CS 353

Database Systems

Final Report

Hospital Management Database System

Group 27

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Description

The hospital database management system is a central management system that offers multiple views to patients, doctors, lab technicians, pharmacists, and the administrators. The administrators are provided the absolute control over the operations of the system. The views for each user type are different. Basic needs for user types are fulfilled in this system; however, there remains opportunity to implement greater functionalities. The platform allows easy communication of information between users - doctors, patients, lab-technicians and pharmacists.

Final ER Diagram
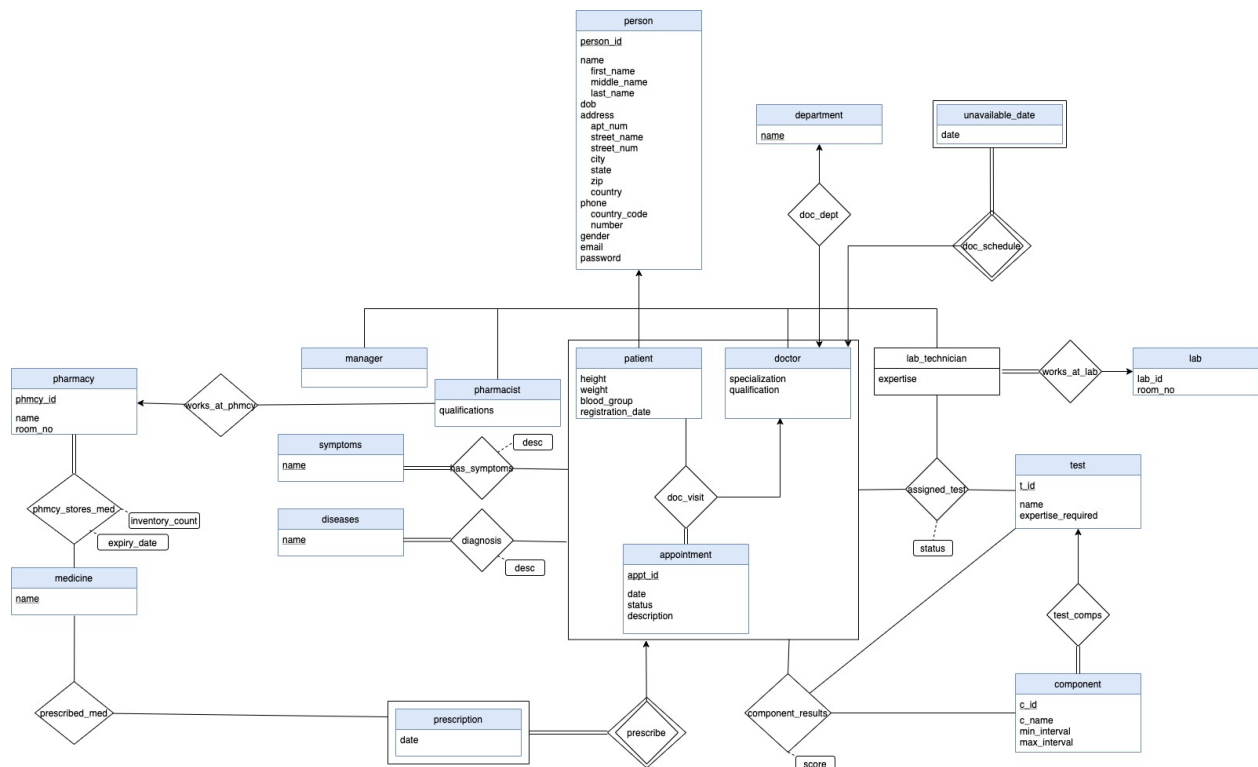
Final List of Tables

person(person_id, first_name, middle_name, last_name, dob, apt_num, street_name, street_num, city, state, zip, country, country_code, number, gender, e_mail, password)

manager(man_id)
FOREIGN KEY (man_id) REFERENCES person.person_id

pharmacist(ph_id, qualifications)
FOREIGN KEY (ph_id) REFERENCES person.person_id

patient(pid, height, weight, blood_group, registeration_date)
FOREIGN KEY (pid) REFERENCES person.person_id

department(name)

doctor(d_id, dept_name, specialization, qualification)
FOREIGN KEY (d_id) REFERENCES person.person_id
FOREIGN KEY (dept_name) REFERENCES department.name

doc_schedule(d_id, unavail_date)
FOREIN KEY (d_id) REFERENCES doctor.d_id

lab_technician(lt_id, expertise)
FOREIGN KEY (lt_id) REFERENCES person.person_id

appointment(appt_id, d_id, p_id, date, status, description)
FOREIGN KEY (d_id) REFERENCES doctor.d_id
FOREIGN KEY (p_id) REFERENCES patient.p_id

symptoms(name)

diseases(name)

has_symptoms(appt_id, name, description)
FOREIGN KEY (appt_id) REFERENCES appointment.appt_id
FOREIGN KEY (name) REFERENCES symptoms.name

diagnosis(appt_id, name, description)
FOREIGN KEY (appt_id) REFERENCES appointment.appt_id
FOREIGN KEY (name) REFERENCES diseases.name

test(t_id, name, expertise_required)

components(c_id, c_name, t_id, min_interval, max_interval)
FOREIGN KEY (t_id) REFERENCES test.t_id

component_result(c_id, t_id, appt_id, score)
FOREIGN KEY (c_id) REFERENCES components.c_id
FOREIGN KEY (t_id) REFERENCES test.t_id
FOREIGN KEY (appt_id) REFERENCES appointment.appt_id

assigned_test(lt_id, appt_id, t_id, status)
FOREIGN KEY (appt_id) REFERENCES appointment.appt_id
FOREIGN KEY (lt_id) REFERENCES lab_technician.lt_id
FOREIGN KEY (t_id) REFERENCES test.t_id

pharmacy(phmcy_id, name, room_no)

medicine(name)

phmcy_stores_med(name, phmcy_id, expiry_date, inventory_count)
FOREIGN KEY (name) REFERENCES medicine.name
FOREIGN KEY (phmcy_id) REFERENCES pharmacy.phmcy_id

works_at_phmcy(name, phmcy_id, expiry_date, inventory_count)
FOREIGN KEY (ph_id) REFERENCES pharmacist.ph_id
FOREIGN KEY (phmcy_id) REFERENCES pharmacy.phmcy_id

prescription(<u>appt_id, name</u>, status, prescribed_date, given_date)
FOREIGN KEY (appt_id) REFERENCES appointment.appt_id
FOREIGN KEY (name) REFERENCES medicine.medicine_name

lab(<u>lab_id</u>, room_no)

works_at_lab(<u>lab_id, lt_id</u>)
FOREIGN KEY (lab_id) REFERENCES lab.lab_id
FOREIGN KEY (lt_id) REFERENCES lab_technician.lt_id

Implementation Details

Technologies

For the frontend, React.js was used. To make queries to the backend a package called 'axios' was used. This package was used as it supports all HTTP methods for backend calls. Many React components were used. These components were from Blueprintjs. This library provided ready-made components including textboxes, forms, etc..

For the backend, Node.js and Express.js were used. A package called 'mysql' was used to write and execute raw MySQL queries. Endpoints were created this way. A MySQL database was used.

Problems Faced

This project was planned to be developed in PHP; however, using PHP we were not able to create view and api logic separate. Therefore, we shifted from PHP to Node.js. This way view was entirely separate from the api logic and the requests were instead served over HTTP.

While implementing the application in PHP, it did not generate well-explained error messages for debugging purposes. The shift to Node.js helped solve this problem. Debuggers were used to trace requests that came to the server.

Group Members Responsibility

Osama Tanveer: Patient Implementation, Management Implementation, Login, Signup,

Adeem Adil Khatri: Pharmacy Implementation, Login, Signup

Mohammad Elham Amin: Lab Technician Implementation, Pharmacy Implementation

Mohammad Sameer Yaseen: Management Implementation, Doctor Implementation

All group members took part in bug fixes.

Advanced Database Features Used

I. Views

All the views below are used when loading the user information during login. Since the details of users are stored in the person table, these views are handy to have a user's information in one place.

CREATE VIEW doctor_info AS SELECT * FROM doctor JOIN person ON (doctor.d_id=person.person_id);

CREATE VIEW patient_info AS SELECT * FROM patient JOIN person ON (patient.pid=person.person_id);

CREATE VIEW lt_info AS SELECT * FROM lab_technician JOIN person ON (lab_technician.lt_id=person.person_id);

CREATE VIEW pharmacist_info AS SELECT * FROM pharmacist JOIN person ON (pharmacist.ph_id=person.person_id);

II. Triggers

The trigger below is used to update test statuses. When a component's result is inserted, the test result status is updated.

```
DELIMITER $$

CREATE trigger test_status_update

AFTER INSERT

ON component_result FOR EACH ROW

BEGIN

     UPDATE assigned_test

  SET status =

    CASE

      WHEN (SELECT count(*) FROM component_result WHERE appt_id=new.appt_id AND t_id=new.t_id) = (SELECT count(*) FROM components WHERE t_id=new.t_id) THEN 'FINALIZED'

      WHEN (SELECT count(*) FROM component_result WHERE appt_id=new.appt_id AND t_id=new.t_id) <> 0 THEN 'PREPARING'

        else 'ASSIGNED'
```

```
        END

        WHERE appt_id=new.appt_id AND t_id=new.t_id;

        END$$

        DELIMITER ;
```

III.   Transactions

A transaction is used when assigning a test to a lab technician. Multiple insertions are required during this process. A lab technician has to be chosen to assign the test. The assigned table is to be updated. The test components are also to be inserted into the component results table with null values, which can be updated later. Any point of failure in this sequence of events can result in inconsistencies. Therefore, an atomic transaction is used.

User Manual

User Manual of Index Page (login/register)

In the login page , users are expected to input their email address and their corresponding passwords, and they also have to choose their User type in the first Login Page. So that if their email address and password selection are correct and already existing in the database then they get forwarded to the next page according to their employee type (patient, doctor, lab technician, management, pharmacist).

If there exists no such email address in the database, then you click on the Register link and you are redirected to the Register page. After you are redirected to the registration page, you have to input all of the credentials like email address, password, and personal details; Name, DOB, Phone Number, Gender, Address. With this you have registered your credentials for an individual, if you tick the box to 'Register as Patient' then you are registered as a patient, if not then you await management's response in assigning you a specific employee type.

User Manual of Management's Page (admin)

As you login with the Management button selected after inputting your correct email address and password. Then you are shown the table 'Unresolved Employees' which lists the people whose employee type is yet to be assigned by the admin. The ID, name, surname email, phone number are displayed in that table, as well as an Add DropDown Button. This button allows the admin to select the employee type to assign the person to, as per the choice of assignment the extra required details are now needed to be input as well - like department name, specialization, qualification, expertise. The following information is displayed when adding for each case:

1. **For Doctor:** department name, specialization, expertise
2. **For Pharmacist:** qualifications
3. **For Lab Technician**: expertise

The manager is presented with a list of all pharmacists currently in the hospital and he is able to assign them to pharmacies or delete them entirely, which removes the user type but maintains information for security purposes. Similar is the case with lab technicians. The pharmacists can be assigned to pharmacies by using the assign button. A popup shows up which enables assignment of pharmacists to pharmacies. The case is slightly different for lab technicians in the sense that the lab technicians would always be assigned to the only lab.

A list of pharmacies is also presented and their particular lists of medicines along with inventory and expiry date is presented as well. The manager is able to add and remove medicines as well. A list of medicines is also presented, this is to allow only the management to have control over the medicines in the pharmacy.

User Manual of Patients' Page

As you login with the patient button selected after inputting our correct credentials in the login page. Then you are shown the patient view where you have the tabs on the top right to access either Personal Information, Appointments, Tests.

Firstly, in the Personal Information's tab you are displayed the full list of details; id, name, surname, DOB, address, phone number and gender.

Secondly, in the Appointments tab, you have the option to select an appointment date by choosing the specified department. If the date slot has already been appointed, or is unavailable due to some other factor then you won't be able to avail an appointment on that slot. A month's schedule is presented on the calendar. After selecting a suitable date slot, you can now select the Doctor you want from the 'Available Doctors' table. You have the option to write a few description details for your appointment as well. Then, you can see your list of Appointments under the 'Appointments Table', where the status (either ONGOING, COMPLETE, CANCELLED) of each appointment is shown. You also have the action buttons through which you can either cancel your appointment or access the further information about your appointment.

Lastly, in the Tests tab you are displayed all the tests you have taken in the 'All Tests' table; where date, name, status (ASSIGNED, PREPARING, FINALIZED), and an info action button which displays the Components for the tests. These components are displayed under a table named 'General Test view' where the component name, the range of the component where the result should be between, the score that you avail for that component are displayed. Also, you have the option to further get details about each component. This detail corresponds to the previous history of scores for a component.

User Manual of Doctors' Page

The doctor is presented with a navigation bar at the top of the window. This navigation bar allows the doctor to view their personal information, all their scheduled appointments, and the current appointment going on if any. Moreover, the doctor is able to logout as well.

In all appointments, the doctor is presented with a table that contains all the appointments' information. The doctor is able to cancel appointments and check the patient's details. The doctor is also presented with a schedule that allows the doctor to cancel any day slots. These day slots will not be available for booking appointments.

In the current appointment tab, the doctor is able to see the patient information at the top. The doctor is able to add symptoms by selecting a symptom from a list. Same is the case with diagnosis. The doctor can also prescribe medicines in a prescription in the same list. The doctor is also presented with an end appointment button, which can be used by the doctor to finish the appointment for the day.

User Manual for Pharmacists' Page

The pharmacist is presented with the particular view of their pharmacy's medicines. This list contains the inventory count. The pharmacist is able to add and remove a certain number of medicines from the inventory. The pharmacist is also able to add new medicines to the pharmacy only if they have been added by the management first into the system. The adding and removing of medicines corresponds to buying and selling the medicines respectively.

User Manual for Lab Technicians' Page

The lab technician is presented with a table that shows the assigned tests, the tests being prepared, and the finalized tests. The assigned tests contain tests whose components have not been added. When the lab technician adds a score to a component, the test status is changed to Preparing, which means that the lab technician is preparing the results for a test. Once all the components have been completed the test is moved to the Finalized column.