Question and Answers

Due to some factors of my system being unclear, I have answered some common questions below to help understand the functionality of my system.

Question	Answers
Will patients be able to access this system?	No. This will be a windows-based system that is designed for hospital staff access only.
How will patients be able to create an appointment?	Patients will have to call up the doctor's office to create a booking. The hospital staff can then book it using the system.
What if a patient shares the same name or similar details to another?	Patients will be given a unique ID.
Will the window-form display the same thing for doctors and receptionists?	No. There will be roles assigned depending on the hospital staff's job title.
Can the patient have multiple appointments?	No. After an appointment, if another is needed they can book it with a receptionist prior to leaving.

User Stories and Acceptance Tests

Stories for all

User Story	Notes	Acceptance Test/s
Hospital staff are concerned about security.	Records are sensitive information. A password will be given to hospital staff to allow access to the system.	- Verify correctly inputted password and staff ID allow access. - Verify incorrectly inputted password and staff ID does not allow access. - Verify that partially inputted (password or staff ID) fails to allow the hospital staff to log in to the system.
As a hospital staff member I want to search for a patient so thatI can quickly find a patient.	The database stores thousands of records. Search function required. When ID is searched, it will prompt the hospital staff with the correlating patient.	- Verify search bar can locate records based on: last name. - Ensure only records matching search display. - Verify only patient details are displayed.

Stories for receptionist

User Story	Notes	Acceptance Test/s
As a receptionist I want to update patient information so that I can keep their records up to date.	Patients may change address, name, etc.	- Ensure receptionists can edit records. - Verify that records display the new information. - Verify message box displays when record update is successful. - Verify patient ID and DOB cannot be edited. - Verify if input is left blank it fails to update the record.

As a receptionist I want to register a new patient so that I can book them in for an appointment.	Patients may register with the hospital.	- Verify when all mandatory information is provided the record is added. - Verify the message box announces when a record is successfully added. - Verify partially inputted (Name, DOB, etc) information does not allow the receptionist to create a new record.
As a receptionist I want to see the doctor's schedule so that I can book a patient into an appointment.	Patients may not be available for some time slots. Patients can be booked using their ID. Multiple time slots will display with specific hospital staff.	- Verify that the patient is booked in when patient ID and available time slot is selected. - Verify the time slot becomes unavailable after booking in a patient. - Ensure the system does not display unavailable timeslots. - Verify that all fields have been filled in. Otherwise, fail to create an appointment. - Ensure invalid ID's aren't accepted.
As a receptionist I want to cancel a patients appointment.		- Ensure successful cancellations are removed from hospital staff's schedule. - Verify that hospital staff is now available for the time slot. - Verify the correct patient has been removed

Stories for Doctors

User Story	Notes	Acceptance Test/s
As a doctor I want to add a note to a patient's record so that I can get a good history of the patient.	Doctors may wish to add notes about: symptoms, theorised diagnosis, lab results, etc.	- Verify that Doctors can see notes when the record is open. - Ensure notes are organised from newest to oldest.
As a doctor I want to view my appointment so that I can understand my	Doctors will need to view their schedule.	- Verify appointments only for that date are displayed. - Ensure time and patient ID are displayed alongside time and

schedule.		date. - Ensure time and date are displayed chronologically.
As a doctor I want to print a prescription so that I can provide my patient with medication.	A print preview will be needed.	- Verify when medication is filled in it can be printed. - Verify when medication is left blank it fails. - Ensure the page has a print preview. - Ensure patient details are automatically filled in.

Stories for Admin

User Story	Notes	Acceptance Test/s
As an admin I want to create an account for a new employee so that I can give them access to the system.	Hospital staff may be hired. A temporary password will be needed.	- Verify successful account creation is added to the database if correct credentials are filled in. - Verify the account can only access what is within their role i.e. a doctor should be unable to make appointments. - Verify it displays an error if mandatory information is empty and ensure account creation fails. - Verify if only partial information is provided (name, username, password, etc) account creation fails.
As an admin I want to remove an account so that I can keep patient files confidential.	Hospital staff may quit or be fired. System will confirm if the admin wishes to continue with deleting the account.	- Verify the account is removed from the database if there are no appointments allocated - Verify cannot be removed if appointments are allocated to the staff being deleted. - Verify the account can no longer login. - Ensure the correct account has been deleted. - Ensure the correct hospital staff's details are displayed for confirmation.

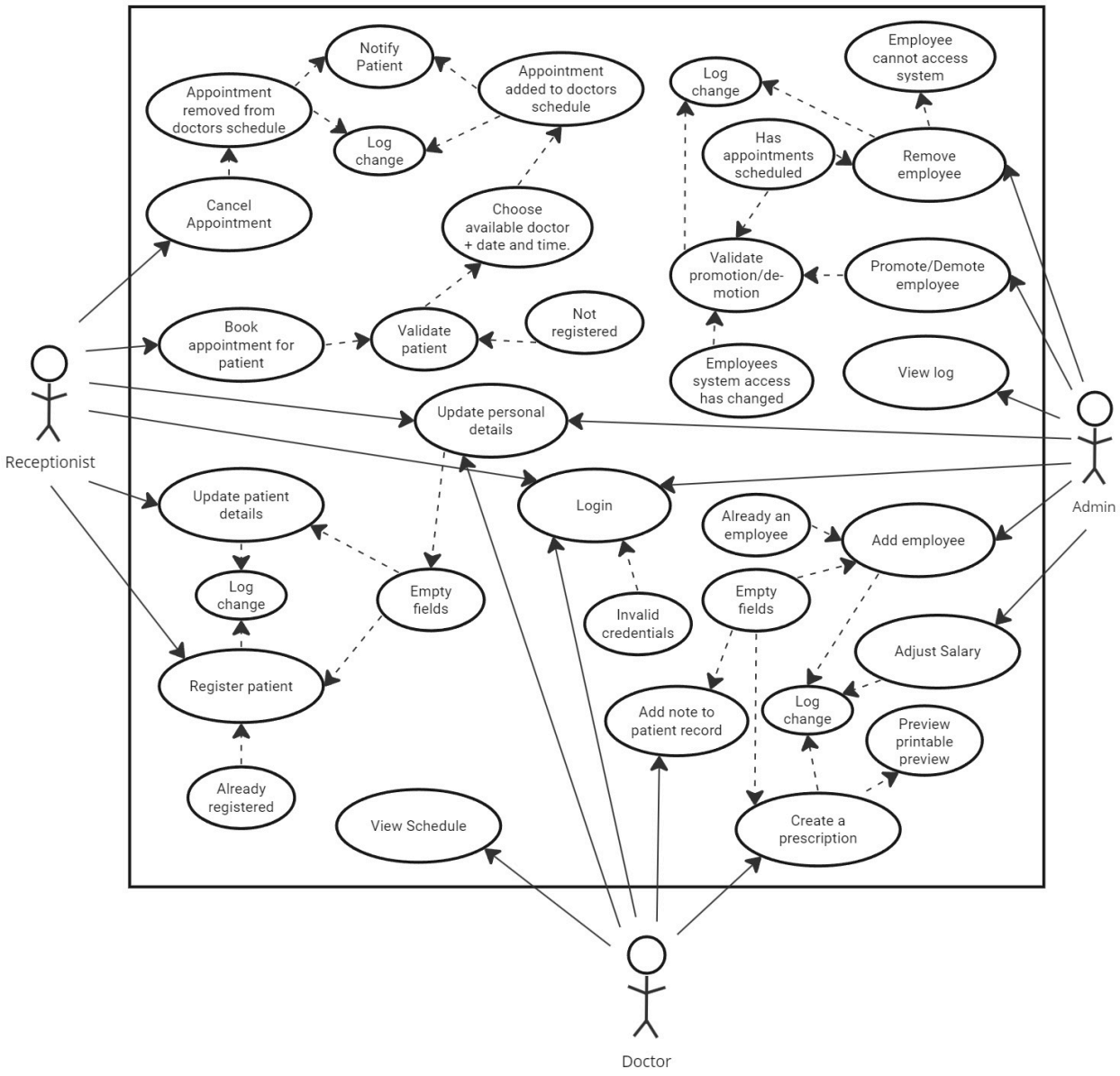
		- Verify if during the cancellation the admin if the admin pressed back rather than confirm no changes take place.
As an admin I want to view all hospital staff.		- Verify it displays all hospital staff. - Ensure it does not display patients. - Verify each hospital staff is only displayed once. - Verify list is ordered by ID number.
As an admin I want to change a member of hospital staff's role so that I can give them the correct access in the system.	Hospital staff may be promoted.	- Verify the system view for hospital staff changes. - Verify a doctor's job role cannot be changed if they have appointments. - Verify staff that have been promoted to doctor can now have appointments.
As an admin I want to see which hospital staff member is responsible for a change so that disciplinary action can be taken.	A log of what every hospital staff has done will be needed. The log will show if a receptionist edits a patient's record, if a doctor writes a prescription, if an admin adds an employee, etc. For example, if a receptionist cancelled an appointment without consulting the patient, an admin will need to find out which receptionist is responsible. To protect patients information, the log should only show ID's and not the patient's name.	- Verify when a change has been made to the patient profile,it has been added to the log. If the change is not saved, ensure it has not been added to the log. - Verify when an appointment is created it has been added to the log. If the appointment creation is not successful, ensure it has not been added to the log. - Verify when an appointment is cancelled it has been added to the log. If cancellation has not been confirmed, ensure it has not been added to the log. - Verify when an account is made it has been added to the log. If an account is not successfully created, ensure it has not been added to the log. - Verify when a hospital staff's role has changed it has been added to the log. If the role has not been successfully changed, ensure it has not

		been added to the log. - Verify when a note is added to a patient's record it has been added to the log. - Verify when a prescription is written it has been added to the log. If a prescription has not successfully been created, ensure it has not been added to the log. - Verify time and date is shown in the log. - Verify no names are shown in the log only patient IDs and employee IDs. - Verify log is order of newest to oldest.

Requirement Prioritisation

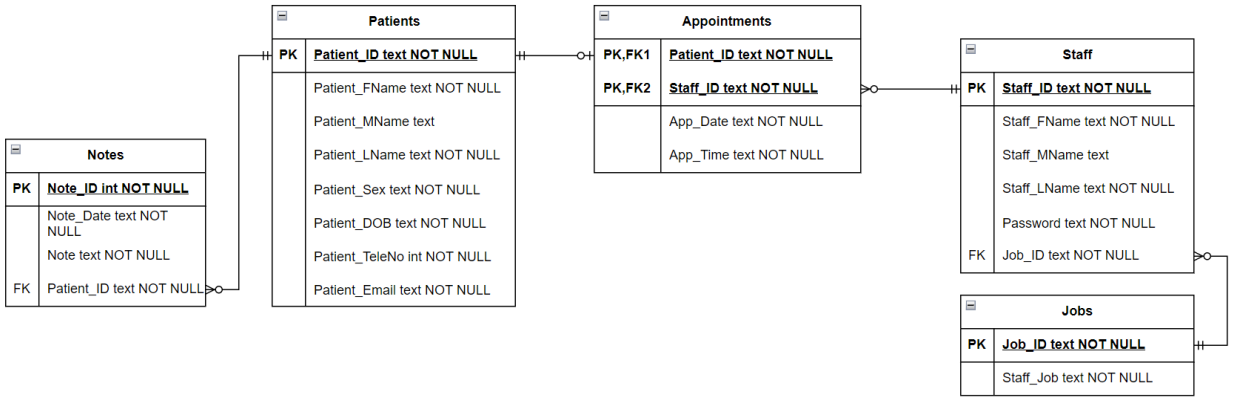
	User Stories
Must Have	- Individual logins for: Doctors, Receptionists and admin - Patient registration - Updatable records - Appointment creation - Appointment removable - Hospital staff account creation - Hospital staff account deletion
Should Have	- Search bar - Add notes to records - Appointment schedule for doctors - View all hospital staff - Change a hospital staff's role
Could Have	- Filtering system in search bar - Print preview of prescriptions - Log of hospital staffs edits and changes
Won’t Have	- Connection to pharmaceutical companies i.e will not be able to order medication directly.

Use case Diagram



Three actors are identified. Each actor is required to login before they can access any other functionality. Each actor has access to different functions of the system.

Design



There are various job roles that a staff member can have i.e admin, doctor and receptionist. The hospital will have many staff members. To become a patient at the hospital, a person must first register with a receptionist. The hospital will have many patients. A patient will ring up if they need an appointment with a doctor. The receptionist will be able to make an appointment with an available doctor. Not all doctors will be available as they will have many appointments a day. During a doctor's appointment a doctor can add notes into the patient's record about lab results, referrals or diagnosis'. The same patient may have many notes on their file.

Transitioning a Prototype to Production-Quality Software

Below, is a table showing what I have done and when to transition my prototype to a production quality software.

Date	Work completed
04/02	Prototype completed, Video recorded.
05/02	Normalised datatable in excel
07/02	Use case diagram
08/02	Created EDR Diagram
11/02	Created an SQLite database
14/02	Changed login UI design Changed UI colour palettes and navbar layout for each login home screen.
15/02	Changed receptionist 'view patient record' page UI.
16/02	Connected database. Changed admin 'View receptionist', 'View doctors' and 'View admin' UI.

	Created admin ‘employee profile page’ UI.
17/02	Created ‘create employee’ page UI. Changed doctors ‘view patients’ page UI.
19/02	Created employees personal profile page UI. Changed register patient UI. Created doctors view of ‘patient record’ UI.
20/02	Added individual logins for each user.
21/02	Can now display the user that is logged in profile which can be edited.
22/02	Receptionists can now see all patients registered. Receptionists can now register patients, an ID is automatically created for patients.
23/02	Receptionists can now view a patient's record and edit patient information. Wrote my report on Legal, Social, Ethical and Professional Issues.
25/02	Doctors can now see all patients registered. Doctors can now see a patient's record. Doctors can now see a patient's notes. Doctors can now add notes to a patient's record. Admin can view all employees. Admin can add employees, a staffID and temporary password are created.
26/02	Admin can now delete employees. Admin can now promote employees. Created appointment booking UI. Partially implemented appointment booking UI.
28/02	Receptionists can now book appointments. Receptionists can now cancel appointments. Doctors can now view their schedule. Receptionists can now search for patients based on last name. Doctors can now search for patients based on last name.
29/02	Created a log
03/03	Hashed passwords

Testing

Cycle 1

Test ID	Test Description	Test Scenario	Expected Result	Test Result	Remark	Response
S1-ID01	Log in	User inputs the correct ID, Password and job role.	The user will be logged in, the home screen displayed will be dependent on their job role. Activity logged.	Success	N/A	
S1-ID02	Log in	User inputs the incorrect ID, Password and job role.	Does not allow access Error displays	Success	N/A	
S1-ID03	Log in	User partially inputs ID required information.	Does not allow access. Reminds users of what is required information.	Success	N/A	
S2-ID01	Using a search bar to find patient	User inputs a last name in the database.	Any and only patients with the matching last name are displayed.	Success	N/A	
S2-ID02	Using a search bar to find patient	User inputs a last name not in the database.	No patients are displayed.	Success	N/A	
S3-D01	Patient details	Receptionist opens the patient's record.	Patients ID, first name, middle name, last name, DOB, email and phone number should be displayed.	Success	N/A	
S3-ID02	Patient details	Receptionist edits patients' contact details.	Patients details should be updated in the database and when searched for. Activity Logged.	Success	N/A	
S3-ID03	Patient details	Receptionist leaves required information blank.	Does not save the changes. Produces an error message.	Success	N/A	
S4-ID01	Register patient	Receptionist registers the patient with all mandatory information.	Message box announces they have been registered. A unique patient ID is given. Added to database and can be searched for, edited and left notes.	Success		

			Activity Logged			
S3-ID02	Register patient	Receptionist partially inputs mandatory information.	Produces an error. Does not add to the database.	Success	N/A	
S4-ID01	Appointment booking	Receptionist books an appointment with an available doctor, time slot and correct Patient ID.	Message box announces appointment has been made. Appointment is displayed in the doctor's schedule. Appointment added to database. Activity Logged	Success	N/A	
S4-ID02	Appointment booking	Receptionist inputs a patient ID that does not exist when booking an appointment.	Produces an error. Does not add to the database.	Partial Success	Did not add to the database but did not produce an error.	This feature has been fixed.
S4-ID03	Appointment booking	Receptionist leaves mandatory information blank when booking an appointment.	Produces an error. Does not add to the database.	Partial Success	Time slot error did not display. Didn't add to the database.	This feature has been fixed.
S5-ID01	Appointment cancellation	Receptionist cancels an appointment.	Appointment is removed from the database and doctors schedule. Activity logged.	Success	N/A	
S6-ID01	Patient record	Doctor views patient records.	Patients ID, Name, DOB and notes are displayed.	Success	N/A	
S6-ID02	Patient record	Doctor adds a note to the patient record.	Note is added to the database. Note can now be viewed on the patient profile. Notes are organised from newest to oldest. Activity is logged.	Success	N/A	
S6-ID03	Patient record	Doctor leaves the note input blank when adding a note.	Does not add to the database. Produces an error.	Success	N/A	
S7-ID01	Appointment Schedule	Doctor views their schedule for a	All appointments for that date are displayed with patient ID	Success	N/A	

		specific date.	and information. No duplicate appointments or double-bookings should be shown.			
S7-ID02	Appointment Schedule	Doctors view their schedule for a date with no appointments.	No appointments are displayed.	Success	N/A	
S9-ID01	Account creation	Admin creates an employee account with mandatory information filled in.	Account is created. Account can log in. Automatically creates a Unique ID and temporary password. New employees can only access their job roles. Added to database. Activity is logged.	Success	N/A	
S9-ID02	Account creation	Admin attempts to create an employee account with mandatory information partially filled in.	Produces an error. Account is not created.	Success	N/A	
S10-ID01	Account deletion	Admin deletes an account with no appointments allocated.	Confirmation is displayed. Removed from database. Cannot log in. Activity logged	Success	N/A	
S10-ID02	Account deletion	Admin attempts to delete an account with appointments allocated.	Produces an error. Account is not deleted.	Failed	Account was deleted, Appointments were deleted automatically.	This feature has been fixed.
S11-ID01	View employees	Admin views receptionists	Only receptionists are displayed.	Success	N/A	
S11-ID02	View employees	Admin views doctors	Only doctors are displayed.	Success	N/A	
S11-ID03	View employees	Admin views admin	Only admin is displayed.	Success	N/A	
S12-ID01	Employee job change	Admin promotes an employee with	When the user logs in it shows the appropriate job home	Success	N/A	

		no appointments.	screen. Activity is logged. Job role is changed in the database.			
S12-ID02	Employee job change	Admin attempts to promote an employee with appointments allocated.	Produces an error. Employee is not promoted.	Failed	Employee was promoted. Appointment was still booked.	This feature has been fixed.

Cycle 2

Test ID	Test Description	Test Scenario	Expected Result	Test Result	Remark
S4-ID02	Appointment booking	Receptionist inputs a patient ID that does not exist when booking an appointment.	Produces an error. Does not add to the database.	Success	N/A
S4-ID03	Appointment booking	Receptionist leaves mandatory information blank when booking an appointment	Produces an error. Does not add to the database.	Success	N/A
S10-ID02	Account deletion	Admin attempts to delete an account with appointments allocated.	Produces an error. Account is not deleted.	Success	N/A
S12-ID02	Employee job change	Admin attempts to promote an employee with appointments allocated.	Produces an error. Employee is not promoted.	Success	N/A

Relevant Issues

Data protection is of massive importance when it comes to hospital management systems and how they store sensitive medical records. In my project, patients do not have control over their information and how it is stored so it is my responsibility to look into General data protection regulation (GDPR) regulations and to make it secure.

Additionally, I want my system to be used by all hospital staff. This means it has to be accessible for everyone to use. For this reason, I will be looking into ways of making accessible to those with disabilities that may cause them to struggle to navigate the system.

Furthermore, high reliability in my system is key. Failure for my system to be reliable could cause issues that range from double-bookings to serious health risks for patients if the system goes down. I am at risk of my system not being accepted if I cannot develop a sense of confidence. (Development Team, *Performance and reliability in Healthcare Systems* 2022) (Vidya & Kumar, *Reliability Analysis in Healthcare Imaging Applications* 2016)

A non-GDPR compliant system can cause severe data breaches. In 2020, an airline, British Airways, was fined over £20m due to a data breach. The data that was stolen included personal information such as names and log-ins. (Tidy, 2020) To avoid this scenario during my transition to production quality. I intend to MD5 encrypt passwords for every user of my system to avoid logins getting leaked if a data breach occurs. Also, to have an audit trail for all my users actions in case an error is made or an internal data leak occurs it will be possible to find who is responsible. To make sure this follows GDPR regulations only IDs will be used in the audit and no personal information will be used. Finally, my system will control who has access to different areas of my system.

A common problem with systems is that people with low-eyesight or are legally blind struggle to navigate. In 2019, a blind-man was unable to order a pizza despite using a screen-reader and won a lawsuit against dominos because it was deemed not to be ADA complaint. (Higgins, 2019) I will be taking into consideration tab order for any inputs, spacing and the usage of high contrast colours to help visibility for all hospital staff.

In 2023, the BBC reported that patients had been: misdiagnosed, not followed-up for treatment, resuscitated when they had a DNR and given wrong medication. Many of these events had led to deaths of patients. (Barbour et al., *IT failures causing patient deaths, says NHS Safety Body* 2023) To establish a sense of trust in my system and avoid scenarios like these, I will be defensively programming to make sure all errors are handled correctly so if an error does occur the entire system should not fail.

4. References

Higgins, T. (2019, October 8). *Supreme Court hands victory to blind man who sued Domino's over site accessibility*. CNBC. https://www.cnbc.com/2019/10/07/dominos-supreme-court.html

Yuan, B., & Li, J. (2019, March 16). *The Policy Effect of the General Data Protection Regulation (GDPR) on the Digital Public Health Sector in the European Union: An Empirical Investigation*. National Library of Medicine. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6466053/

Kharchenko, B. (2024, January 18). *How to create accessible winforms applications*. DevExpress Blogs. https://community.devexpress.com/blogs/winforms/archive/2024/01/18/how-to-create-accessible-winforms-applications.aspx

Tidy, J. (2020, October 16). *British Airways fined £20M over Data Breach*. BBC News. https://www.bbc.co.uk/news/technology-54568784

Coding Ideas, J. (2021, October 12). *Part 1 | how to create a calendar in c#.net windows form using UserControl*. YouTube. https://www.youtube.com/watch?v=tY8_GE6NRYA

Coding Ideas, J. (2021b, October 22). *Part 2 | how to create a calendar | ADD events | C# windows form*. YouTube. https://www.youtube.com/watch?v=j2T72fxMH60&t=3s

Vidya, C. S., & Kumar, B. P. V. (2016, September). *Reliability Analysis in Healthcare Imaging Applications*. sciresol. https://sciresol.s3.us-east-2.amazonaws.com/IJST/Articles/2016/Issue-34/Article73.pdf

Development Team, T. (2022). Performance and reliability in Healthcare Systems. Infocare Health. https://infocarehealth.com/performance-and-reliability-in-healthcare-systems/#:~:text=Well%20designed%20healthcare%20software%20will,ensure%20errors%20are%20handled%20correctly.

Barbour, S., Wright, N., & Roxby, P. (2023, December 19). *IT failures causing patient deaths, says NHS Safety Body*. BBC News. https://www.bbc.co.uk/news/health-67503126