Hospital Management System

Data Modelling and Databases I, Fall 2019

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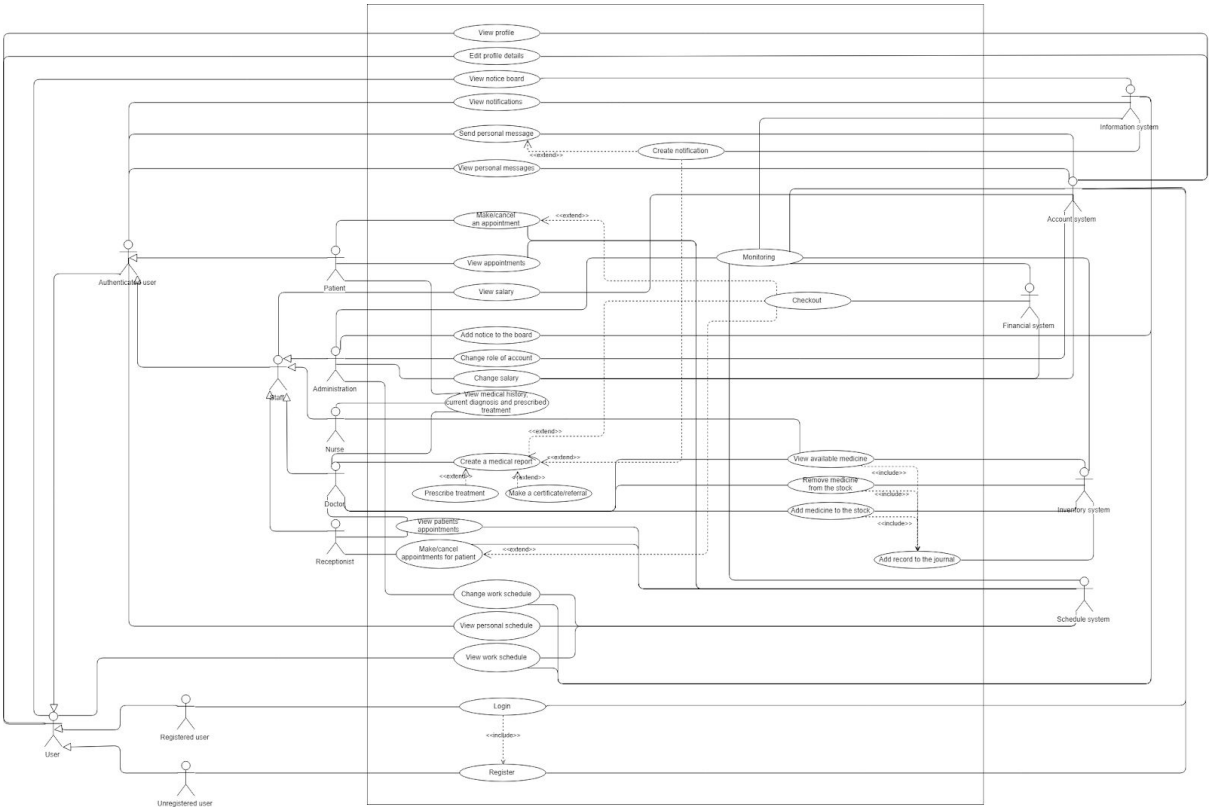
TABLE OF CONTENTS

1. Use case diagram



Better quality picture:
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Drawio file:
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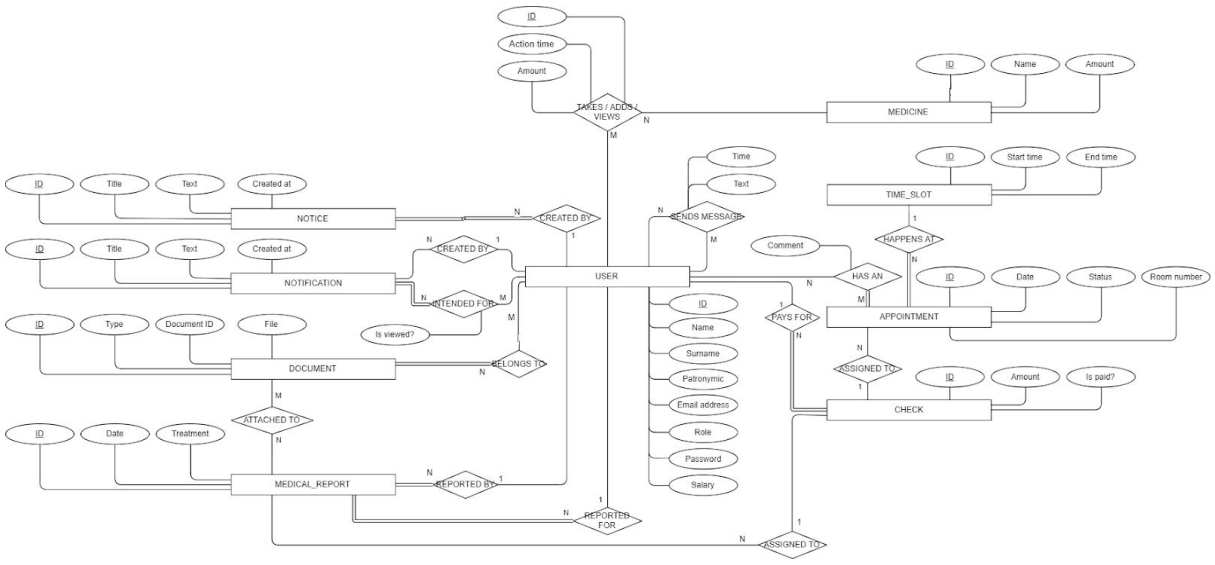
2. ERD



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4. Description

4.1. User system

In the use case diagram we have multiple different users. In some user came to the site for the first time, they will be unregistered user, after registration he will become registered user, and after login he will become patient. Administration can change role of a user, so after login they will be not patient, but doctor, nurse or receptionist. This corresponds to 'Role' attribute in ER diagram. Some features of ERD are available only for certain roles. For example, 'Salary' attribute will not be filled for patient role; Patient will not be able to take/add/view medicine; administration role can create notices and monitor all of the systems (account, information, inventory, schedule and financial); etc.
Phone number is a multivalued attribute, because each person may have multiple phone numbers.

4.2. Notice board and notifications

Each NOTIFICATION should be 'Intended for' at least one user. NOTIFICATION can be 'Created by' automatic system and therefore not be involved in this relation.
By the use case diagram you can understand that notifications created automatically, when personal message has sent, or when medical report is created.
NOTICES are different from NOTIFICATION - they are supposed to be shown on the main page for everyone, but they can not be created automatically.

4.3. Documents and medical reports

Entity DOCUMENT has attribute 'Type' (which can be 'social security card', 'passport', 'driving license', 'health insurance', etc.). Also, it has attribute 'File', which is a link to a scanned copy of the document.
As the use case diagram shows, doctors can create medical reports, and optionally prescribe treatment and make a certificates or referral. In the ERD, those certificates and referrals will be DOCUMENTS 'Attached to' MEDICAL_REPORT and 'Belong to' both patient and doctor.
Each DOCUMENT and MEDICAL_REPORT should correspond to at least one user.

4.4. Medicine journal

As for the use case diagram, each action with medicine should be recorded. This is done by 'Takes / Adds / Views' relation in the ERD. Entity MEDICINE is used to implement the inventory system to keep track of the stock.

Nurses can only 'View medical history, current diagnosis and prescribed treatment'. Every manipulation with medicine is done with a permission of a doctor, therefore only doctor can add/remove/view the stock.

4.5. Schedule

In the use case diagram, there are two types of schedules: work and personal. Work is a schedule of doctor, that can be seen by everyone. Personal is a schedule that takes appointments into account.
USER and APPOINTMENT ‘Has an’ relation has attribute 'Comment', which user can fill in when making the appointment and change any time.
'Status' of an APPOINTMENT can be 'awaiting', 'in progress', 'cancelled'.
The relation between APPOINTMENT and USER is one-to-many, because there might be multiple doctors, nurses and/or patients participating in the appointment. But every appointment should have at least one user participating.
APPOINTMENT happens at some TIMESLOT. TIMESLOT is a separate table in order to show users available time slots.

4.6. Paid services

Use case diagram: checkout can happen when someone making an appointment (prepayment), or when doctor creates a report (postpayment). So, in the ERD multiple APPOINTMENTs and MEDICAL_REPORTs may be 'Assigned to' one CHECK, as well as a USER that 'Pays for' it.

4.7. Other

Each total participation was explained by the words "should correspond to at least one", every other participation is partial by the opposite reason. There are no weak entities, because every entity is independent and may be defined by itself.

4.8. Tables and design decisions

In total we got 15 tables in our database design. Their description can be seen here: https://docs.google.com/spreadsheets/d/12WXUeBFsKyzKB6hEhwrYT3J8_MfFB1R-kvU-5TSgdTQ. All fields are ‘not null’ by default, all nullable fields are explained in the table above. All primary keys are integers and has autoincrement property for convenience.

5. Requirements

5.1. Functional

Requirement ID	1
Title	Diagnosis
Type	Functional
Description	The main feature of any hospital is to diagnose a patient and tell him how to get better
Priority	1 The main feature
Risk	(C) Critical This feature shows that the hospital system is working properly. Diagnosis is the main task that the hospital should do in order to help its visitors

Requirement ID	2
Title	Write a prescription
Type	Functional
Description	The main feature that tells patients how to take the medicine and to get better
Priority	1 The main feature
Risk	(C) Critical After the diagnosis, patient have to know what they should do and how to get better. In the prescription doctor says, how they can do it

Requirement ID	3
Title	Profile registration
Type	Functional
Description	Allows users to register in the hospital system, where will be stored any information about the patient, visits and history. The user should enter their login or email, and password to succeed the profile registration
Priority	1 Feature must be implemented for optimized work of the hospital system. Without this feature the system can work like standalone

Risk	(H) High The profile registration allows users to use the hospital service as remote. Also it is a common place where will be stored any information about patients, their visits, receipts and everything else, that is useful for doctors

Requirement ID	4
Title	Medical history
Type	Functional
Description	Medical history system should have functional to view medical history of patients, to add records to medical history of patients. There also should be an ability for patients, doctors and nurses view medical history, current diagnoses and prescribed treatment of the patient.
Priority	1 The main feature of the hospital system
Risk	(H) High Without this feature there's no ability to keep track of patients' records which is very crucial

Requirement ID	5
Title	Inventory system
Type	Functional
Description	The inventory system should have functional to manage inventory, view remaining medicine in stock, add and remove medicine from stock in order to keep track of available medicine in stock
Priority	1 Inventory management is one of the main features of the whole system. There must be an ability to keep track of medicine circulating in the hospital.
Risk	(H) High Without this feature there could be situations

	when it’s unclear how much medicine is left, and where it is. Such situations could result in decreasing the level of service.

Requirement ID	6
Title	Appointment system
Type	Functional
Description	Appointment system should have functional to add, delete and view appointments with patients
Priority	1 The main feature of the hospital system
Risk	(H) High Without this feature there’s no ability to keep track of appointments, which is one of the main functionalities of the hospital system

Requirement ID	7
Title	Profile log-in
Type	Functional
Description	Allows users to log in their account in the hospital system. User should enter their relevant login and password to get access to the system
Priority	1 Feature is necessary as well as account registration is
Risk	(H) High Profile registration is useless with no ability for users to log in. That is the place, where they can communicate with doctors and the whole hospital system

Requirement ID	8
Title	Profile edit
Type	Functional
Description	Allows the users, who have registered in the system, to edit their profile on their own

Priority	2 Feature should be implemented for better user experience, but it is not necessary for proper hospital system work
Risk	(M) Medium There should be an ability to edit user's profile after registration to provide a relevant information about patients

Requirement ID	9
Title	Salary management
Type	Functional
Description	A sub-system that provides a salary for the hospital staff
Priority	2 No company will work without salary for its employees
Risk	(M) Medium The main feature of any system where there is the word "finance". Even if it is a hospital system, it cannot work without salary

Requirement ID	10
Title	Personal messaging
Type	Functional
Description	The feature that allows users to write private messages to doctors or doctors to users. There are two types: internal messaging (between employees) and external (user <-> doctor)
Priority	3 Useful, but not necessary
Risk	(M) Medium After registration it is very handy to have an ability to write a message directly to doctor. It is useful, because there will no need to meet a doctor in the hospital. Just PM him

Requirement ID	11
Title	Paid services
Type	Functional

Description	The paid services system should be able to handle paid services and keep track of bills (including already paid ones)
Priority	2 Feature must be implemented for optimized work of the hospital system.
Risk	(M) Medium Without this feature paid service management will be not trackable, not transparent and unclear.

Requirement ID	12
Title	Notice board
Type	Functional
Description	Allows users to see the public notices located at the main page (e.g. shortened day due to a holiday)
Priority	3 Just better user experience
Risk	(L) Low Not necessary feature, the system can work without this feature, but it will be very useful for end-users

Requirement ID	13
Title	Notifications
Type	Functional
Description	Allows users to see their latest notifications, for example, where will be their next visit to hospital and so on
Priority	3 Just better user experience
Risk	(L) Low Not necessary feature, the system can work without this feature, but it will be very useful for end-users

Requirement ID	13

Title	Schedule system
Type	Functional
Description	Schedule system is aimed to provide an ability for administration to view and edit doctors' and nurses' schedules.
Priority	3 Nice to have feature for administrators
Risk	(L) Low Hospital system would work properly without this feature

Requirement ID	14
Title	Referral system
Type	Functional
Description	Referral system should provide an ability for doctors to refer a patient to another doctor based on medical report. System should be linked with notification system in order to create notifications for doctors and patients.
Priority	2 Referral system provides better experience for doctors.
Risk	(L) Low System would work properly without this feature, it's just nice to have feature

5.2. Non-functional

Requirement ID	15
Title	Persistence of medical history
Type	Non-functional
Description	Medical history should be persistent, i.e. no records should be lost or corrupted.

Priority	1 The main feature of the hospital system
Risk	(C) Critical Without this feature the quality of service will decrease drastically

Requirement ID	16
Title	Email confirmation during registration
Type	Non-functional
Description	This feature makes users to enter their real email, phone and names for preventing fake users
Priority	2 It is a part of registration
Risk	(H) High Without this feature, everyone will be able to have as many accounts as they want and it will be unable to realize if the user is not fake

Requirement ID	17
Title	Big throughput of the servers
Type	Non-functional
Description	Feature allows to serve and to stay connected for a lot of users simultaneously
Priority	1 This feature allows the system to work properly
Risk	(H) High Big throughput is a required thing for every big system. With low throughput there will be situations, when the server is unreachable because the throughput is too low and it’s unable to handle all the incoming requests