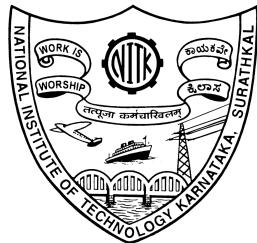


National Institute of Technology Karnataka, Surathkal



Database Management Systems Lab Project Report On **Virtual Clinic - An Integrated Care System**

Submitted By

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DECLARATION

We certify that the report on ‘Virtual Clinic’ which is being submitted as record of our DBMS course project is a bonafide report of the work carried out by us. The material contained in this report has not been submitted to any university or Institution for the award of any degree.

Signature	Signature
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Abstract

“Virtual Clinic” is based on the concept of integrated care system. Stakeholders for the system are Doctors, Patients, Labs and Chemists. A patient makes his/her consultation request to the system either by creating an offline or an online appointment by entering the symptoms, the system forwards the consultation request to a doctor of the concerned speciality. Doctor generates a prescription comprising of Diagnosis, Medicines and Lab Requests(if needed) based on the symptoms provided by the patient. The prescription is received by patient, localized chemist and localized labs. Using the prescription Chemists provide medicines to the patient via offline delivery. Labs, too, use the same prescription to collect specimen from patient and upload the lab reports based on lab tests. For Chemists and Labs, only need to know information will be displayed thereby protecting the Patient’ confidentiality.

The technologies used to develop the software are MySQL database, Django 2.0 for backend, HTML, Bootstrap, Javascript, jQuery, libraries like flatly, datatables etc. for the frontend development. For Continuous Integration and Continuous Deployment(CI/CD), TravisCI and Heroku are used.

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Introduction

1.1 Purpose:

Virtual Clinic is an application that integrates the different stakeholders involved in medical profession. The concept of the project is as follows, a patient can make a consultation request to any registered hospital and doctor in the system by entering the symptoms, the system forwards the consultation request to the doctor across the concerned speciality. The consultation request can be offline or online. Doctor after consultation generates a prescription comprising of Diagnosis, Medicines and Lab Requests(if needed) based on the symptoms provided by the patient. The prescription can be viewed by the patient, and is sent to nearest local chemist (for medicine delivery) and nearest local lab (for lab tests). Using the prescription, the assigned chemist provides medicines to the patient via offline delivery. Assigned Lab uses the same prescription to collect specimen from patient to perform lab tests and update the report on the system to view for the patient anytime. Fully customized admin panel to view the activity of the users to monitor, change the roles of the registered candidates will be some core features for the admin panel. The system will be one of the best of it's kind and will be used for any city by the government for various hospitals across for better healthcare towards the society.

1.2 Objective :

A Multi-speciality Hospital has created a vision to provide 24/7 Primary Care at Doorstep of Patients using a panel of high quality doctors. Further, the Hospital has decided to provide quality medicines vide authorized Pharmacies at the doorstep at discounted prices as well as give doorstep Laboratory services wherever possible vide specimen collection. The aim is to help elderly and infirm people as well as people who need regular monitoring services to get access to quality healthcare services at affordable prices at the Door-step. It is envisaged that preventive and regular monitoring services can reduce the hospital admissions and reduce the suffering in General. As per Chairman' directive, the services have to be operationalized in a short span of 4 months within a budget of Rs. 50 Lakhs. Further, the system must be available round-the-clock with 10 minutes outage per month and should be highly stable and reliable with very low maintenance costs.

Requirement Analysis and specifications

The aim of the system is to develop “Virtual Clinic” software, which should automate the process of healthcare, and make it easier for every stakeholder involved in the process. The system is supposed to be used in any city with availability 24x7. Therefore, the proposed system must be able to function under all circumstances.

2.1 Software Requirements

- Database : MySQL has proved to be the database for web based applications, because of its performance and scalability, reliability, availability. From the perspective of database administrator, it's perfectly reliable and easily maintainable.
- Web Server : Nginx (web server which can be used as reverse proxy, load balancer, HTTP Cache), Gunicorn (python web server gateway)
- Automated testing : Travis CI (Hosted, distributed continuous integration system used to build and test software projects)

Our development platform was Django and the following tools and languages were used :

- Django - Backend python programming language web framework
- Javascript - Front End scripting language
- HTML - Markup language for creating web pages and web applications.
- CSS(Bootstrap, Flatly theme) - Stylesheet language for styling the documents
- Sqlite3 - Default database for django based development

Other Development Software:

- Ubuntu 18.04 LTS operating system
- Lucidchart for UML diagrams
- PyCharm Professional IDE
- Postman for testing APIs

Hardware Requirements

- Web Server: We need a reliable web server for the system. The machine must be fast and must show high performance in all situations. Atleast 512MB RAM and Pentium 4 2000 MHz processor seems to be minimum requirements for the machine.
- Database Server: Since the system will be used across all cities and huge amount of data will be stored, a machine will be needed which can serve as a database. Atleast 40 GB storage capacity is needed for the system, and the machine must be high performance machine.

Database Design

3.1. ER Diagram

This ER diagram represents the model of Virtual Clinic system entities. The entity-relationship diagram of Virtual Clinic System shows all the visual instruments of database tables and relationship between different users, appointment, prescription etc. It used structured data and define relationship between structured data groups of Virtual Clinic System functionalities. The main entity of Virtual Clinic are user, account, profile, appointment, prescription, medical test.

Virtual Clinic entities and attributes:

- Location Entity :

Attribute Name	Meaning	Value
id	Unique number of a location	11
address	Address of the location i.e. street no, building no.	50
zip	Zip code of area	50
city	City of the location	50
state	State of the location	50
country	Country of the location	50

- Hospital Entity :

Attribute name	Meaning	value
id	Unique number of a hospital	11
name	Name of the hospital	50
phone	Phone no. of hospital	10

- User Entity

Attribute name	Meaning	Value

<code>id</code>	Unique number given to a user	11
<code>username</code>	Username chosen by user	128
<code>password</code>	Password set by user	150
<code>first_name</code>	First name of user	30
<code>last_name</code>	Last name of user	150
<code>email</code>	Email of user	254

- Symptom Entity

Attribute name	Meaning	Value
<code>symptom_id</code>	Unique id associated with a symptom	11
<code>symptom_name</code>	Name of the symptom	50
<code>symptom_description</code>	Description of the symptom	100

- Speciality Entity

Attribute Name	Meaning	Value
<code>speciality_id</code>	Unique id associated with speciality	11
<code>name</code>	Name of speciality	50
<code>description</code>	Description of speciality	100

- Account Entity

Attribute name	Meaning	Value
<code>id</code>	Unique number associated with an account	11

role	Role of the user i.e. doctor, patient, lab, chemist	patient,doctor,admin,lab,chemist
archived	Tells whether the account is archived or not	true/false

- Profile Entity

Attribute name	Meaning	Value
id	Unique number associated with a profile	11
First name	First name of user	50
Last name	Last name of user	50
sex	Sex of user	1
birth date	Birth date of user	date
phone	Phone no. of user	10
allergy	Allergy of user	250
created	Time at which profile is created	date

- Appointment entity :

Attribute Name	Meaning	Value
id	Unique number associated with an appointment	11
description	Description about the appointment	200
status	Status of appointment whether active or closed	50
appointment_type	Type of appointment - online / offline	20
Start time	Start time of appointment	date

End time	End time of appointment	date
----------	-------------------------	------

- Prescription entity

Attribute name	Meaning	Value
id	Unique number associated with a prescription	11
instruction	Instructions given by doctor	200
medicine	Medicine prescribed	100
date	Date when prescription is generated	date
active	Tells whether prescription is active or not	true/false

- Medical Test Entity :

Attribute name	Meaning	Value
id	Unique number associated with a medical test	11
Name	Name of the medical test	50
description	Description of the test	200
completed	Whether test is completed or not	true/false

Description of Entity and Relationships

The entity is a concept or object in which the piece of information can be stored. There are three types of relationship between entities. They are as follows:

- One to One(1-1): This relationship specifies that one instance of an entity is associated with another instance of an entity.

- One to Many(1-N): This relationship specifies that one instance of an entity is associated with zero or many other instances of another entity.
- Many to Many(N-N): This relationship specifies that one instance of an entity is associated with zero or many other instances of another entity.

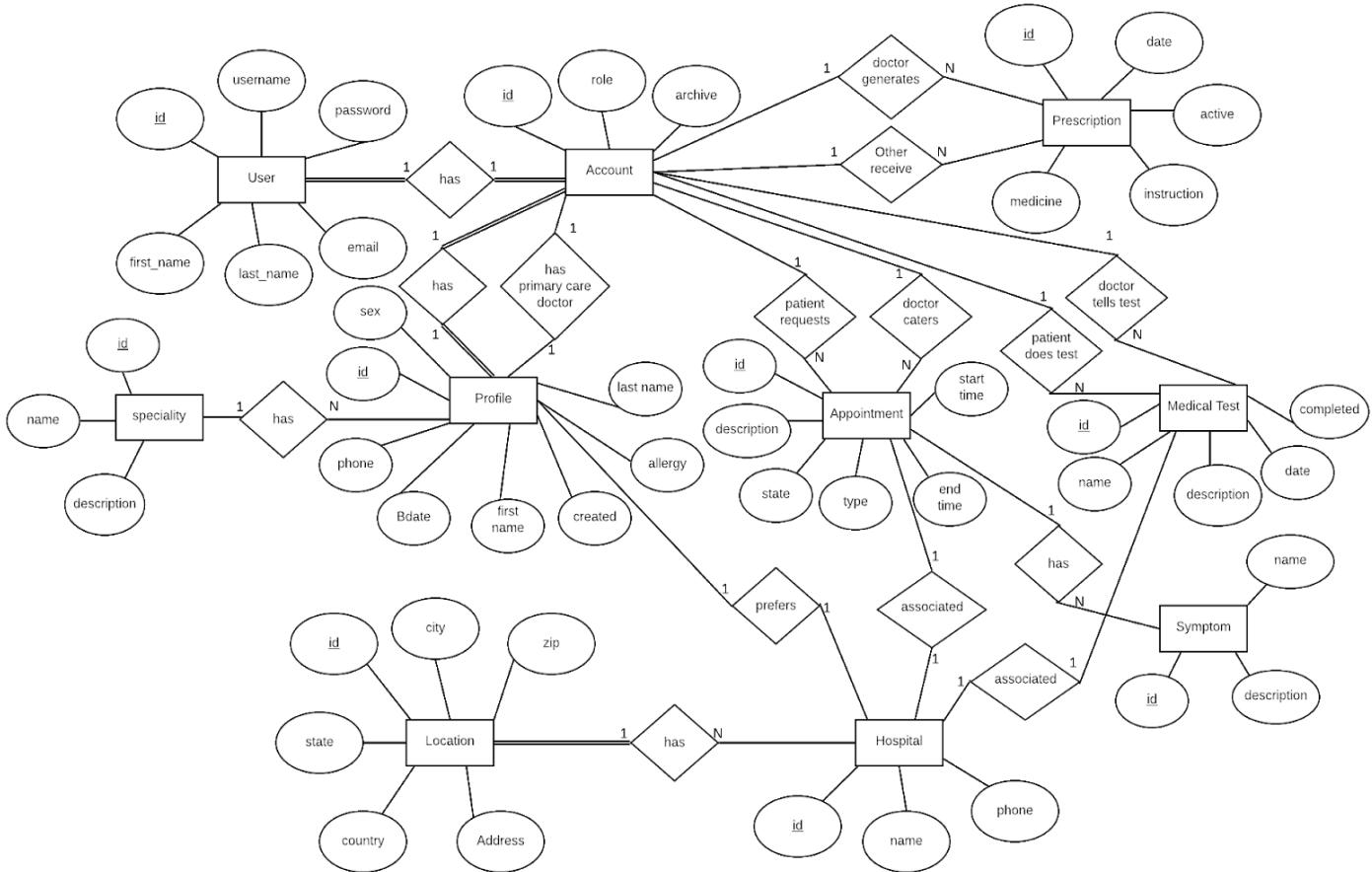


Fig. 1. ER Diagram

Description of ER Diagram

The application will be used in several locations that are uniquely identified by an id given to it and contain address, city, zip, state and country as its features. One location can have many

hospitals associated with it and each hospital is uniquely identified by its id. There are 5 users of the application namely admin, doctor, patient, lab, chemist and each of them are identified by an id and have their username and password. Each user has exactly one account that shows user's role and whether its archived or not. And from each account we can make a user profile that contains information about each user. A speciality can be associated with many doctor profiles. One patient account can request for many appointments, each appointment has a description, status, appointment type, start and end time as its attributes. One appointment can have many different medical symptoms associated with it.

Doctor account caters to one or many appointment requests. One doctor account generates many prescriptions. Each prescription has an associated id, instructions, medicine, date and active status. Patient, lab, chemist can receive one or many prescriptions. Chemist on seeing prescription can update its status and lab can perform many medical tests related to a patient account.

3.2 Relational Database design

A relational database schema is the tables, columns and relationships that make up a relational database. There are two steps to creating a relational database schema: creating the logical schema and creating the physical schema. The logical schema depicts the structure of the database, showing the tables, columns and relationships with other tables in the database and can be created with modeling tools or spreadsheet and drawing software. The physical schema is created by actually generating the tables, columns and relationships in the relational database management software.

(RDBMS). Most modeling tools can automate the creation of the physical schema from the logical schema, but it can also be done by manually.

Steps to map ER diagram to Relational Schema :

- Step 1 : For each strong entity make a relation with all its simple attributes.
- Step 2 : For multivalued attribute make a separate relation with primary key of the associated relation and multivalued attribute as its attribute. Both attribute together act as key.
- Step 3 : for weak entity include all its attributes as well as key of its owner entity. Combination of weak entity's partial key and owners key act as key for relation.
- Step 4 : To map 1:1 relation we can either merge relations or add key of one relation to other relation or make a separate relation that has keys from both the relations which together act as key for it.
- Step 5 : To map 1:N relationship on N side relation put other relation's key so that it acts like foreign key.
- Step 6 : To map M:N relationship make a separate relation and add keys of the associated relation in it. Together they act as key and act as foreign keys.
- Step 7 : If its n-ary relationship then make a separate relation that has keys of all the n relation as foreign keys.

Below diagram depicts the relational schema of the Virtual Clinic :

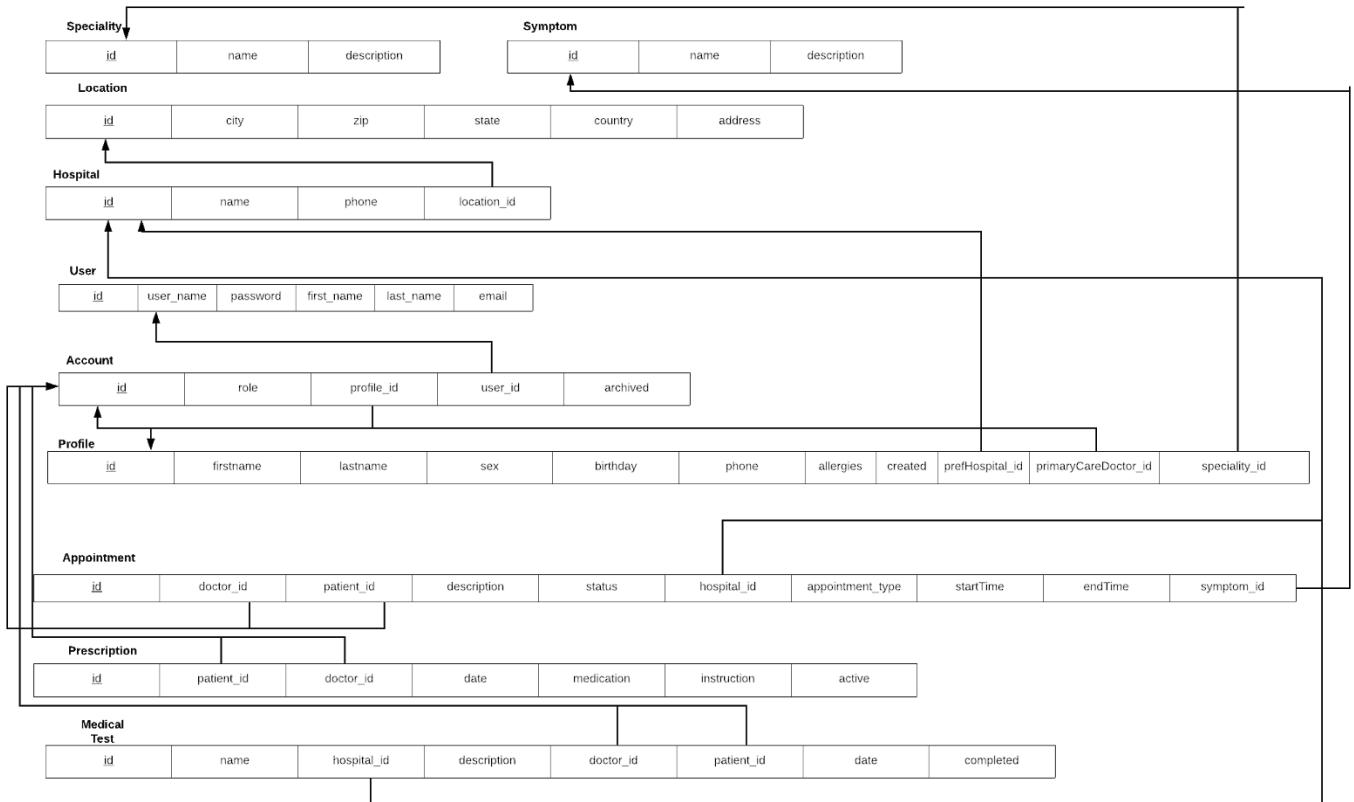


Fig.2. Relational Schema

Description of Relational Schema :

The above diagram shows the relational schema corresponding to the ER diagram drawn above. Steps written above are followed to draw this schema. Additional feature of this database design is that all the schemas have ids that act as primary key and identify a tuple uniquely. According to requirements analysis there are no further functional dependencies except that each attribute in a relation is functionally dependent on the attribute id. Thus the above relational schema is in BCNF (Boyce Codd Normal Form) and hence having low redundancy. This is so because according to definition of BCNF a relation is in BCNF if for all functional dependency $X \rightarrow Y$ X has to be a superkey. This property is followed by above relational schema.

3.3 Constraints in relation Schema:

- Key constraint : each entity has an unique id that identifies it. It is set as primary key hence it does not accept duplicate values and also is not NULL.
- Cardinality Ratio :
 - Each location can have many hospitals hence cardinality ratio is 1:N for location-hospital relationship.
 - Each user will have 1 account associated with it and hence cardinality ratio is 1:1 for user-account relationship.
 - Each account will have 1 profile hence it has 1:1 cardinality ratio.
 - A patient account can request for many appointments hence cardinality ratio is 1 : N
 - Each doctor can cater to many appointment requests hence cardinality ratio is 1:N
 - A doctor can generate many prescriptions hence cardinality ratio is 1:N
 - Each user can receive many prescription hence cardinality ratio is 1:N
 - Each speciality can have many doctors hence cardinality ratio is 1:N
 - Each appointment can have many symptom hence cardinality ratio is 1:N.
 - Each patient account can have many medical tests hence cardinality ratio 1:N
- Participation constraint :
 - Locations participation should be total as there needs to be a location for project to deploy, whereas for hospital its partial as one location might not have any hospital.
 - Both user,account has total participation as they both need to exist.
 - Similarly both account and profile have total participation.
 - All relationships associated with appointments and prescription are partial because its not mandatory for a patient to request for an appointment and receive a prescription.

Project Components

4.1 Front End Design:

All the modules showed on the user side have a corresponding view written in the server side code, which has the necessary business logic for what content to show based on authorization, permissions and necessary content.

Framework Used:

Django : Django is a python based framework which allows full stack website development. Following the MVT(Model-View-Template) architecture, it makes the code more readable and modular.

4.2 Security Measures:

Below there are a list of possible vulnerability that may occur while creating an application:

1. HTTPS

HTTP using SSL (Secure Sockets Layer) encrypts the traffic between your web server and its clients. This means the traffic, even if intercepted, can not be decoded by an attacker. This is important if there is any kind of confidential information on your site, so basically any site that uses logins.

We ran a test on our deployed site, and the results are shown in the diagram below:

You are here: [Home](#) > [Projects](#) > [SSL Server Test](#) > virtual-clinic.herokuapp.com

SSL Report: virtual-clinic.herokuapp.com

Assessed on: Mon, 29 Oct 2018 09:14:45 UTC | [Hide](#) | [Clear cache](#)

[Scan Another >>](#)

	Server	Test time	Grade
1	35.170.37.11 ec2-35-170-37-11.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:00:22 UTC Duration: 107.892 sec	A
2	35.175.30.164 ec2-35-175-30-164.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:02:10 UTC Duration: 108.788 sec	A
3	52.4.95.228 ec2-52-4-95-228.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:03:59 UTC Duration: 107.550 sec	A
4	52.45.22.48 ec2-52-45-22-48.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:05:46 UTC Duration: 108.561 sec	A
5	52.4.86.246 ec2-52-4-86-246.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:07:35 UTC Duration: 100.505 sec	A
6	35.169.120.211 ec2-35-169-120-211.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:09:21 UTC Duration: 107.926 sec	A
7	35.170.227.83 ec2-35-170-227-83.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:11:09 UTC Duration: 107.83 sec	A
8	35.169.241.252 ec2-35-169-241-252.compute-1.amazonaws.com Ready	Mon, 29 Oct 2018 09:12:56 UTC Duration: 108.331 sec	A

SSL Report v1.32.6

Fig.3. SSL Report

2. Heartbleed Bug

The Heartbleed bug is a very serious vulnerability in OpenSSL 1.0.1 versions prior to OpenSSL 1.0.1g. It can allow an attacker to retrieve memory contents, without leaving a trace. It can reveal private SSL keys, session IDs, passwords and other sensitive information. It's not a theoretical risk, but practically possible.

3. Debug Mode

The Django Debug mode helps in debugging, mainly by showing very detailed error pages. These error pages contain very detailed tracebacks, most settings and all sorts of other data about your environment that can be helpful in debugging. You should not enable this on production site, as it gives out lot of internal information.

Keeping this in mind, the debug mode is kept off in production mode to avoid debugging

information/content visible to any of the user.

4. Clickjacking protection

Clickjacking is an attack where one website is transparently overlayed on top of another website. The user thinks they are manipulating the website they see, but in reality their actions go to the invisible website. This depends on the invisible website being placed in a HTML frame. To prevent this, you set the X-Frame-Options header. This tells your browser not to permit your website to be embedded in HTML Frames.

This is taken care by Django by a middleware named clickjacking.

5. Trace Method

Avoids Cross-site scripting attacks, it asks the web server to return exact request as it was received. This can be used to retrieve the session cookie.

This is taken care mainly by performing all server side input validations, and not performing any validations on the client side.

6. SQL Injections

SQL injection is a type of web application security vulnerability in which an attacker attempts to use application code to access or corrupt database content. If successful, this allows the attacker to create, read, update, alter, or delete data stored in the back-end database. SQL injection is one of the most prevalent types of web application security vulnerabilities.

To avoid any SQL Injection, we have made sure not to use any RAW SQL queries in any of server side code.

7. Cross Site Scripting

Cross-site scripting (XSS) targets an application's users by injecting code, usually a client-side script such as JavaScript, into a web application's output. The concept of XSS is to manipulate client-side scripts of a web application to execute in the manner desired by the attacker. XSS allows attackers to execute scripts in the victim's browser which can hijack user sessions, deface websites, or redirect the user to malicious sites.

Our website doesn't have any page modification javascript code running on the client side, making it invulnerable to any XSS attacks, moreover the test result also couldn't perform any XSS attack on the webpage.

8. Broken Authentication & Session management

Broken authentication and session management encompass several security issues, all of them having to do with maintaining the identity of a user. If authentication credentials and session identifiers are not protected at all times an attacker can hijack an active session and assume the

identity of a user.

To make sure broken authentication and session management doesn't occur, we have made sure the passwords are saved using hashing, and none of the session ID or ID of users are shown in the URL, and passwords, session IDs, and other credentials are shared over HTTPS encrypted connections, thus preventing broken authentication and session management.

9. Insecure Direct Object References

Insecure direct object reference is when a web application exposes a reference to an internal implementation object. Internal implementation objects include files, database records, directories, and database keys. When an application exposes a reference to one of these objects in a URL hackers can manipulate it to gain access to a user's personal data.

10. Security Misconfiguration

Security misconfiguration encompasses several types of vulnerabilities all centered on a lack of maintenance or a lack of attention to the web application configuration. A secure configuration must be defined and deployed for the application, frameworks, application server, web server, database server, and platform. Security misconfiguration gives hackers access to private data or features and can result in a complete system compromise.

We have made sure not to expose the security key used in production.

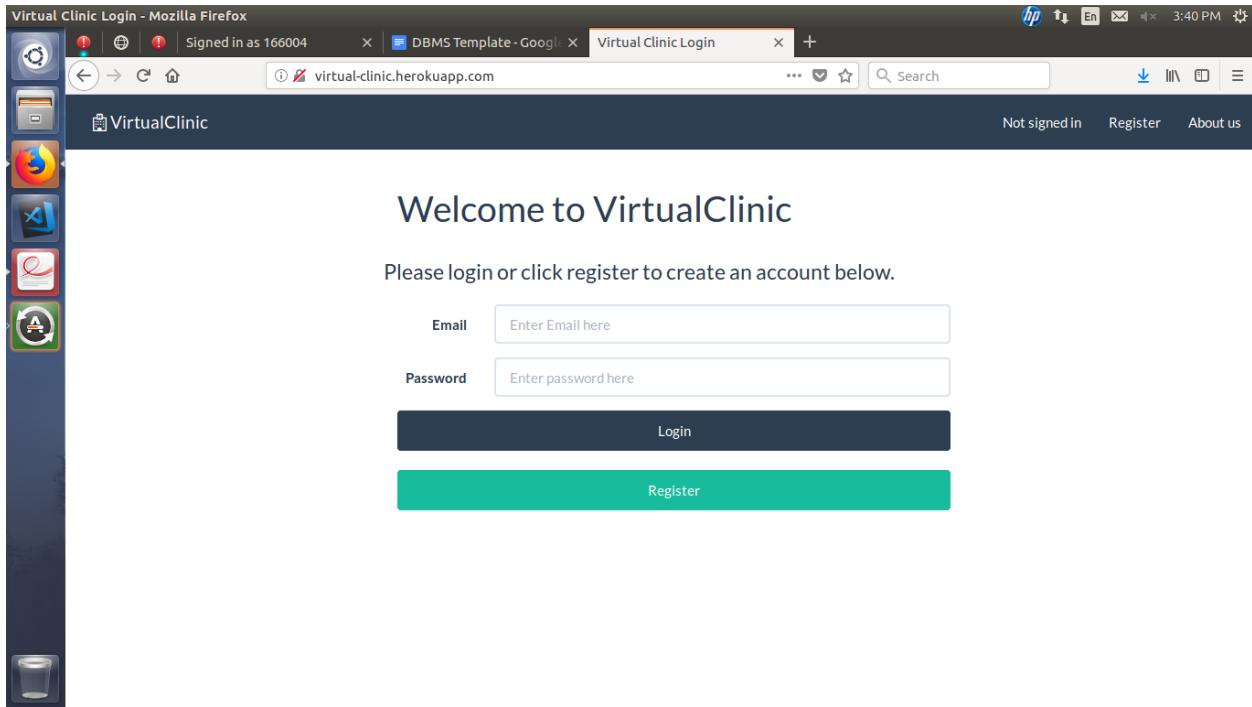
11. Cross Site Request Forgery

Cross-Site Request Forgery (CSRF) is a malicious attack where a user is tricked into performing an action he or she didn't intend to do. A third-party website will send a request to a web application that a user is already authenticated against (e.g. their bank). The attacker can then access functionality via the victim's already authenticated browser. Targets include web applications like social media, in browser email clients, online banking, and web interfaces for network devices.

`Csrf_token` is used in various forms to prevent cross site request forgery, the django middleware `csrf.CsrfViewMiddleware` provides support for it.

Results & Discussion

1. Login Page



Above screenshot shows the homepage of application. Top left shows navbar button to get to homepage. Top right shows signing information, registration button, and about us button. If already registered user can login by entering valid username and password or he/she can register.

2. Admin homepage

The screenshot shows the Mozilla Firefox browser window with the title bar "Virtual Clinic Overview - Mozilla Firefox". The address bar displays the URL "virtual-clinic.herokuapp.com/profile/". The main content area is titled "Welcome Mishal Shah" and includes a message: "Navigate through the VirtualClinic system using the bar on the left-hand side of the browser." Below this, there are two main sections: "All System Statistics" and "Recent messages".

All System Statistics

Statistic	Count
Users logged in	74
Users logged out	43
Appointments created	0
Medical tests created	0
Users registered	18

[For a more detailed statistics view, click here](#)

Recent messages

From	Subject	Options
	new	Reply Read Archive

Show 10 entries Search:

Showing 1 to 1 of 1 entries

Previous 1 Next

[For a more detailed message view, click here](#)

The left sidebar of the browser window contains several icons for managing users, specialties, symptoms, and system tasks.

Above picture shows homepage for admin. It shows system statistics, messages exchanged and left sidebar shows message management, manage specialty, symptom, user, view activity, view system statistics and csv management.

3. Manage symptom

The screenshot shows a Mozilla Firefox browser window with three tabs: 'Virtual Clinic Speciality - Mozilla Firefox', 'Signed in as 166004', and 'DBMS Template - Google'. The main content area displays the 'Virtual Clinic' interface under 'VirtualClinic'. At the top right are 'Account Management' and 'About us' links. Below the header is a navigation bar with icons for Home, Search, and other clinic-related functions. The main section is titled 'View Symptom' and contains a table with two entries:

Symptom	Description	Option
Cold & Cough	Fever	Delete
fever	high fever 104	Delete

Below the table, it says 'Showing 1 to 2 of 2 entries'. At the bottom are 'Previous', '1', and 'Next' buttons.

Above picture shows how admin can manage symptoms. He/she can add or delete the symptoms.

4. Manage speciality

The screenshot shows a Mozilla Firefox browser window with the title "Virtual Clinic Speciality - Mozilla Firefox". The address bar displays "virtual-clinic.herokuapp.com/admin/speciality/". The main content area is titled "View Speciality" and contains a table with one entry: "ENT" under "Speciality" and "Ear Nose Throat" under "Description". A red "Delete" button is visible next to the entry. Below the table, it says "Showing 1 to 1 of 1 entries". At the bottom, there are navigation buttons for "Previous", "1", and "Next". The browser's sidebar shows other open tabs and icons.

Above picture shows how admin can manage specialty. He/she can add or delete the specialty.

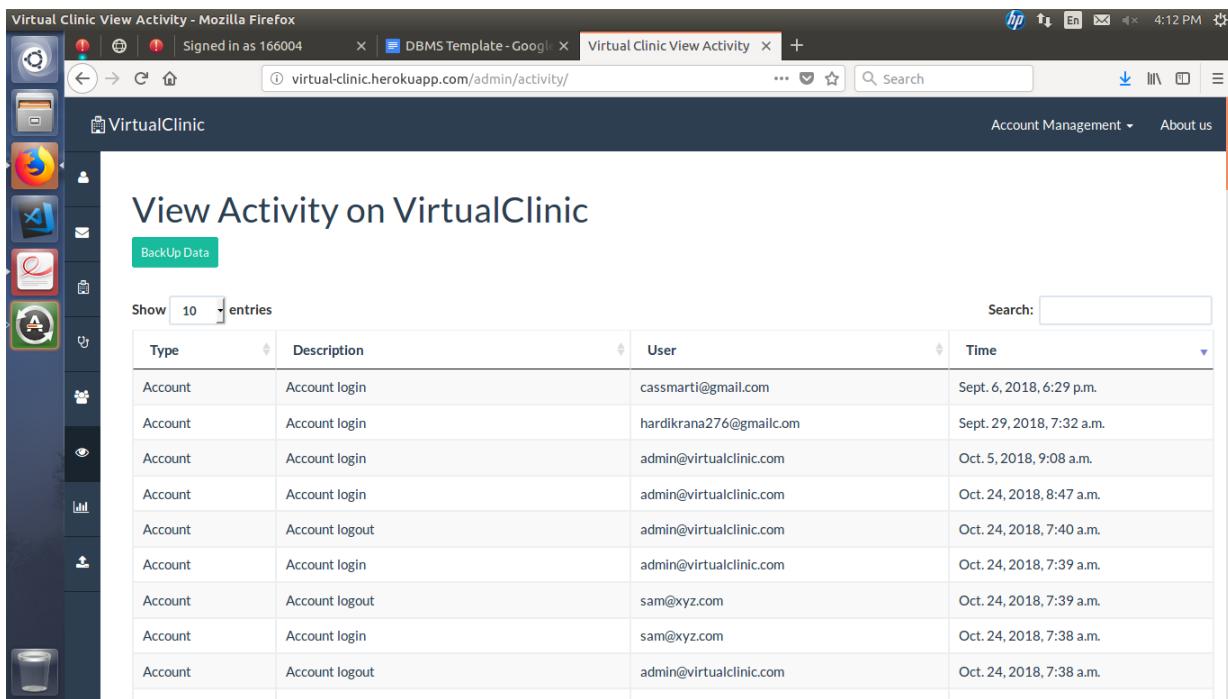
5. Manage Users

The screenshot shows a Mozilla Firefox browser window with the title "Virtual Clinic Manage Users - Mozilla Firefox". The address bar displays "virtual-clinic.herokuapp.com/admin/users/". The main content area is titled "Manage Registered VirtualClinic Users" and contains a table with six user entries. The columns are "Username", "First name", "Last name", "Role", and "Action". The users listed are: 16co254.samyak@nitk.edu.in (samayak, jain, Patient), abcdef@example.com (abcd, efgh, Patient), admin@virtualclinic.com (Mishal, Shah, Admin), brc@gmail.com (BRC, NITK, Patient), cassmarti@gmail.com (cassio, marti, Patient), and emmy1000okello@gmail.com (emanuel, okello, Patient). Each row has a "Save" button in the "Action" column and an "Archive" button in the "Action" column. Below the table, it says "Showing 1 to 6 of 6 entries". At the bottom, there are navigation buttons for "Previous", "1", and "Next". The browser's sidebar shows other open tabs and icons.

Above picture shows the page admin uses to manage users. He/she can add user, archive user or

view archive user.

6. Activity



The screenshot shows a Mozilla Firefox browser window with the title "Virtual Clinic View Activity - Mozilla Firefox". The address bar displays "virtual-clinic.herokuapp.com/admin/activity/". The page content is titled "View Activity on VirtualClinic". On the left, there is a vertical sidebar with icons for Home, BackUp Data, Logout, and other navigation links. The main area contains a table with the following data:

Type	Description	User	Time
Account	Account login	cassmarti@gmail.com	Sept. 6, 2018, 6:29 p.m.
Account	Account login	hardikrana276@gmail.com	Sept. 29, 2018, 7:32 a.m.
Account	Account login	admin@virtualclinic.com	Oct. 5, 2018, 9:08 a.m.
Account	Account login	admin@virtualclinic.com	Oct. 24, 2018, 8:47 a.m.
Account	Account logout	admin@virtualclinic.com	Oct. 24, 2018, 7:40 a.m.
Account	Account login	admin@virtualclinic.com	Oct. 24, 2018, 7:39 a.m.
Account	Account logout	sam@xyz.com	Oct. 24, 2018, 7:39 a.m.
Account	Account login	sam@xyz.com	Oct. 24, 2018, 7:38 a.m.
Account	Account logout	admin@virtualclinic.com	Oct. 24, 2018, 7:38 a.m.

This page shows all the recent activity to the admin. Backup data can be clicked to backup the data.

7. Statistics

The screenshot shows the 'Virtual Clinic View System Statistics' page. At the top, there are tabs for 'Signed in as 166004', 'DBMS Template - Google', and 'Virtual Clinic View System'. The main content area has a title 'View VirtualClinic System Statistics'. Below it is a table showing system statistics:

Statistic	Count
Users logged in	0
Users logged out	0
Appointments created	0
Medical tests created	0
Users registered	0

On the right side, there are two input fields for 'Start Time' and 'End Time', both labeled 'Enter as YYYY-MM-DD HH-MM'. Below them is a 'Get Statistics' button.

Above picture shows how to get statistics for a particular time interval.

8. CSV

The screenshot shows the 'Virtual Clinic Upload CSV File' page. At the top, there are tabs for 'Signed in as 166004', 'DBMS Template - Google', and 'Virtual Clinic Upload CSV File'. The main content area has a title 'Upload CSV File'. It includes two buttons: 'Export Information' (green) and 'What's the format' (blue). Below that, there is a note: 'Choose a .csv file and click 'Submit' when finished.' Another note says: 'If you are unsure of the format, click 'What's the format' to know the format.' There are two buttons: 'Upload' and 'Browse...', followed by a message 'No file selected.'. At the bottom is a 'Submit' button.

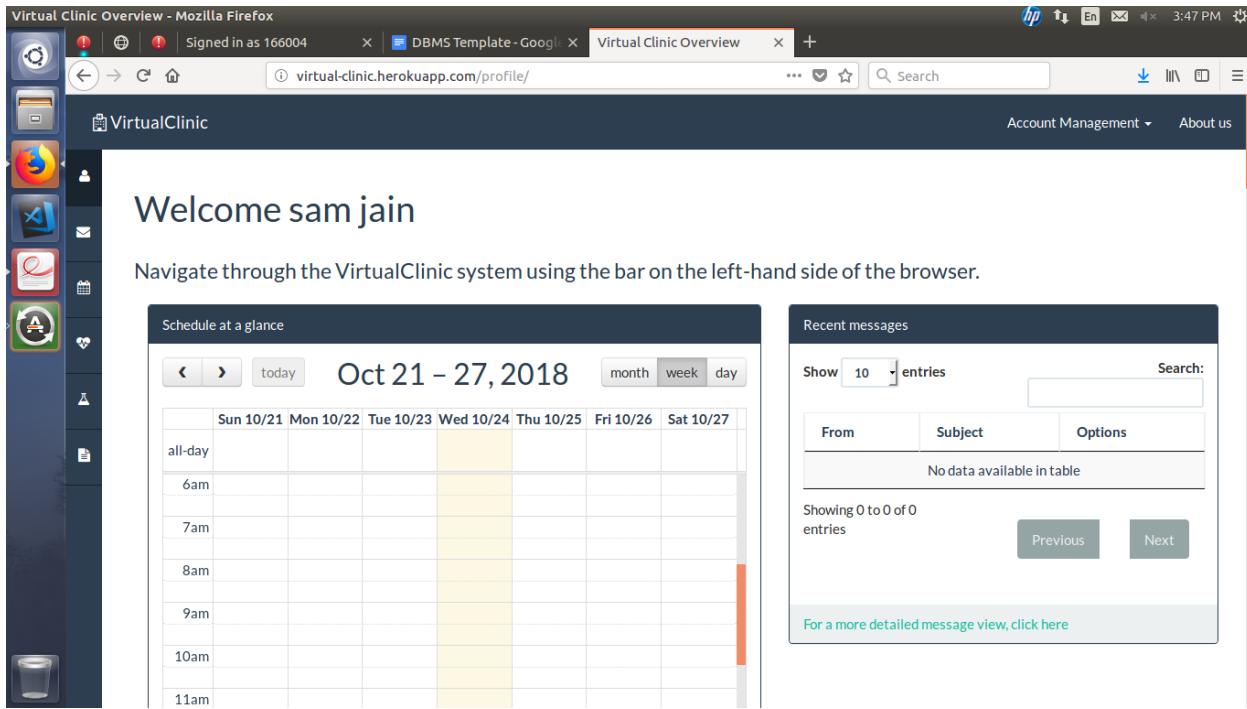
Above picture shows how can we upload or download data in .csv files.

9. Registration (Patient)

The screenshot shows a registration form for a virtual clinic. The form requires five pieces of information: First Name, Last Name, Email, Password, and a confirmation of the Password. A 'Register' button is at the bottom.

Above page shows registration form that the user can fill in order to register himself. (we can get to this page by clicking register button on homepage)

10. Patient home page



Above picture shows homepage for a patient. Navbar shows account management button via which patient can change the settings. It also shows schedule and messages. Left sidebar helps to send/receive messages, set appointments, update medical information, see medical test results and see prescriptions.

11. Update profile page

Virtual Clinic Update Profile - Mozilla Firefox

Signed in as 166004 | DBMS Template - Google | Virtual Clinic Update Profile | +

virtual-clinic.herokuapp.com/profile/update/

VirtualClinic Account Management About us

Update Profile

Make changes to your profile and click 'Update profile' when finished.

First Name	sam
Last Name	jain
Sex	Male
Birthday	Enter birthday as YYYY-MM-DD
Phone	Enter phone number here
Allergies	Enter any allergies here
Preferred Hospital	-----
Primary Care Doctor	-----

Above picture shows the form that a patient can fill to update his/her profile.

12. Change Password

Virtual Clinic Password Reset - Mozilla Firefox

Signed in as 166004 | DBMS Template - Google | Virtual Clinic Password Reset | +

virtual-clinic.herokuapp.com/profile/password/

VirtualClinic Account Management About us

Password Reset

Enter your current and new passwords, then click 'Change password' when finished.

Current	Enter your current password here
New	Enter new password here
	Enter new password again

Change password

Above picture shows the form required to be filled to change the password.

13. Message

The screenshot shows the 'View Messages' page of the Virtual Clinic application. The browser title bar reads 'Virtual Clinic View Messages - Mozilla Firefox'. The address bar shows the URL 'virtual-clinic.herokuapp.com/message/list/'. The page header includes the 'VirtualClinic' logo, 'Account Management', and 'About us' links. On the left, there is a vertical sidebar with icons for Home, VirtualClinic, Logout, and Help. The main content area is titled 'View Messages' and features a 'New message' button. Below it are tabs for 'Received messages' (selected), 'Sent messages', and 'Archived messages'. A search bar and a table header with columns 'To', 'From', 'Subject', 'Timestamp', and 'Options' are present. The table body displays the message 'No data available in table'. At the bottom, there are buttons for 'Previous' and 'Next'.

Above picture shows the page to see sent messages, receive messages and archived messages. We can create a new message by clicking on new message button.

14. Update Medical Information

The screenshot shows the 'Update Medical Info' page of the Virtual Clinic application. The browser title bar reads 'Virtual Clinic Update Medical Info - Mozilla Firefox'. The address bar shows the URL 'virtual-clinic.herokuapp.com/medicalinfo/patient/'. The page header includes the 'VirtualClinic' logo, 'Account Management', and 'About us' links. On the left, there is a vertical sidebar with icons for Home, VirtualClinic, Logout, and Help. The main content area is titled 'Update Medical Info' and contains instructions: 'Make changes to your medical info and click 'Update Medical Info' when finished'. It features several input fields: 'Patient' (text input 'samjain'), 'Blood Type' (dropdown 'A+ Type'), and 'Allergy' (text input 'Enter allergies here'). Below these are four checkboxes for medical conditions: 'Alzheimer' (unchecked), 'Asthma' (unchecked), 'Diabetes' (unchecked), and 'Stroke' (unchecked). At the bottom right is a large 'Update Medical Info' button.

Above picture shows the form that can be filled by patient to update its medical information.

15. Appointment

The screenshot shows a 'Create Appointment' form in a Google Chrome browser window. The URL in the address bar is 127.0.0.1:8000/appointment/create/. The page title is 'Virtual Clinic Create Appo...'. The form fields are as follows:

Description	Headache
Symptom	Cold & Cough
Hospital	Memorial Strong
Doctor	Dr. doctor doctor
Patient	patient patient
Appointment type	Online
Start Time	2018-11-01 08:14
End Time	2018-11-02 08:14

At the bottom right of the form area is a 'Create' button.

Above picture shows the form patient needs to fill in order to make an appointment

16. View uploaded medical tests

The screenshot shows a web browser window with two tabs: "DBMS Template - Google Docs" and "Virtual Clinic View Medical Tests". The URL in the address bar is "Not secure | virtual-clinic.herokuapp.com/medtest/list/". The main content area is titled "View Uploaded Medical Tests". On the left is a dark sidebar with icons for Profile, Messages, Appointments, Medical Info, Medical Tests (selected), and Prescriptions. The main content area has a search bar and a table with the following columns: Doctor, Patient, Name, Hospital, Date, Status, and Options. Two entries are listed:

Doctor	Patient	Name	Hospital	Date	Status	Options
doctor doctor	patient patient	Headache test	Highland	March 5, 2018	Completed	<button>Display</button>
doctor doctor	patient patient	test	Memorial Strong	Oct. 22, 2018	In Progress	<button>Display</button>

Below the table, it says "Showing 1 to 2 of 2 entries". At the bottom are navigation buttons: "Previous", "1", and "Next".

Above image shows the page used to display the medical test results to patient

17. View prescription

The screenshot shows a web browser window with three tabs: "Virtual Clinic View Prescriptions - Mozilla Firefox", "DBMS Template - Google Docs", and "Virtual Clinic View Prescriptions". The URL in the address bar is "virtual-clinic.herokuapp.com/prescription/list/". The main content area is titled "View Prescriptions". On the left is a dark sidebar with icons for Profile, Messages, Appointments, Medical Info, Medical Tests, Prescriptions (selected), and Prescriptions. The main content area has a search bar and a table with the following columns: Doctor, Patient, Medication, Strength, Date, Number of Refill(s), Status, Options, and Invoice. It displays the message "No data available in table". Below the table, it says "Showing 0 to 0 of 0 entries". At the bottom are navigation buttons: "Previous" and "Next".

Above picture displays the prescriptions given to patient.

18. Doctor homepage

The screenshot shows a Mozilla Firefox browser window with three tabs open: "Virtual Clinic Overview - Mozilla Firefox", "Signed in as 166004", and "DBMS Template - Google". The main content area displays the "Virtual Clinic Overview" page. At the top, it says "Welcome Dr. Sam Jain". Below that, a message reads: "Navigate through the VirtualClinic system using the bar on the left-hand side of the browser." To the left of the main content is a vertical sidebar with icons for a profile picture, a folder, a person, a red circle, a blue square, a green circle, a white square, a heart, and a glass. The main content area features a "Schedule at a glance" section showing a weekly calendar from Oct 21 to Oct 27, 2018. The days are labeled Sun 10/21 through Sat 10/27. The hours are labeled 6am, 7am, 8am, 9am, 10am, and 11am. A yellow shaded area covers the time from 6am to 11am on Wednesday (Oct 24). To the right of the calendar is a "Recent messages" section. It has a search bar set to "Show 10 entries" and a "Search:" field. Below the search bar is a table with columns "From", "Subject", and "Options". A message in the table states "No data available in table". Below the table, it says "Showing 0 to 0 of 0 entries" and has "Previous" and "Next" buttons. At the bottom of the message list, there is a link "For a more detailed message view, click here".

Above page shows homepage for any doctor.

19. Medical Information of patient

The screenshot shows a Mozilla Firefox browser window with three tabs open: "Virtual Clinic View Medical Info - Mozilla Firefox", "Signed in as 166004", and "DBMS Template - Google". The main content area displays a table titled "View Patient's Medical Information". The table has columns for "Patient", "Blood Type", "Allergy", and "Options". The "Patient" column contains the following entries: ABC XYZ, abcd efg, BRC NITK, cassio marti, emanuel okello, Hardik Rana, hi bye, joel reyes, Mishal Shah, and Mishal Shah. A search bar at the top right of the table allows users to search for specific patient names.

Above picture shows the medical information for a particular patient as seen by doctor.

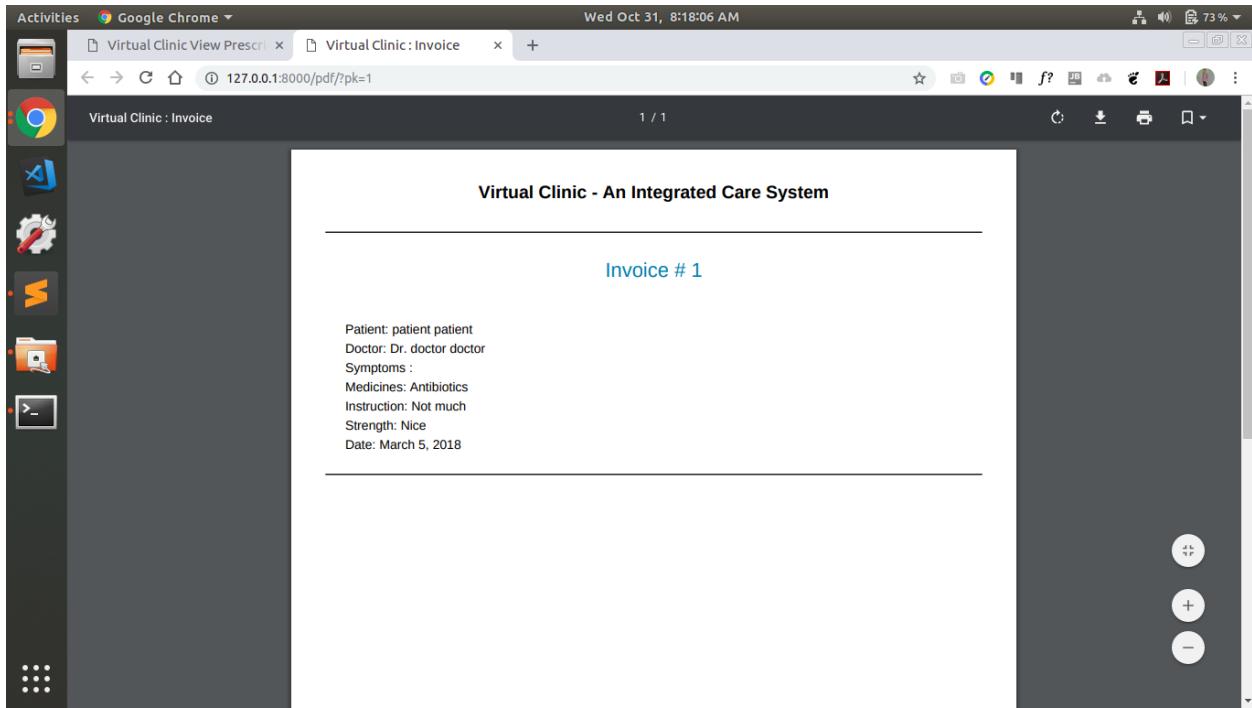
20. Prescription

The screenshot shows a Mozilla Firefox browser window with three tabs open: "Virtual Clinic View Prescriptions - Mozilla Firefox", "Signed in as 166004", and "DBMS Template - Google". The main content area displays a table titled "View Prescriptions". The table has columns for "Doctor", "Patient", "Medication", "Strength", "Date", "Number of Refill(s)", "Status", "Options", and "Invoice". A single entry is shown: Sam Jain, Mishal Shah, Crocin, 30 mg, Oct. 10, 2018, 6, Active. There are buttons for "Delete", "Update", and "Generate Invoice". Below the table, it says "Showing 1 to 1 of 1 entries". Navigation buttons for "Previous", "1", and "Next" are also present.

Above shows prescription details that doctor sees. He / she can add prescription by clicking on

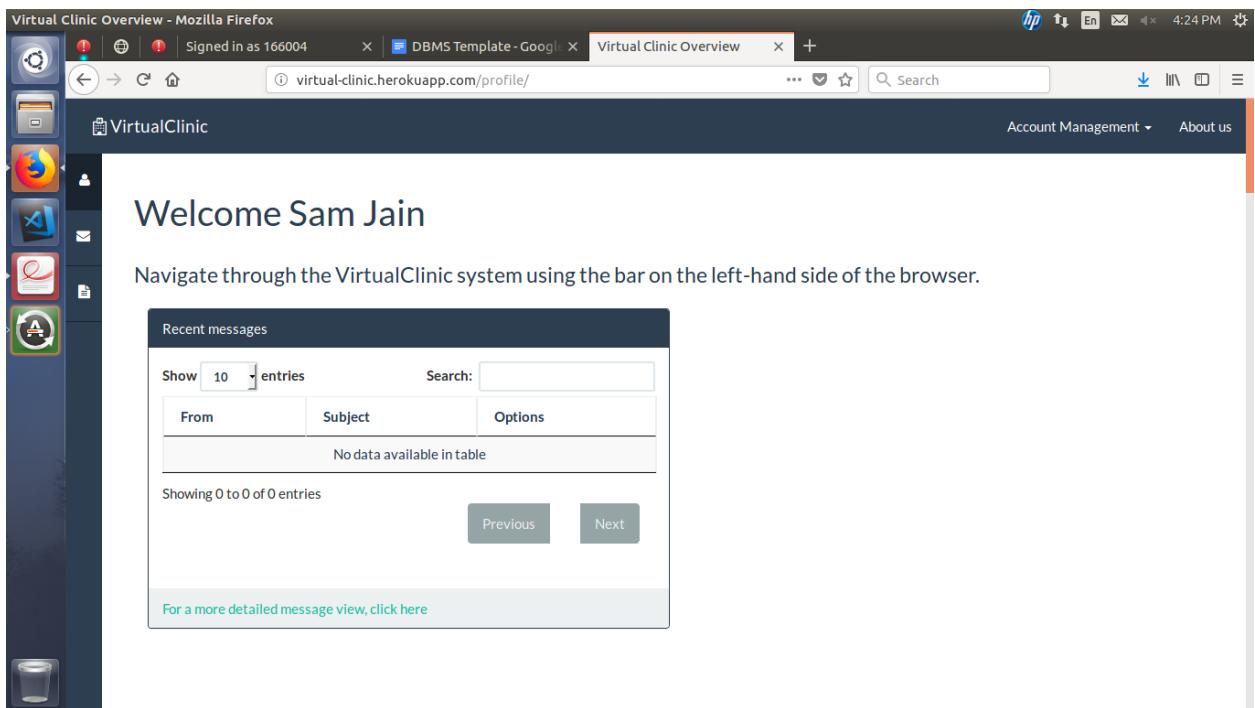
add prescription and delete or update it, also invoice can be generated.

21. Invoice Generated



This is the generated invoice from the prescription

20. Chemist homepage



Above picture shows the homepage as seen by chemist.

21. Chemist prescription

A screenshot of a Mozilla Firefox browser window showing the 'Virtual Clinic View Prescriptions' page. The title bar says 'Virtual Clinic View Prescriptions - Mozilla Firefox'. The address bar shows 'virtual-clinic.herokuapp.com/prescription/list/'. The main content area displays a 'View Prescriptions' heading and a table with columns: Doctor, Patient, Medication, Strength, Date, Number of Refill(s), Status, Options, and Invoice. There is one entry: 'Sam Jain', 'Mishal Shah', 'Crocin', '30 mg', 'Oct. 10, 2018', '6', 'Active', 'Update', and 'Generate Invoice'. Below the table, it says 'Showing 1 to 1 of 1 entries' and has navigation buttons for 'Previous', '1', and 'Next'. The browser interface includes a toolbar with various icons on the left and top, and a status bar at the bottom right showing '4:25 PM'.

Above picture shows how chemist sees prescription and updates it when medicines are delivered.

22. Lab home page

The screenshot shows a Mozilla Firefox browser window with the title bar "Virtual Clinic Overview - Mozilla Firefox". The address bar displays "virtual-clinic.herokuapp.com/profile/" and the status bar shows "Signed in as 166004" and the time "4:28 PM". The main content area is titled "VirtualClinic" and displays a "Welcome Sam Jain" message. Below this, a message from "Sam Jain" dated "2023-09-12" is shown, reading: "I have received your prescription. Please update it when medicines are delivered." A "Reply" button is visible next to the message. To the left of the main content is a sidebar with icons for "Recent messages", "Upcoming appointments", "Prescription history", and "Medicine inventory". The "Recent messages" section is currently active, showing a table with columns "From", "Subject", and "Options". The table is empty, displaying "No data available in table". Navigation buttons "Previous" and "Next" are present below the table, along with a link "For a more detailed message view, click here". The top right of the page includes "Account Management" and "About us" links.

Above shows the homepage as seen by lab technician

23. Medical test upload

The screenshot shows a web application titled "Virtual Clinic View Medical" running in Google Chrome. The URL is 127.0.0.1:8000/medtest/list/. The page displays a list of uploaded medical tests. On the left, there is a vertical sidebar with various icons. The main content area has a title "View Uploaded Medical Tests" and a green "Upload Medical Test" button. Below this is a table with columns: Doctor, Patient, Name, Hospital, Date, Status, and Options. Two entries are shown:

Doctor	Patient	Name	Hospital	Date	Status	Options
doctor doctor	patient patient	Headache test	Highland	March 5, 2018	Completed	<button>Display</button> <button>Update</button>
doctor doctor	patient patient	test	Memorial Strong	Oct. 22, 2018	In Progress	<button>Display</button> <button>Update</button>

Below the table, it says "Showing 1 to 2 of 2 entries". At the bottom are navigation buttons: "Previous", "1", and "Next".

Above picture shows the medical test screen as seen by lab, and by clicking on upload medical test he/she can upload the test results.

CONCLUSION

This report completely defines the Virtual Clinic application that visions to transform the modern healthcare system. Section 1 outlines the purpose and the objective of the application. Section 2 describes various software specifications required to build the application. Section 3 describes the database design techniques adopted to design the application, first entity relationship diagram was drawn and then it was mapped to the corresponding relational model following the rules of conversion. In section 4 front end design was explained along with various security measures that were considered. In last section results showing the snapshot of the application along with a description of them are highlighted. Finally we can say that Virtual Clinic is the go to application for modern healthcare that will connect various lives and save many by making the process stronger and easier by involving all the stakeholders in one system.