his system. This will revolutionize hospital management because doctors will no longer need to use a heavy and tough book to write the medical code. The doctor can choose the disease with code or write the disease with code if it is not found. Fig (11)

The doctor can choose the disease with code or write the disease with code if it is not found. Fig (11)

4.1. Operation

If the doctor decides to do the operation, he chooses the operation and the code comes automatically fig (12) . In the end, the patient can obtain the report of his appointment by just pressing the report button in the appointment module and can be printed out or downloaded in PDF form.

4.2. Pharmacy

When the doctor writes the medicine, he wants it. He presses the button on the pharmacy Button in the appointment module then it creates a record with the patient reference number, name, and medicine in the pharmacy record. The form view of the pharmacy is in Fig (13)

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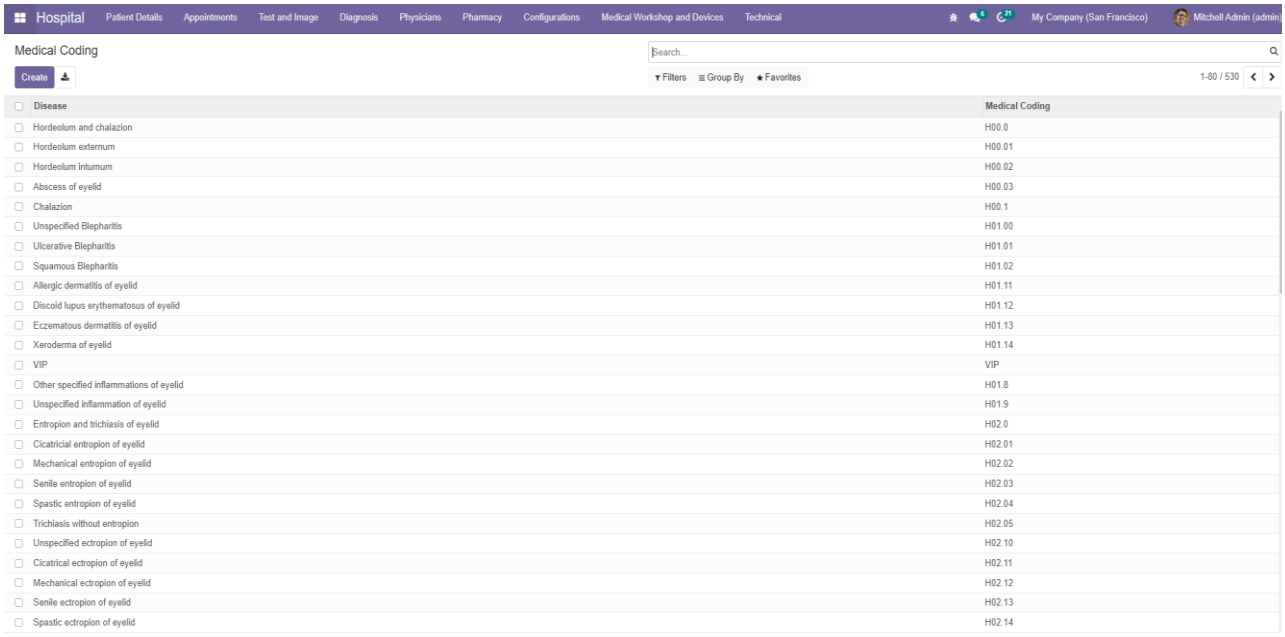

Fig 10. Eye section medical code

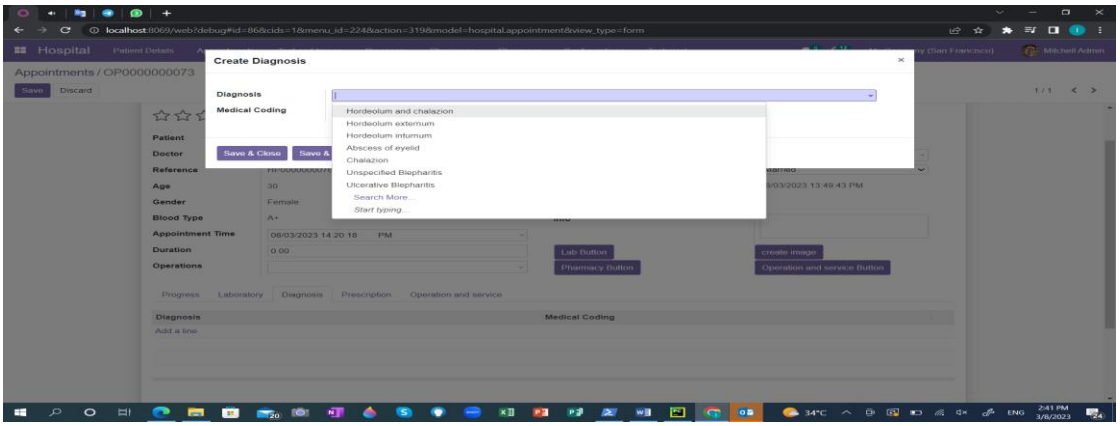

Fig 11. Choose disease

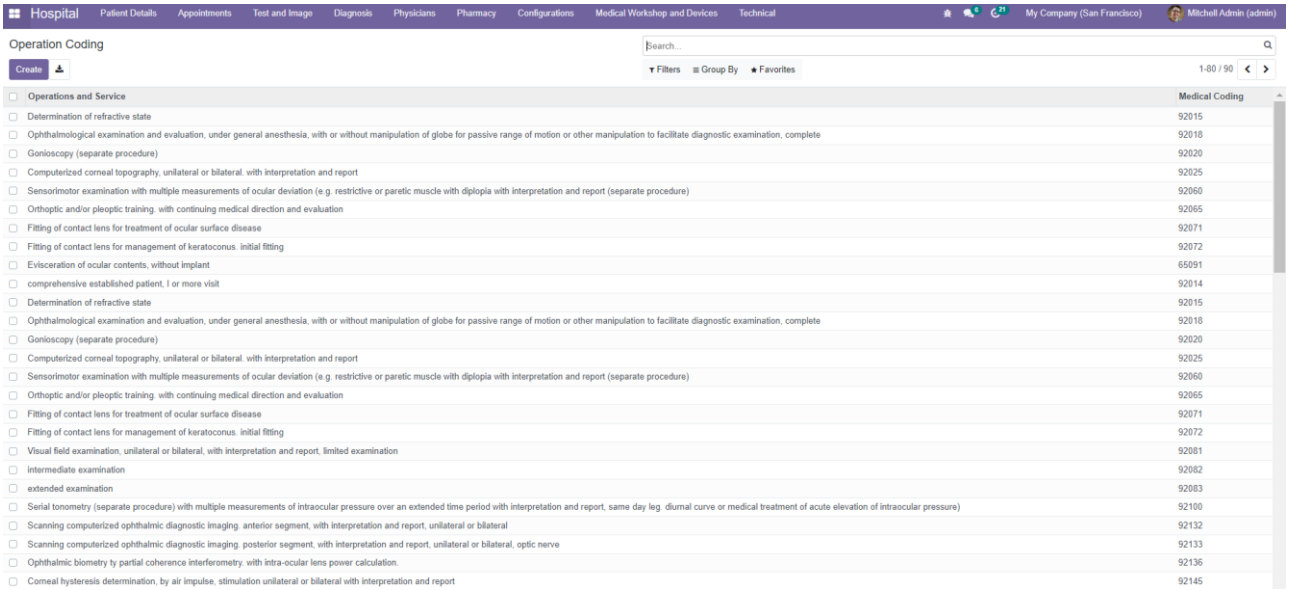

Fig 12. Operation code

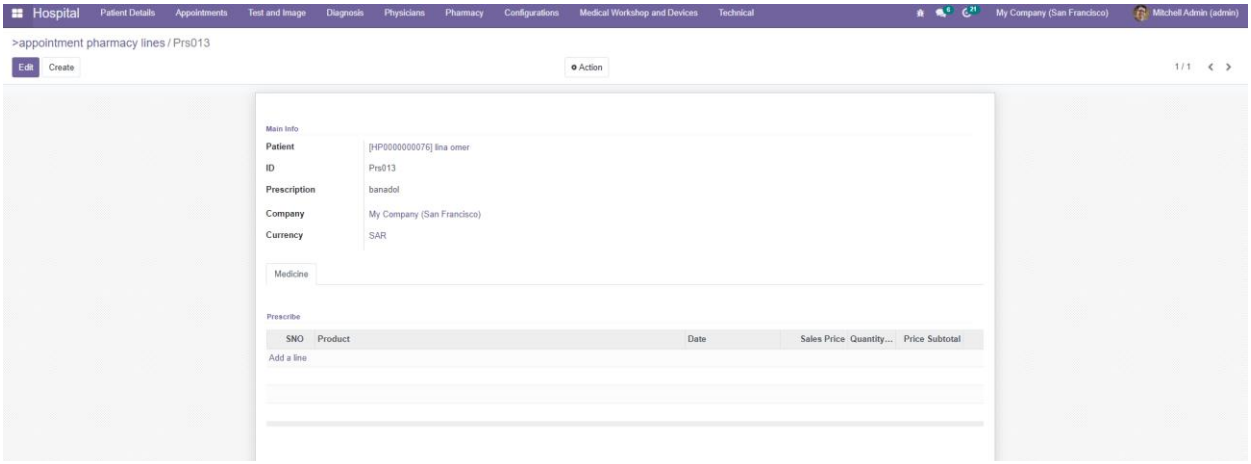

Fig 13. Pharmacy patient form

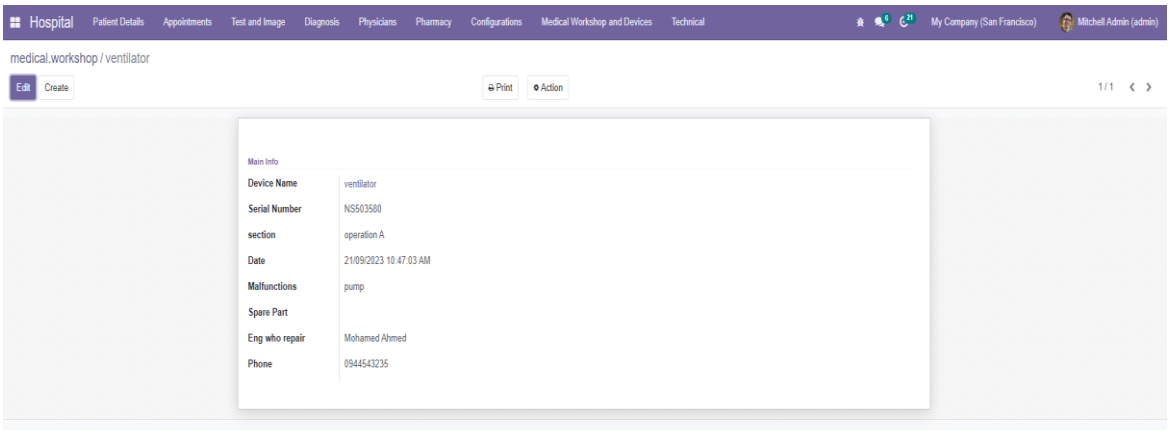

Fig 14: workshop form view

4.3. Medical device and workshop

Another feature is there is an inventory of all devices. If there is any malfunction in the device, it is sent to the medical workshop Fig (14). This model for the workshop relates to biomedical engineering. It will facilitate the management and maintenance of medical devices. It holds all data about devices.

4. Conclusion:

The study proposes the adoption of Odoo and medical coding to digitize hospital operations. This approach not only eliminates the need for patients to carry physical copies of their testing reports and health histories but also ensures interoperability between systems. Medical coding, in particular, facilitates efficient information transfer and ensures uniform documentation across medical facilities. It also empowers administrators to analyze treatment prevalence and effectiveness within their facilities, thereby enhancing overall management. Healthcare managers and administrators are the linchpins of hospital and doctor's office operations. Their role is crucial in ensuring the smooth functioning of these institutions, supporting the development of new medical products and services, and ultimately improving patient care and addressing local needs. Their support is vital in the successful implementation of digital systems in healthcare management. The relationship between public healthcare and modernized hospital management systems is not static but continuously evolving. This evolution is driven by factors such as population growth, increasing patient numbers, and rising medical challenges. Technological advancements play a key role in this evolution, necessitating robust management system architectures to sustain

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operational efficiency and adapt to these changes. In response to the growing demand for quick access to information, enterprise resource planning (ERP) systems have emerged. These systems effectively meet these human development needs by streamlining operations across various departments.

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All authors contributed equally to this work

Conflicts of Interest:

The authors declare no conflicts of interest.

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