

HealthCare Management System Proposal

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1. CUSTOMER PROBLEM STATEMENT

1.1 Problem Statement

While healthcare has become more advanced, the need for sophisticated data applications has become more acute. Current documentation management for healthcare is old-fashioned, sluggish, time-consuming, and unreliable. Records are maintained on paper and managed through files, which, as a result, can create inaccurate results, documents, and information. The manual filing system has many concerns, which include file security, slow file retrieval system, and inefficient updating of the file system, etc. This project would aim at implementing an automated database management system that would maintain patients' data records in a healthcare environment. The motive for this project is the obstacles correlated with the manual filing of healthcare file management.

2. SYSTEM REQUIREMENTS

A database management system is a platform that provides for improved methods of storing and accessing data whenever it is needed. Application programs facilitate the access to data. The system would provide information integrity by continuously syncing the information that has been entered. The system would always ensure that even when more than one person is performing an update operation on the database at the same time, the data will be updated on the right part of the database. The system would reduce storage space by performing automatic archiving of old, infrequently accessed data from expensive storage devices to low cost-effective storage devices. The system would enhance data sharing capabilities by increasing access to the database using queries. This increases the accuracy of access to data, although the information is from the same database. Different users would be able to access the same database from different devices and at different physical locations.

2.1. Functional Requirements

Requirement No.	Priority Weight	Description
REQ-1 Login	18.2	The associate can enter their correct credentials in the login page and will be successfully logged in. If entered data is invalid, an error message will be displayed.
REQ-2 Add new patient	16.8	A receptionist will enter the patient details and the system will assign a unique patient ID.
REQ-3 Add/edit/delete user	14.6	An administrator will have the ability to add, edit, and delete users.
REQ-4 Search for patient	12.7	All associates will be able to search for patient details.
REQ-5 Generate bill	11.0	The Billing Clerk will enter the patient details and charges in order to get a total and generate a bill.
REQ-6 Request lab test	8.9	Doctors can request for lab tests.
REQ-7 View lab test requests	7.1	Doctors and lab associates can view all new lab test requests. Lab associates will be able to approve or deny requests.
REQ-8	6.7	Doctors and lab associates can view all lab tests in progress. Lab associates can complete lab tests.

View lab tests in progress		
REQ-9 View lab test results	6.0	Doctors and lab associates can view all lab test results.
Total: 100		

2.2 Nonfunctional Requirements

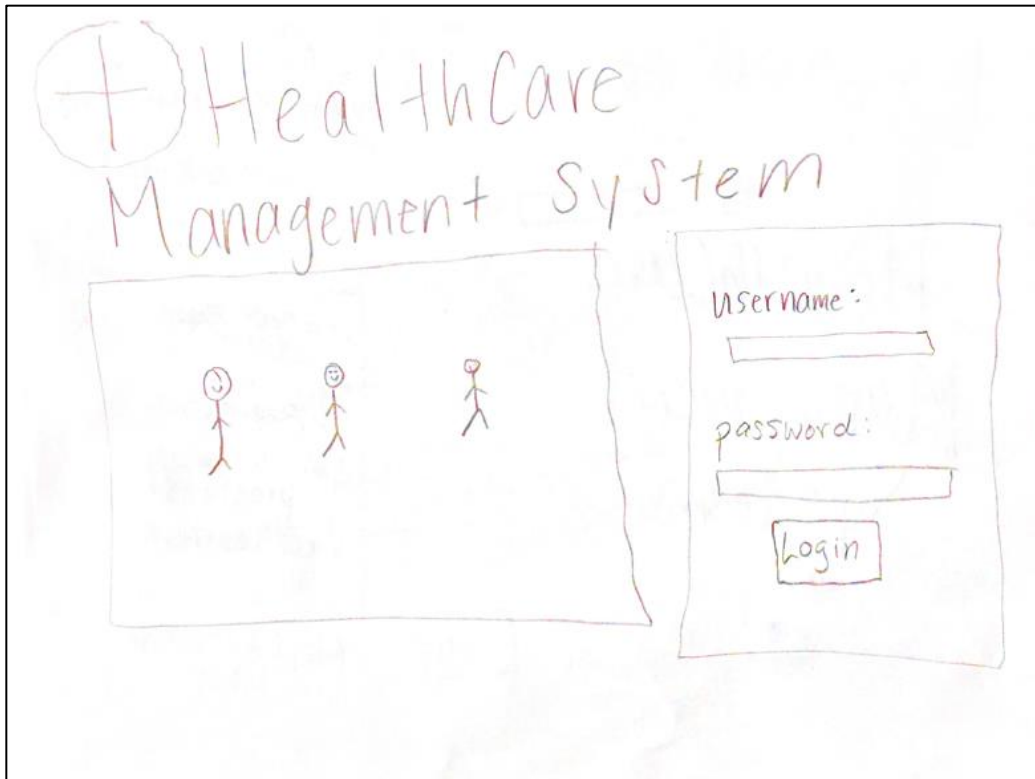
Requirement No.	Priority Level	Description
REQ-10 Security	Critical	Secure access by username (ID) and password.
REQ-11 Performance	High	User-friendly interface for better interaction.
REQ-12 Platform Independent	Normal	Can be accessed by any type of platform.
REQ-13 Maintainability	Low	Backup of the database will be taken, and extra memory will not be occupied because there will not be any redundancy in the database.

2.3 User Interface Requirements

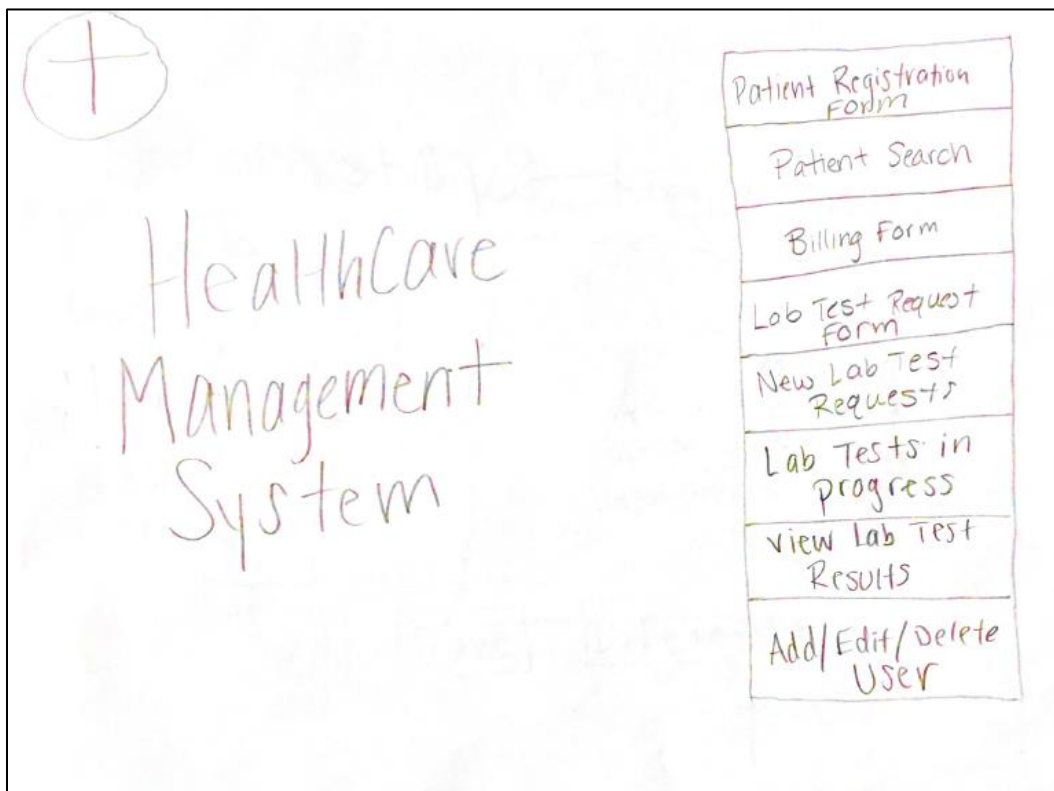
Requirement No.	Priority Level	Description
REQ-14	High	A login screen for entering username and password
REQ-15	High	Display a homepage for the system
REQ-16	High	Add/edit/delete user
REQ-17	Normal	Patient registration form
REQ-18	Normal	Patient search
REQ-19	Normal	Billing form
REQ-20	Low	Lab test request form
REQ-21	Low	New lab test requests
REQ-22	Low	Lab tests in progress
REQ-23	Low	View lab test results

2.3.1. User Interface Requirement Sketches/Graphics

2.3.1.1 REQ-14 sketch



2.3.1.2 REQ-15 sketch



2.3.1.3 REQ-16 sketch

Add/Edit/Delete User

Select one

Add user ☐

Edit user ☐

Delete user ☐

ID

Name

DOB

Contact No

ID

Gender

Department

2.3.1.4 REQ-17 sketch

Patient Registration Form

Patient ID

Patient Name

DOB

Gender

Address

Contact No

Registration Date

Room No

Doctor

Incomplete/saved Patient Registration Forms:

2.3.1.5 REQ-18 sketch

Patient Search

Patient ID Patient Name DOB

Patient ID Registration Date
 Patient Name Room Number
 DOB Doctor
 Gender
 Address
 Contact No

2.3.1.6 REQ-19 sketch

Billing Form

Bill No Date

Patient ID Date of Admission
 Name Date of Discharge
 DOB
 Gender

Room Charges
 Doctor Fees Miscellaneous
 Lab fees

2.3.1.7 REQ-20 sketch

Lab Test Request form

Patient Name Patient ID
 DOB
 Gender
 Test Name
 Description
 Doctor

Incomplete / Saved Lab Test Request Forms:

2.3.1.8 REQ-21 sketch

New Lab Test Requests

Patient Name Patient ID
 DOB
 Gender
 Test Name
 Description
 Doctor

New Lab Requests:

2.3.1.9 REQ-22 sketch

Lab Test in Progress

Patient Name Patient ID

DOB

Gender

Test Name

Description

Doctor

Lab Tests in Progress:

Complete
Save
Delete
Exit

2.3.1.10 REQ-23 sketch

Lab Test Results

Patient Name Patient ID

DOB Lab Test Results

Gender

Test Name

Description

Doctor

Completed Lab Tests:

Delete
Exit

3. FUNCTIONAL REQUIREMENTS SPECIFICATION

3.1 Stakeholders

The major stakeholders in the healthcare system are patients, physicians, employers, insurance companies, pharmaceutical firms and government. In this HealthCare Management System, the primary actors (stakeholders) that are involved are:

- Doctors
- Receptionists
- Lab Associates
- Billing Clerks
- Administrators

3.2 Actors and Goals

Actor	General Goal
<i>Doctors</i>	
Doctors	Doctors have their own unique ID and password for logging in, they can search for patients to view their details, and they can submit lab tests for patients.
Lab associates	Lab associates have their own unique ID and password for logging in, they can search for test details, and they receive test requests.
Receptionists	Receptionists have their own unique ID and password for logging in and they fill out patient registrations forms.
Billing Clerks	Billing clerks have their own unique ID and password for logging in and they generate bills for patients.
Administrators	Administrators have their own unique ID and password for logging in, they can create users and delete users.

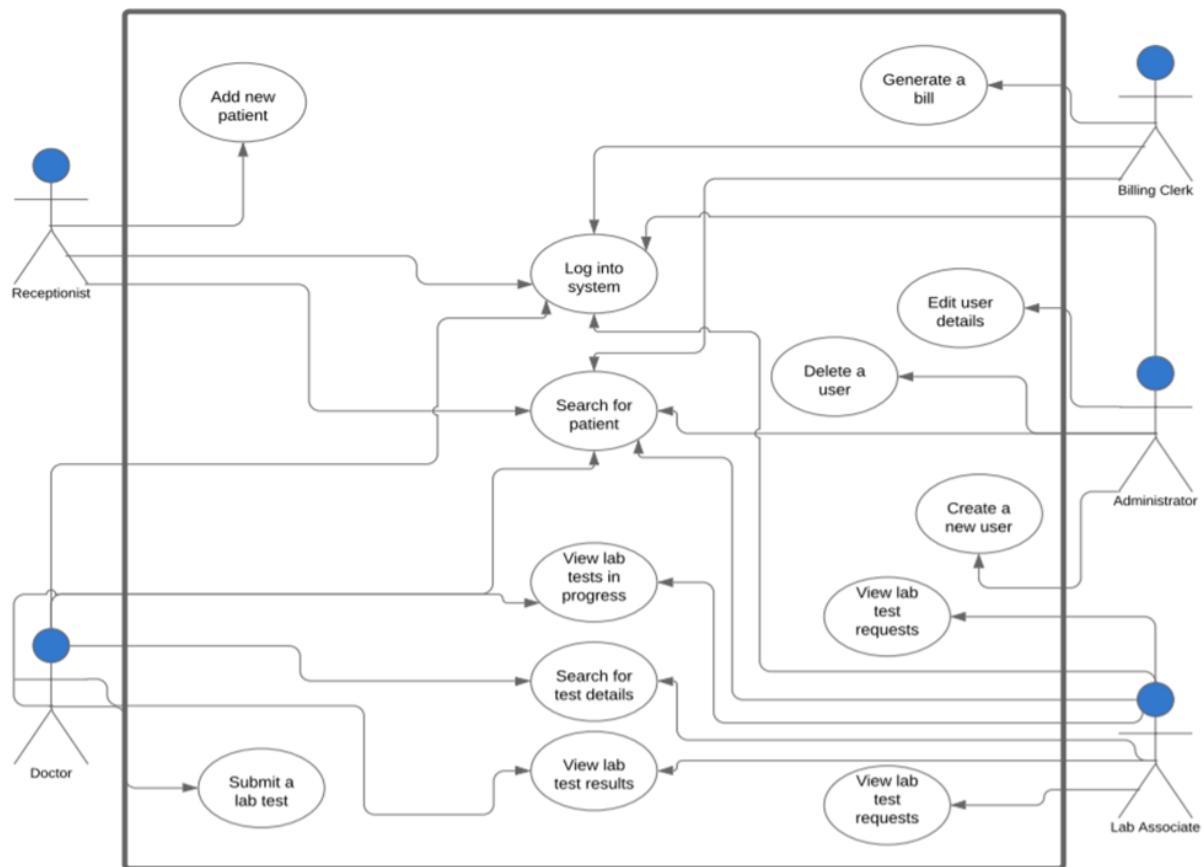
3.3 Use Cases

3.3.1. Casual Description

Use Case ID	Use Case Name	Casual Description
UC.1	Log into system	All associates (users) will use their unique ID and password for logging into the system.
UC.2	Search for patient	Associates can search for patients using their ID number.
UC.3	Submit a lab test	Doctors can fill out and submit lab test forms for patients to request a test from the lab.
UC.4	Search for test details	Lab associates can search for test details for patients using their patient ID numbers.
UC.5	View lab test requests	Lab associates can view all new lab test requests
UC.6	View lab tests in progress	Lab associates will review all lab test forms for patients submitted by doctors and approve or deny them.
UC.7	View lab test results	Doctors and lab associates can view all lab test results.

UC.8	Add a new patient	Receptionist can register new patients by filling out the patient registration form.
UC.9	Generate a bill	Billing clerks can generate a bill by filling out and submitting billing forms.
UC.10	Create a new user	Administrators can create new users by filling out the add associate form.
UC.11	Edit user details	Administrators can edit user details.
UC.12	Delete a user	Administrators can delete users.

3.3.2. Use Case Diagram



3.3.3. Traceability Matrix

REQ No.	REQ Priority Level	REQ Description	Use Case ID	Use Case Priority Weight	Use Case Description
REQ-14	High	A login screen for entering username and password	UC.1	18.2	All associates (users) will use their unique ID and password for logging into the system.
REQ-15	High	Display a homepage for the system	UC.1	16.8	All associates (users) will use their unique ID and password for logging into the system.

REQ-16	High	Add/edit/delete user	UC.10 UC.11 UC.12	14.6	Administrators can add, edit, and delete users
REQ-17	Normal	Patient registration form	UC.2 UC.8	12.7	Receptionist can add new patients and all associates can search for patients.
REQ-18	Normal	Billing form	UC.9	11.0	Billing clerks can generate a bill by filling out and submitting billing forms.
REQ-19	Normal	Lab test request form	UC.3	8.9	Doctors can fill out and submit lab test forms for patients to request a test from the lab.
REQ-20	Low	New lab test requests	UC.5	7.1	Lab associates can view all new lab test requests
REQ-21	Low	Lab tests in progress	UC.6	6.7	Lab associates will review all lab test forms for patients submitted by doctors and approve or deny them.
REQ-22	Low	View lab test results	UC.7	6.0	Doctors and lab associates can view all lab test results.
				Total: 100	

3.3.4. Fully Dressed Description

<i>UC.1 – Log into system</i>	
Actors	Doctors, Lab Associates, Receptionists, Billing Clerks, and Administrators
Inputs	Username and Password
Preconditions	Valid Email Id, Valid Password, and Internet Connectivity
Flow of Events	1. Associate opens system 2. Associate enters ID and password 3. Associate is logged into the system
Postconditions	Actors must stay connected to the internet in order to stayed logged in

<i>UC.8 – Create a new user</i>	
Actors	Administrator
Inputs	New users' information
Preconditions	Internet connectivity
Flow of Events	1. Administrator opens system 2. Administrator enters ID and password 3. Administrator is presented with the systems homepage 4. Administrator selects the "Add/Edit/Delete User" tab from the homepage 5. Administrator is presented with the "Add/Edit/Delete User" page 6. Administrator selects "Add user" 7. Administrator fills in all information needed to add the new associate 8. Administrator will select the "Add" button 9. System will present Administrator with a unique ID number for the new user/associate

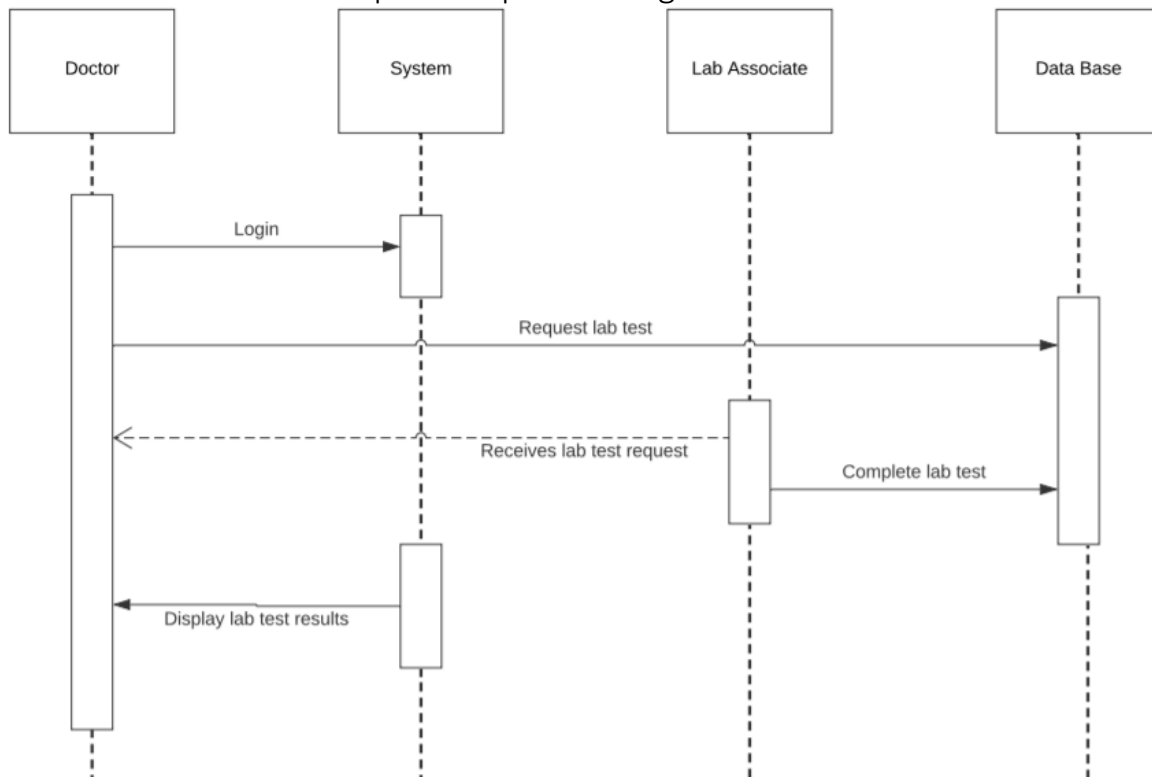
Postconditions	New user will be added to the system
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<i>UC.9 – Edit user details</i>	
Actors	Administrator
Inputs	Associates ID number
Preconditions	Valid associate ID number
Flow of Events	1. Administrator opens system 2. Administrator enters ID and password 3. Administrator is presented with the systems homepage 4. Administrator selects the “Add/Edit/Delete User” tab from the homepage 5. Administrator is presented with the “Add/Edit/Delete User” page 6. Administrator selects “Edit user” 7. Administrator types in the user/associates ID number then selects “Search” 8. The system will present the user/associates information 9. Administrator will edit the information 10. Administrator will select the “Save” button 11. System will present Administrator with an alert box that tells them that the information was saved
Postconditions	User records will be updated

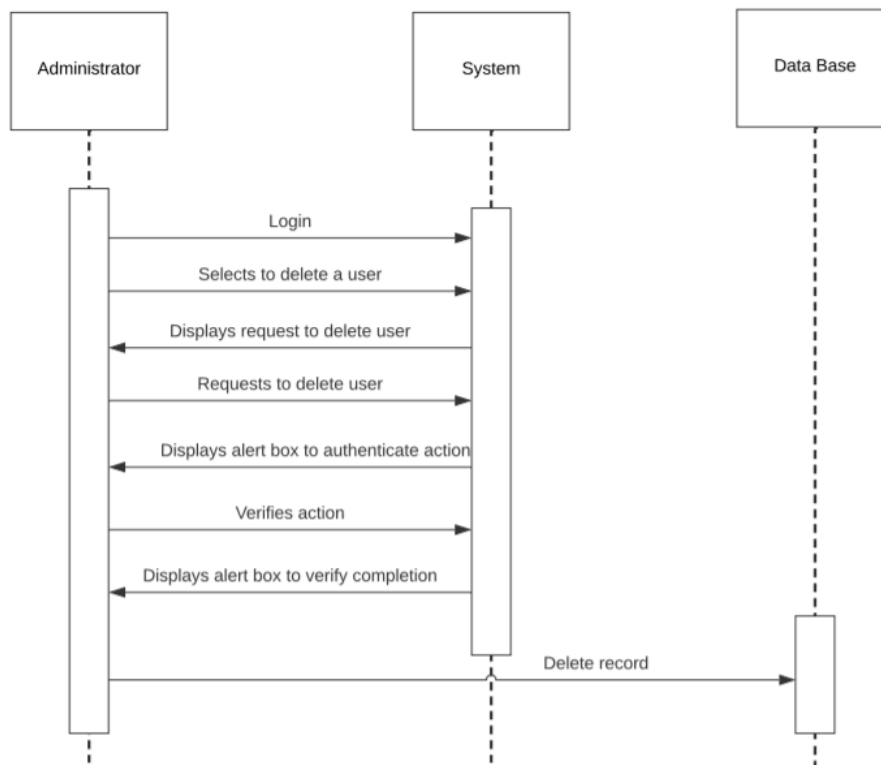
<i>UC.10 – Delete a user</i>	
Actors	Administrator
Inputs	Associates ID number
Preconditions	Valid associate ID number
Flow of Events	1. Administrator opens system 2. Administrator enters ID and password 3. Administrator is presented with the systems homepage 4. Administrator selects the “Add/Edit/Delete User” tab from the homepage 5. Administrator is presented with the “Add/Edit/Delete User” page 6. Administrator selects “Delete user” 7. Administrator types in the user/associates ID number then selects “Search” 8. The system will present the user/associates information 9. Administrator will select the “Delete” button 10. System will present the Administrator with an alert box if they are sure they want to delete this user 11. Administrator will select “yes” in the alert box 12. System will present an alert box verifying that the user account has been deleted
Postconditions	User records will be deleted

3.4 System Sequence Diagram

3.4.1. Lab Test Request Sequence Diagram



3.4.2. Delete User Sequence Diagram



4. USER INTERFACE SPECIFICATION

4.1. Preliminary Design

4.1.1. UC.1

For use case number one, the user will log into the system by entering their username (which is their ID number) and password into the blank fields, which is indicated by the red arrows in figure 1. After the user selects the login button, the system will present the homepage, as shown in figure 2.

Navigation path:

1. Click on the username field
2. Then, type in username
3. Click on the password field
4. Then, type in password
5. Then, select the login button

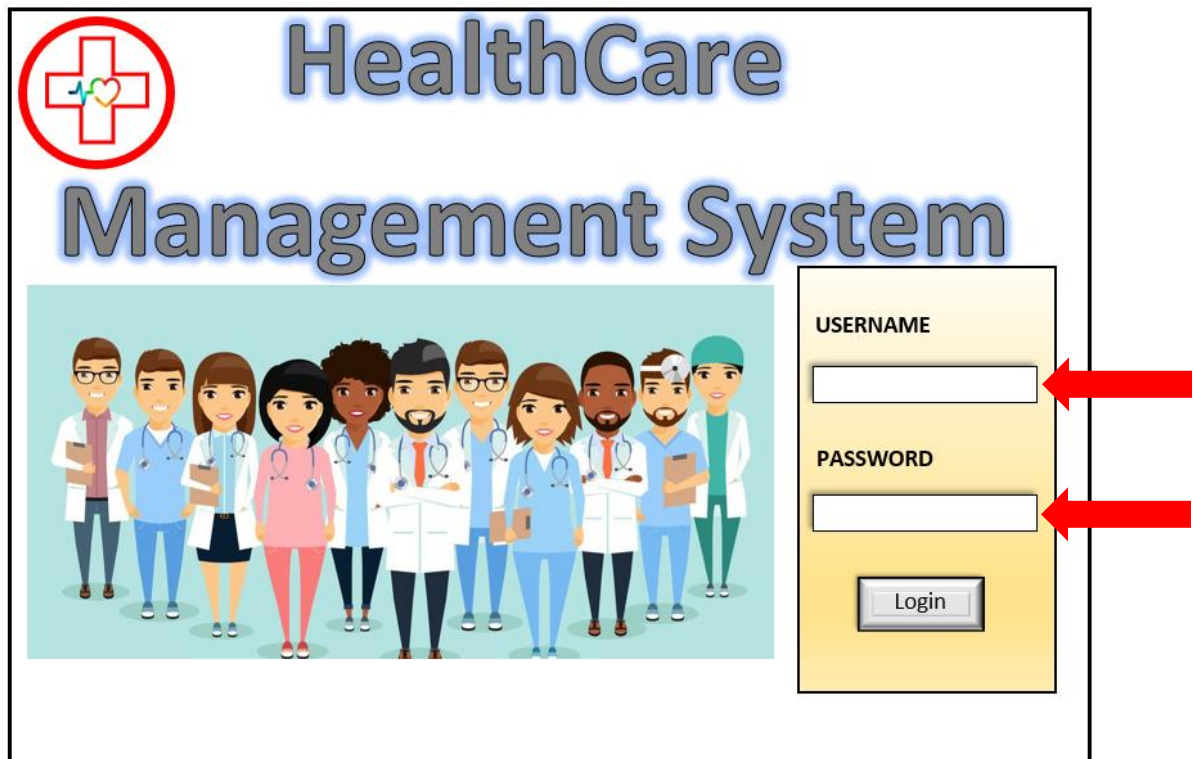


Figure 1: Log into system



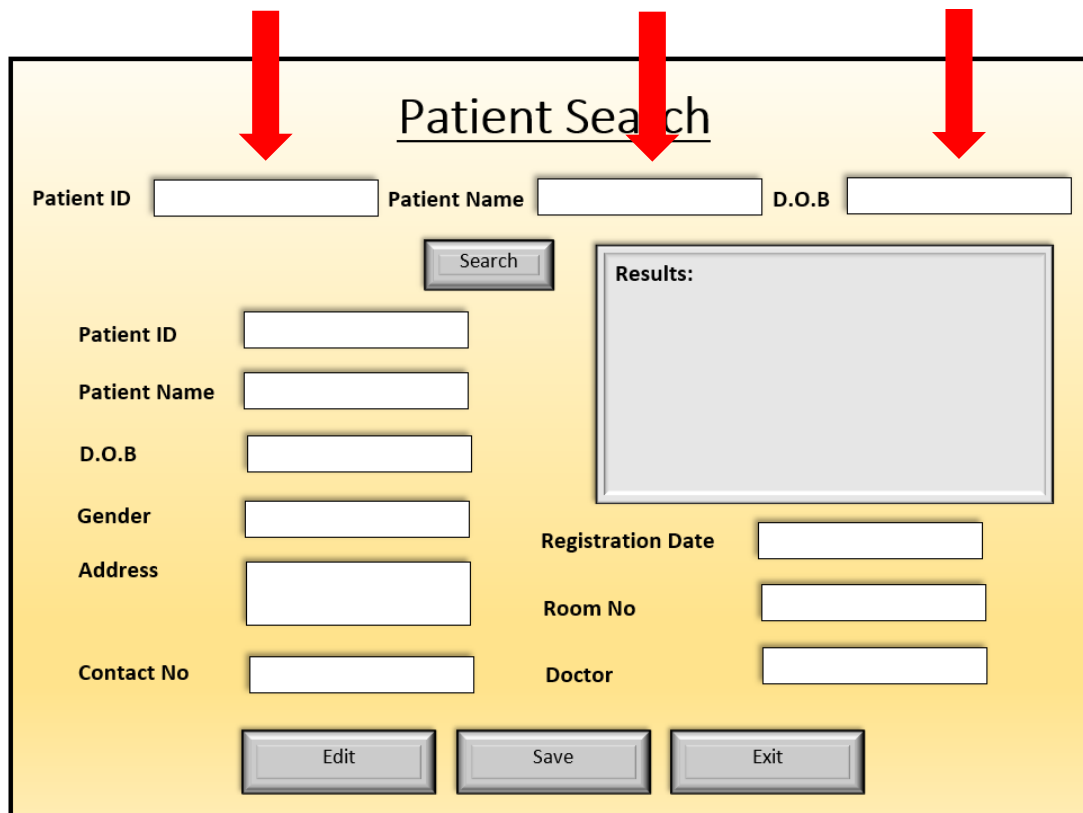
Figure 2: Homepage

4.1.2. UC.2

For use case number two, the user will click on "Patient Search" from the homepage (figure 2). The system will present the user with the patient search page. The user will enter the patient's ID number (indicated by a red arrow in figure 3), name (indicated by a red arrow in figure 3), or date of birth (indicated by a red arrow in figure 3). Once the user has entered the information in at least one of the fields, they will select the search button. The system will display all results in the results window, which is indicated by a blue arrow in figure 4. The user will select which patient profile is needed, then the system will display all the patient's information, as shown in figure 5. From here, the user can edit and save any information if needed.

Navigation path:

1. Log in
2. Click on patient search from homepage
3. Then, enter patients D.O.B
4. Click the search button
5. Select patient from results window



Patient Search

Patient ID Patient Name D.O.B

Results:

Patient ID

Patient Name

D.O.B

Gender

Address

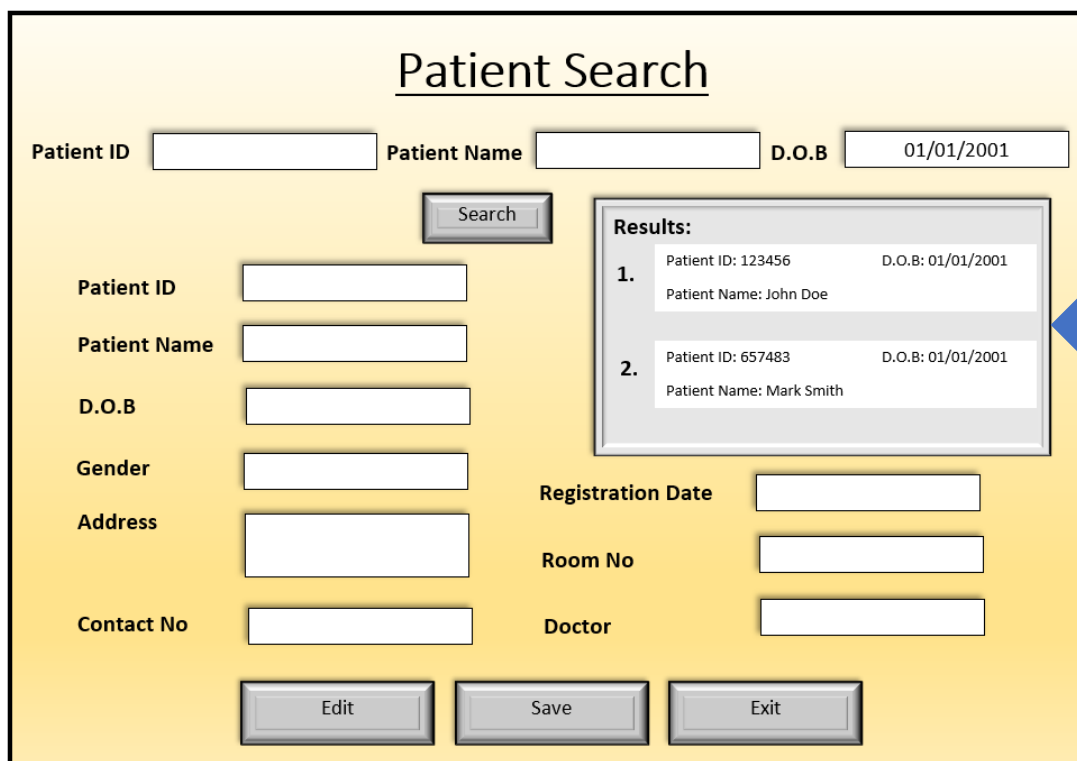
Contact No

Registration Date

Room No

Doctor

Figure 3: Patient search page



Patient Search

Patient ID Patient Name D.O.B

Results:

1. Patient ID: 123456 D.O.B: 01/01/2001
Patient Name: John Doe
2. Patient ID: 657483 D.O.B: 01/01/2001
Patient Name: Mark Smith

Patient ID

Patient Name

D.O.B

Gender

Address

Contact No

Registration Date

Room No

Doctor

Figure 4: Patient search results

Patient Search

Patient ID Patient Name D.O.B

Results:

- Patient ID: 123456 D.O.B: 01/01/2001
Patient Name: John Doe
- Patient ID: 657483 D.O.B: 01/01/2001
Patient Name: Mark Smith

Patient ID

Patient Name

D.O.B

Gender

Address

Contact No

Registration Date

Room No

Doctor

Figure 5: Patient details

4.1.3. UC.3

For use case number three, the user will log in and click on "Lab Test Request Form" from the homepage. Doctors are the only users authorized to submit lab test requests. The system will present the user with the page for lab test request forms (figure 6). The user will enter all information that is displayed on the form and select submit (figure 7). If the user doesn't want to submit the form right away, they can select the save button instead. The patient's name will appear in the incomplete/saved lab test request form window so they can go back and submit the request later, indicated by a blue arrow in figure 8.

Navigation Path:

1. Log in
2. Click on lab test request form from homepage
3. Enter in all information for the form
4. Then, click on the submit button

Lab Test Request Form

Patients Name		Patient ID		
D.O.B		Incomplete/Saved Lab Test Request Forms:		
Gender				
Test Name				
Description				
Doctor				
Submit		Save	Delete	Exit

Figure 6: Lab test request form

Lab Test Request Form

Patients Name	Jane Brown	Patient ID	678439	
D.O.B	02/02/2002	Incomplete/Saved Lab Test Request Forms:		
Gender	Female			
Test Name	Lipid panel			
Description	Checking LDL levels			
Doctor	Dr. Grey			
Submit		Save	Delete	Exit

Figure 7: Submitting lab test request form

The image shows a web form titled "Lab Test Request Form". It contains several input fields for patient information: "Patients Name" (Jane Brown), "Patient ID" (678439), "D.O.B" (02/02/2002), "Gender" (Female), "Test Name" (Lipid panel), "Description" (Checking LDL levels), and "Doctor" (Dr. Grey). Below these fields are four buttons: "Submit", "Save" (highlighted with a thick black border), "Delete", and "Exit". To the right of the form fields is a box titled "Incomplete/Saved Lab Test Request Forms:". Inside this box, there is a list item "1. Patient Name: Jane Brown". A blue arrow points from the right side of the image towards this list item.

Figure 8: Saving request for later

4.1.4. UC.4 and 5

For use case number four and five, the user will log in and click on "Lab Test Requests" from the homepage. Lab associates are the only users authorized to access the lab test requests page. The system will present the user with the lab test requests page that displays all the new lab test requests in the window, as indicated by a blue arrow in figure 9. If needed, the user can search for a patient's lab test request by entering the patient's ID number in the blank field, as indicated by the red arrow in figure 9. The user can approve, deny, edit, or delete a lab test request.

Navigation path:

1. Log in
2. Click on lab test requests from the homepage
3. Click on the first new lab test request shown in the window
4. Approve or deny the request

New Lab Test Requests

Patients Name

D.O.B

Gender

Test Name

Description

Doctor

Patient ID

New Lab Requests:

Figure 9: New lab test requests

4.1.5. UC.6

For use case number six, the user will log in and click on "Lab Tests in Progress" from the homepage. Lab associates are the only users authorized to access the lab test progress page. The system will present the user with the lab test progress page that displays all the lab tests that are currently in progress in the window, as indicated by the blue arrow in figure 10. If needed, the user can search for a patient's lab test by entering the patient's ID number in the blank field, as indicated by the red arrow in figure 10. Once the lab associate has finished a lab test, they will click on the request from the window (indicated by the blue arrow) and select complete, as depicted in figure 11.

Navigation path:

1. Log in
2. Click on lab tests in progress from the homepage
3. Select the request from the window
4. Click on complete

Lab Tests in Progress

Patients Name

D.O.B

Gender

Test Name

Description

Doctor

Patient ID

Lab Tests in Progress:

1. Patient Name: Karen Hill

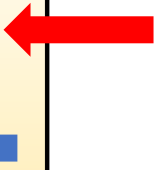


Figure 10: Lab tests in progress

Lab Tests in Progress

Patients Name

D.O.B

Gender

Test Name

Description

Doctor

Patient ID

Lab Tests in Progress:

1. Patient Name: Karen Hill

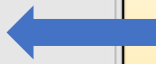


Figure 11: Complete lab test

4.1.6. UC.7

For use case number seven, the user will log in and click on "Lab Test Results" from the homepage. Lab associates and doctors are the only users authorized to access the lab test results. The system will present the user with the lab test results page that displays all the lab tests that have been completed in the window indicated by the blue arrow in figure 12. If needed, the user can search for a patient's lab test by entering the patient's ID number in the blank field, as indicated by the red arrow in figure 12. The user will click on the patient's name in the window to see their test results, as shown in figure 13.

Navigation path:

1. Log in
2. Click on lab test results from the homepage
3. Select the patients name from the window

Lab Test Results

Patients Name

D.O.B

Gender

Test Name

Description

Doctor

Patient ID **Search**

Lab Test Results

Completed Lab Tests:

1. Patient Name: Bryan Myers

Delete **Exit**

Figure 12: Lab test results

Lab Test Results

Patients Name

D.O.B

Gender

Test Name

Description

Doctor

Patient ID

Lab Test Results

TSH: 1.3 mIU/L
 Test range: Normal

Completed Lab Tests:

- Patient Name: Bryan Myers

Figure 13: View patients lab test results

4.1.7. UC.8

For use case number eight, the user will log in and click on "Patient Registration Form" from the homepage. Receptionists are the only users authorized to access the patient registration form. The system will present the user with the patient registration form page. The receptionists will enter all patient information into the blank fields and click on add. If needed, the user can click on save instead of adding, and the system will save the patient info and display it in the incomplete/saved patients registration form window as indicated by the blue button in figure 14.

Navigation path:

1. Log in
2. Click on patient registration form
3. Enter in patient information
4. Click add

Patient Registration Form

Patient ID		Registration Date	
Patient Name		Room No	
D.O.B		Doctor	
Gender		Incomplete/Saved Patient Registration Forms: 1. Patient Name: Sally Lee	
Address			
Contact No			

Figure 14: Add new patient

4.1.8. UC.9

For use case number nine, the user will log in and click on "Billing Form" from the homepage. Billing Clerks are the only users authorized to access billing forms. The system will present the user with the billing form, and they will enter all information into the blank fields, as shown in figure 15. The user will then click on the total button, and the system will present the total amount due, as shown in figure 16.

Navigation path:

1. Log in
2. Click on billing form
3. Fill in blank fields
4. Click on total

Billing Form

Bill No Date

Patient Details

Patient ID	389275	Date of Admission	05/01/2005
Name	Riley Lakes	Date of Discharge	05/05/2005
D.O.B	09/22/1999	Third Party Name	Medicaid
Gender	Female	Member ID	10045578900

Charges

Room Charges	\$2,500.00	Miscellaneous
Doctor Fees	\$5,000.00	
Lab Fees	\$600.00	

Figure 15: Fill out billing form

Billing Form

Bill No Date

Patient Details

Patient ID	389275	Date of Admission	05/01/2005
Name	Riley Lakes	Date of Discharge	05/05/2005
D.O.B	09/22/1999	Third Party Name	Medicaid
Gender	Female	Member ID	10045578900

Charges

Room Charges	\$2,500.00	Miscellaneous
Doctor Fees	\$5,000.00	
Lab Fees	\$600.00	

Figure 16: Total bill

4.1.9. UC.10, 11, 12

For case numbers ten, eleven, and twelve, the user will log in and click on "Add/Edit/Delete User" from the homepage. Administrators are the only users authorized to access this page. The system will present the user with the page. The user will select which action they want to do, as indicated by the blue arrow in figure 17. If the user selects add user, they will then enter in all information at the bottom of the page (except for ID), select add, then they system will generate a unique ID number (indicated by a green arrow in figure 17) for the user (as shown in figure 17). If the user selects edit user, they will enter in the associate's (user) ID number and click search, as indicated by the red arrow in figure 19. After the user selects the search button, the associate's information will be displayed, as shown in figure 19. If the user wants to delete a user, they will select delete users, enter users ID as shown in figure 20. They will then enter the ID number (as indicated by the red arrow in figure 20), click on search, then click on delete as shown in figure 19.

Navigation path:

1. Log in
2. Click on add/edit/delete user from homepage
3. Select which action is needed
4. Enter information into blank fields
5. Click on add if adding user
6. Or click on save if editing user
7. Or click on deleted if deleting user

Add/Edit/Delete User

Which do you want to do?
(Select one)

Add user ☐

Edit user ☐

Delete user ☐

If you selected add user, continue to the bottom, and fill in all information. A unique ID number will then be generated for the new user.

If you selected edit user or delete user, input the user's ID number and select search.

ID

Name **ID**

D.O.B **Gender**

Contact No **Department**

Figure 17: Select action

Add/Edit/Delete User

Which do you want to do?
(Select one)

Add user ☒

Edit user ☐

Delete user ☐

If you selected add user, continue to the bottom, and fill in all information. A unique ID number will then be generated for the new user.

If you selected edit user or delete user, input the user's ID number and select search.

ID

Name ID

D.O.B Gender

Contact No Department

Figure 18: Add user

Add/Edit/Delete User

Which do you want to do?
(Select one)

Add user ☐

Edit user ☒

Delete user ☐

If you selected add user, continue to the bottom, and fill in all information. A unique ID number will then be generated for the new user.

If you selected edit user or delete user, input the user's ID number and select search.

ID

Name ID

D.O.B Gender

Contact No Department

Figure 19: Edit user

Add/Edit/Delete User

Which do you want to do?
(Select one)

Add user ☐

Edit user ☐

Delete user ☒

If you selected add user, continue to the bottom, and fill in all information. A unique ID number will then be generated for the new user.

If you selected edit user or delete user, input the user's ID number and select search.

ID 

Name ID

D.O.B Gender

Contact No Department

Figure 20: Delete user

4.2. User Effort Estimation

Usage Scenario	Mouse Clicks and/or Keystroke Count
Adding a new user to the system	13
Registering a new patient	15
Request for a lab test for a patient	13
Generating a bill for a patient	20

5. DOMAIN ANALYSIS

5.1. Domain Model

Concept definitions: A domain model is represented by several class diagrams. The purpose of the domain model diagram, shown in figure 21, is to display and demonstrate the structure of the hospital and the relationships with the associates (staff). Every associate (staff) has a unique ID number and personal credentials to access the system. Every associate is part of a department. Departments are divisions of the hospital shared by patients who need a similar classification of care. There are specific doctors assigned to each department in the hospital. Every patient is assigned a unique ID number when they are registered for the first time in the system.

Association definitions: In the domain model, shown in figure 21, Patient could be associated with different Staff members, and Staff members could care for multiple Patients. Every Staff member is associated with one Department, and every Department has multiple Staff members.

Attribute definitions:

In the domain model, shown in figure 21, Patient name is a multi-value attribute because it contains their first and last name. Staff contactNo is a simple single-valued attribute.

Traceability matrix:

The domain model was designed from the existing use case model. The domain model should be view as an interface between the planning phase and the design phase of the database development.

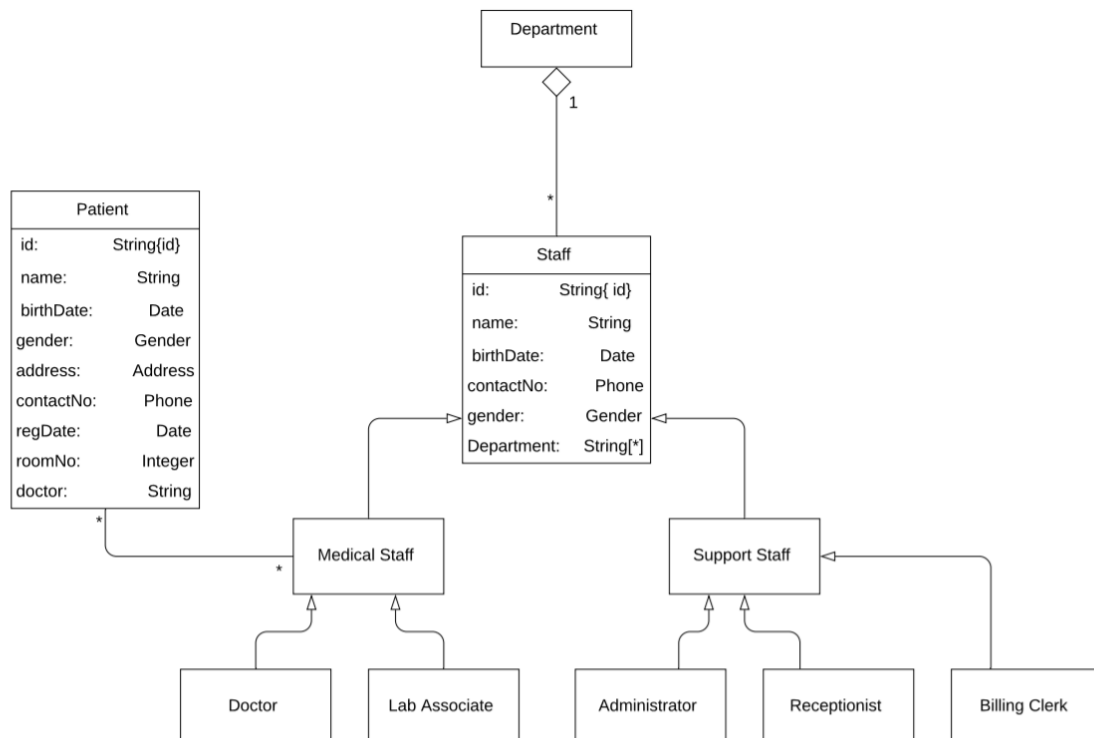


Figure 21: Domain Model

5.2. System Operation Contracts

<i>Contract CO1: logIntosystem</i>	
Operation	LogIntoSystem()
Cross References	Use Case: Log into System
Preconditions	none
Postconditions	The user was logged into the system.

<i>Contract CO2: createNewuser</i>	
Operation	CreateNewUser()
Cross References	Use Case: Create a new user

Preconditions	The associated doesn't already have an account.
Postconditions	A new user was created.

<i>Contract CO3: editUser</i>	
Operation	EditUser()
Cross References	Use Case: Edit a user
Preconditions	The associated has an existing account to edit.
Postconditions	An existing user's information was edited.

<i>Contract CO4: deleteUser</i>	
Operation	DeleteUser()
Cross References	Use Case: Delete a user
Preconditions	The associated has an active account to delete.
Postconditions	An existing user was deleted from the system.

6. PROJECT MANAGEMENT

6.1. Use Case Point Approach

The purpose of the use case approach is to estimate the size of the project at its initial stage. Software effort estimation requires a significant amount of time in the initial phase of the software development stage. The extensive amount of effort should be calculated precisely to avoid underestimation and overestimation. In this use case point approach, the software size is determined according to the number of use cases and actors in the use case diagram (located in section 3.3.2) multiplied by the complexity factors of the use cases.

The size of this project is calculated by:

1. Calculation of Unadjusted Use Case Point (UUCP)
2. Calculation of Adjusted Use Case point (AUCP)

Term	Acronym	Calculation
Unadjusted Actor Weight	UAW	(simple actors * 1) + (average actors * 2) + (complex actors * 3) = UAW
Unadjusted Use Case Weight	UUCW	(simple use cases * 5) + (average use cases * 10) + (complex use cases * 15) = UUCW
Unadjusted Use Case Point	UUCP	UAW + UUCW = UUCP
Technical Complexity Factors	TCF	$0.6 + (TF/100) = TCF$
Environmental Complexity Factors	ECF	$1.4 + (-.03 * EF) = ECF$
Adjusted Use Case Point	AUCP	$UUCP * TCF * ECF = AUCP$

6.1.1. Actor Classification

Classification	Type	Weight
Simple	Interacts with the system using API	1
Average	Interacts with the system using standard communication protocols	2
Complex	Human	3

Actor No	Description	Complexity	Weight
1	Doctor	Complex	3
2	Lab associate	Complex	3
3	Receptionist	Complex	3
4	Billing Clerk	Complex	3
5	Administrator	Complex	3

$$(simple\ actors * 1) + (average\ actors * 2) + (complex\ actors * 3) = UAW$$

$$(0*1) + (0*2) + (5*3) = 15$$

6.1.2. Use Case Classifications

Classification	Transactions	Weight
Simple	1 to 3	5
Average	4 to 7	10
Complex	8 or more	15

Use Case ID	Description	Complexity	Weight
UC.1	Log into system	Simple	5
UC.2	Search for patient	Simple	5
UC.3	Submit a lab test	Average	10
UC.4	Search for test details	Average	10
UC.5	View lab test request	Simple	5
UC.6	View lab tests in progress	Simple	5
UC.7	View lab test results	Average	10
UC.8	Add a new patient	Complex	15
UC.9	Generate a bill	Complex	15
UC.10	Create a new user	Complex	15
UC.11	Edit user details	Complex	15
UC.12	Delete a user	Complex	15

$$(simple\ use\ cases * 5) + (average\ use\ cases * 10) + (complex\ use\ cases * 15) = UUCW$$

$$(4*5) + (3*10) + (5*15) = 125$$

6.1.3. Technical and Environmental Factor Values

Factor Values	Significance	Weight
0	No significance	0.5
1	Insignificant effect	1.0
2	Moderate effect	1.5
3	Intermediate effect	2.0
4	Strong effect	2.5
5	Powerful effect	3.0

Technical Factors	Value	Weight	Total
Distributed system	3	2.0	6
Response time/performance objectives	3	2.0	6
End-user efficiency	3	2.0	6
Internal processing complexity	5	3.0	15
Code reusability	3	2.0	6
Easy to install	4	2.5	10
Easy to use	5	3.0	15
Portability to other platforms	5	3.0	15
System maintenance	0	0.5	0
Concurrent/parallel processing	4	2.5	10
Security features	1	1.0	1
Access for third parties	4	2.5	10
End user training	0	0.5	0
			90
Environmental Factors	Value	Weight	Total
Familiarity with development process used	3	2.0	6
Application experience	0	0.5	0
Object-oriented experience of team	3	2.0	6
Lead analyst capability	3	2.0	6
Motivation of the team	3	2.0	6
Stability of requirements	3	2.0	6
Part- time staff	0	0.5	0
Difficulty of programming language	3	2.0	6
			36

$$0.6 + (TF/100) = TCF$$

$$0.6 + (90/100) = 1.5$$

$$1.4 + (-.03 * EF) = ECF$$

$$1.4 + (-.03 * 44) = 0.32$$

$$UAW + UUCW = UUCP$$

$$15 + 125 = 140$$

$$UUCP * TCF * ECF = AUCP$$

$$140 * 1.5 * 0.32 = 67.2$$

$$ER = 20 \text{ person-hours per UCP}$$

$$UCP * ER = \text{Effort}$$

$$67.2 * 20 = 1,344$$

$$8.5 \text{ hours per day}$$

$$1,344 / 8.5 = 158$$

Effort = 158 person-day