Medication Error Prevention
(Cardiology & Pharmacy Management System)*

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ABSTRACT

"The FDA receives more than 100,000 reports yearly related to medication errors". The statistics prove that the need to update the medical systems nowadays has become not an entertainment option. Still, it's very necessary for saving the patients' lives and preventing human errors as much as we could misunderstandings of the handwriting methods in the prescriptions or in the medical reports. Moreover, the new

generation of developed technology existing enthusiasm for the need of transferring the old ways of the hospitals, clinics, and pharmacies' systems to follow the new technologies, and depending on the actual demand which is increasing day by day in order to be in the same way as the advanced international technologies. Applying this digital transformation, prevent the existence of medication errors done by humans, the ability to easily find the patient history and offer the needed help for doctors to make the right decisions, the timing of the staff shifts in the hospital, and the availability of beds would be so easy to know through just one click, and

Another great feature that couldn't be counted for this hospital will gain through using the digital system. Also, healthcare digitization and such a transformation not only help hospitals offer better public health services but also proves to be a positive change for patients, who can now participate more

actively in their wellness decision-making. Provide a friendly platform for doctors to save their patient history and share the needed data directly with the pharmacy through the digital platform. We have 2 systems (Pharmacy & Cardiology Clinic) that will be connected for data exchange that helps in making the two systems work as one big system by using the API. It's a fully digital system for the clinic since it has many features that help the doctor in handling the patients' data, sharing data easily, and other stuff connecting both systems through API to make the exchanging of data easy and smoothly.

I. INTRODUCTION

"The problem with heart disease is that the first symptom is often fatal." — Michael Phelps. cardiovascular diseases are the leading cause of death worldwide. In 2019, an estimated 17.9 million people died from CVDs, accounting for 32% of all global deaths. 85 percent of these deaths were caused by a heart attack or a stroke. More than three-quarters of CVD deaths occur in low- and middle-income countries according to the WHO organization. Since the 1990s, cardiovascular disease (CVD) has been the leading cause of premature death in Egypt [1]. CVD accounted for 46.2 percent of overall mortality in Egypt in 2017.

Heart failure (HF) is a significant and growing public health burden, owing to the aging of the population and the success in extending the survival of those who have had coronary events. Because of that cardiology and cardiovascular clinics have a huge number of visits every day and tens number of visits every day, and because of the sensitivity of heart disease diagnosing and the dangerously of doing tiny errors that could lead to death. One of the vital problems faced the cardiology patients, especially the patients with chronic diseases who need to visit the doctor for their whole life, is the way their data is stored where with the paper systems and hospital archives it is challenging for the patient to view this medical history even if he tried to store it n his own where the papers could be lost or damaged, and if he tried to go to the archive it would be more difficult to find his data within thousands of files. In addition, medication errors are among the most common types of medical errors, causing at least 1.5 million people to be harmed each year. According to the report, the extra medical costs of treating drug-related injuries in hospitals alone are at least $3.5 billion per year, and this estimate does not include lost wages and productivity or additional health care costs [3]. Medication errors associated with the pharmacy or the health care professional who dispenses the medication are referred to as dispensing errors. Illegible handwritten prescriptions are a well-known source of error, and it is recognized worldwide, itis caused because of the blurred writing of the prescription where the pharmacies could misread it, then give the patient another medicine which can cause critical problems and in cardiology patients can cause death. other reasons for the medication errors are Inadequate or missing information about co-prescribed medications, past dose-response relationships, laboratory values, and allergic sensitivities can all lead to errors. Prescription errors can occur when the wrong drug or dose is chosen, or when a regimen is overly complex. Sound-alike

names may cause errors when prescriptions are transmitted orally. Similarly, when prescriptions are handwritten, drugs with similar-sounding names may be incorrectly dispensed. When a prescription is not transmitted to a pharmacy or when the patient does not fill the prescription, errors can occur. Physician sampling of medications can contribute to medication errors due to a lack of adequate documentation and drug utilization review. Thanks to technology and information systems that have allowed an advanced way of managing and organizing all the interactions within clinics and hospitals department and the question are what could be done to save cardiology patients from medication error, in addition to the cardiology clinic management?

Problem Definition:

The main problem is the lack of technology in cardiology clinics where there is a paper or archive system which made it challenging for the physicians to save and check their patients' medical history and past diagnosis in addition to tracking their progress continuously which could mainly affect their diagnosis, and on the other side, the patient finds it extremely difficult to save his medical history and save his past prescriptions and diagnosis in addition to, difficulty in tracking his progress. In addition to the medication errors that occur due to the handwritten prescriptions can cause misreading of blurred writing and confusion between the drug with a similar-looking name which could cause cardiology patients critical problems. the main problem could be summarized as the lack of direct communication between the pharmacy and the cardiology department to avoid

II. PURPOSE

we aim to develop a clinical management system that can manage all the clinical and financial interactions and, help in collecting, storing, and managing the patients' data whether their medical history and past diagnosis or recent prescriptions. in addition to helping the physician in writing prescriptions according to chosen ontology and in a form of online form also, viewing all his patient profiles. the system will relate to the pharmacy using the APIs where the physician could view all the pharmacy available medicine and chose from them then, the prescriptions will be sent directly to the pharmacy in the form of online form that will prevent any meditational error

III. METHODOLOGY

Primary Data Collection: in this step, we depended on the direct way of collecting the data by asking three categories of people. -Doctors in the clinics who are working in directly with the patients asked about the easiest data collection method for them. At the same time, collect the information from the patient, write the prescription, and the problem they are facing with the missing patient history while making the examination and determining the treatment plan, how this may affect their decision regarding the medical history of the patient not fully known by them. -The second type are

Pharmacists who are receiving the prescription from the patients.

Our investigation in this part was essential to highlight a very significant problem that exists on the actual ground. The prescription written by the doctors depends on the handwriting method, which may cause a misunderstanding made by the pharmacist and will affect the patients by possibly taking a different medicine.

Although the unavailability of some types of medication forces the pharmacist to unwillingly give an alternative type of medication which may sometimes differ in effect, type or even quantity. That medicine may not be suitable for the case; however, it may be for others.

So, depending on the medical history of the patient may cause some harmful side effects. Knowing the exact type of medication that exists in the pharmacy by the clinic's doctor prevents all of these mistakes that may occur.

The third category of people were patients who have monthly visits to the doctors, the main questions in the survey were focused on asking about the impact of having a digital medical history and whether it will help them avoid missing medical papers and prescriptions, and what kind of design for the platform do they think would make it easier for their process of signing up. Upon doing so they create the profile with which they use to book an appointment by it. The team made sure to make the cardiology clinic system based platform as friendly as possible, in order to make it easier for all patients from different sectors.

Secondary Data Collection: in this step, the team depended on the previous clinical and pharmacy systems' users, in identifying the problems they were facing before while using such systems, what were the missing parts of them, and the upgrades they needed. Their feedback was very significant in the process of developing the cardiology clinic system. Identifying the users of both two systems is always an essential step in any software project design phase, identifying the persona of the user helps a lot to customize the system according to the needs of the user and what is the ideal system for them in order to encourage them to shift from the traditional method to the digital method by using the new system without much hassle.

The Cardiology Clinic System mainly has three types of users which are:

1) Admin (The Clinic Doctor): The doctor in this case is thought to be the one in control of many of the essential features, as he can Show the patients appointments, manage, and view his patient's medical history, make decisions by writing reports and can check the entirety of the patient's profile, He is also capable of writing the prescription for the patient through the drop list form, send the needed medication to the pharmacy and know the condition of the stock for each type of medication in the signed-up pharmacies stock or not in order to choose an alternative medicine in that case, the admin in this part can add new doctors to the system and give them the access to all the features that he got access to.

2) The Pharmacist: who can Manage the main 3 parts of the system which are (Medication, Medicine categories, and providing Companies). The Medication part holds all details about each medication including its scientific name through the ontology and the commercial name, the company which produced this medicine, the number of items in the stock, its price, and other needed information. Medicine categories include all medication divided into categories depending on their usual use. Companies: it has a profile for each company the pharmacy deals with. Additionally, the pharmacist can add, delete, or modify any one of them depending on the case, and that option eases the system used for the pharmacist. The system in the pharmacy is receiving the prescriptions automatically from the other system in the clinic and books the chosen medicine from the stock in order to put it on hold.

3) The Patient: As for the patient as a user type the cardiology clinic system provides ease of use as its top feature so in order to do that, each patient has access to the sign-up / Log-in Screen, as well as seeing all the updates for their medication.
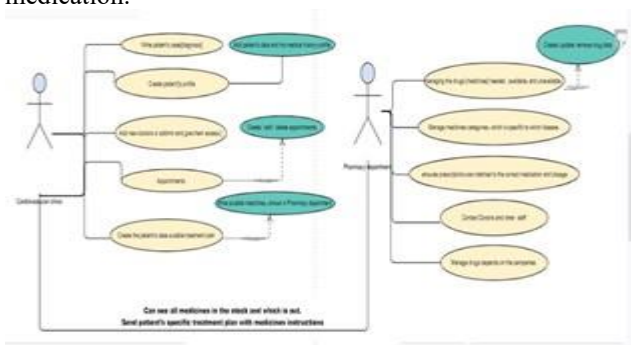

Fig.1

The High-level design (HLD) explains the architecture that would be used to develop a system. In our architecture diagram, we provide an overview of an entire system, identifying the main components that would be developed for the product, identifying the relations between every component and the rest of the components as shown in the figure.
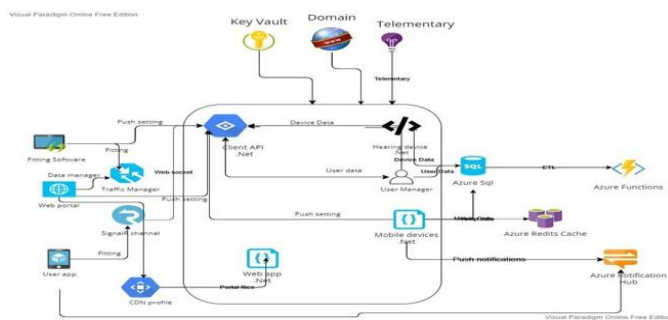

Fig. 2

The Technologies used to finalize this project are. •Python Programming Language in the back end, specifically "Django" which is a high-level Python Web Framework that enables rapid development with highly secure and easy maintenance of the system.

• In the Front End we have used HTML, CSS, and also JavaScript to handle some small points in the front end to make the system friendly and usable.

• Regarding the Database it's SQL Light which is a built-in database in Python Django.

• The interaction between both two systems and exchanging the data were mainly dependent on the Restful API.

Cardiology & Cardiovascular Clinic: It's a fully digital system for the clinic since it has many features that help the doctor in handling the patients' data, sharing data easily, and other stuff: Give the patient the opportunity to create a profile for himself and log in to show his updates and book an appointment. Give the doctor an easy and friendly tool to receive the appointments online, show the patient profile and update on it, write the bill on the platform through drop list for both diseases and options of medicines instead of using paper, can easily send the bill to the pharmacy to reserve this medicine and check if it's available on this pharmacy or not and send the alert to the pharmacy to book this medicine to the patient, has full access to review the old prescription and patients profiles.

Features that the Cardiology Clinic system has is listed below: Login / Register: Available Email and password will allow you to log in to the system.

Admin view: [Cardiology Clinic's Doctor] Appointment: Add – edit and delete Disease: add disease with description and available drugs Prescription: add medicine from each company Medicine: add medicine from each company with the disease type. Patient view: Appointment, add and edit appointments from the website.

Pharmacy Department System: It performs many of the same services as traditional pharmacies, but with a digital system that has an admin login page, and some main points as: Medicines Page: It includes all medicines in the pharmacy and each one of them has a full profile which represents its price, several items, active as it's in stock or inactive, its description, the producing company, and all features must be shown in the medicine profile. Medicines Categories Page: It includes the medicines categories for what specific purpose they are usually using, and devising depending on their usual usage. Companies: It represents all companies that the pharmacy is dealing with and their contacts with a full profile for each company. The system is mainly used for: - Storing and tracking the medicine's [number, type, price…etc.]. - The system is linked with the Cardiology Clinic system thus the doctor can select the medicine found in the pharmacy while writing the prescription for the patient. - Save companies' information who deal with the pharmacy. - Contain the users' Profiles who are acting as admins.

API is the way we used to connect both two systems together to share their data and interact. Using RESTFUL API [Application Programming Interface] is a set of rules that define how applications or devices can connect to and communicate with each other. A REST API is an API that conforms to the design principles of the REST, or representational state to transfer architectural style. Thus, by the API the Cardiology Clinic System can make two requests GET & POST to the medicine table.

GET request – read data:

0. Check the method of the request.

1. Take the data.

2. Serialize it to check is it valid or not.

3. Send is in a JSON format.

POST request – create:

0. Check the method of the request.

1. Take the data sent to us (from request).

2. Deserialize it.

3. Validate the request specifications you want to save to the database.

4. "Response" create a python object from it

RESULTS

Our project has resulted with a unique system that provides a friendly platform for doctors to save their patient history and share the needed data directly with the pharmacy through the digital platform, Making a dependent system for both cardiology clinic and the pharmacy with its needed features in the hospital but connecting and integrating all of them together and easy the way of exchanging the data between them, Saving a patient profile for each patient in the system database makes it easy to find, handle, and be updated continuously, Organizing the pharmacy with everything in it, medicines to know the available and unavailable, and medicines that are valid and expired, Managing and organizing the Cardiology & Cardiovascular clinic with all data, and the way it communicates with the pharmacy, connect both systems through API to make the exchanging of the data easy and smoothly.

The system consists of 2 systems (Pharmacy, Cardiology & Cardiovascular clinic) that will be connected for data exchange that help in making the two systems work as one big system. Pharmacy department: it performs many of the same services as traditional pharmacies. It has an admin login page, some main points as, Medicines column which includes all medicines in the pharmacy and each one of them has a full profile which represent its price, number of items, active as it's in stock or inactive, its description, the produced company, and all features must be shown in the medicine profile. Medicine categories: includes the medicine categories for what specific purpose they are usually using. Companies' column: is representing all companies that the pharmacy is dealing with and their contacts. Receiving the prescription from the clinic and booking the items that have been sent.

Cardiology & Cardiovascular clinic: It's a fully digital system for the clinic since it has many features that help the doctor in handling the patients' data, sharing data easily, and other stuff as it gives the patient the opportunity to create a profile for himself and log in to show his updates, and book an appointment. Gives the doctor an easy and friendly tool to receive the appointments online, show the patient profile and update on it, write the bill on the platform through drop list for both diseases and options of medicines instead of using paper, can easily send the bill to the pharmacy to reserve this medicine and check if it's available on this pharmacy or not and send the alert to the pharmacy to book this medicine to the patient, has a full access to review the old prescription and patients profiles.

With the use of the API the clinic and the pharmacy connect to each other where all the prescription will be sent to the pharmacy directly and the physician can view all the available medicines and choose from them which will deduce any medication error and both the pharmacy, physicians and the patients will have all the prescriptions saved in their profiles.
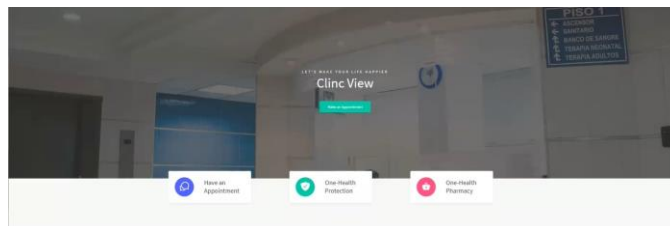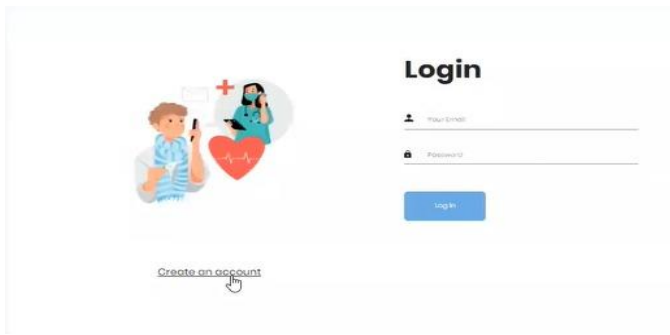

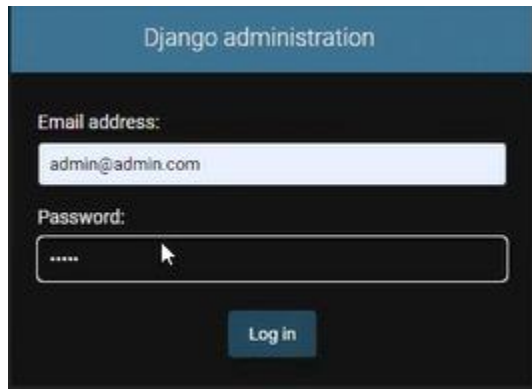**The Cardiology Clinic Home Page Fig. 3**
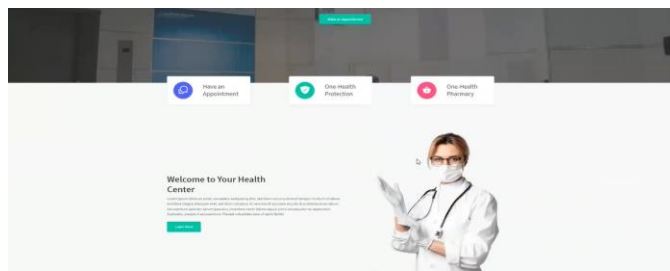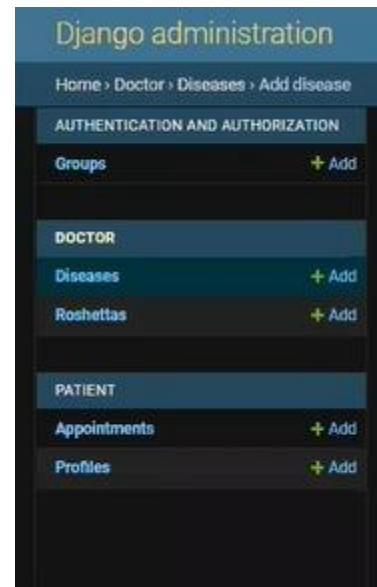

The Pharmacy System Home Page Fig. 4
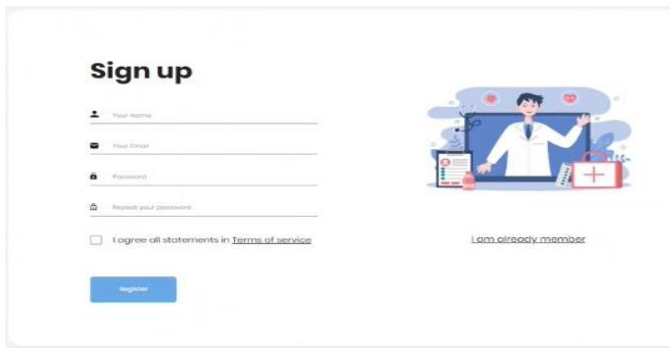
The Sign-up Page for the Patients Fig. 5

The Login Page for The Patients Fig. 6

Login to The Pharmacy System Fig. 7

The Availability of Choices to the Clinic Admin Fig. 8

CONCLUSION

In conclusion, our project aims to solve a crucial problem of managing all aspects of two of the most important departments in hospitals, and the problem of their communication. We made an integrated system, it's a cardiovascular, and pharmacy management system. We provide complete management to each one of the two departments or clinics. In the Pharmacy department, it performs many of the same services as traditional pharmacies. It has an admin login page, some main points as Medicines column, Medicine categories, in addition to Companies column. For Cardiology & Cardiovascular clinic: It's a fully digital system for the clinic since it has many features that help the doctor in handling the patients' data, sharing data easily, and other stuff, and give the patient the opportunity to create a profile for himself and log in to show his updates, and book an appointment. Our solution we ease the data management and sharing between the departments. It also will help the doctors, nurses, and all health providers with patient's data. And finally help patient to access his data

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