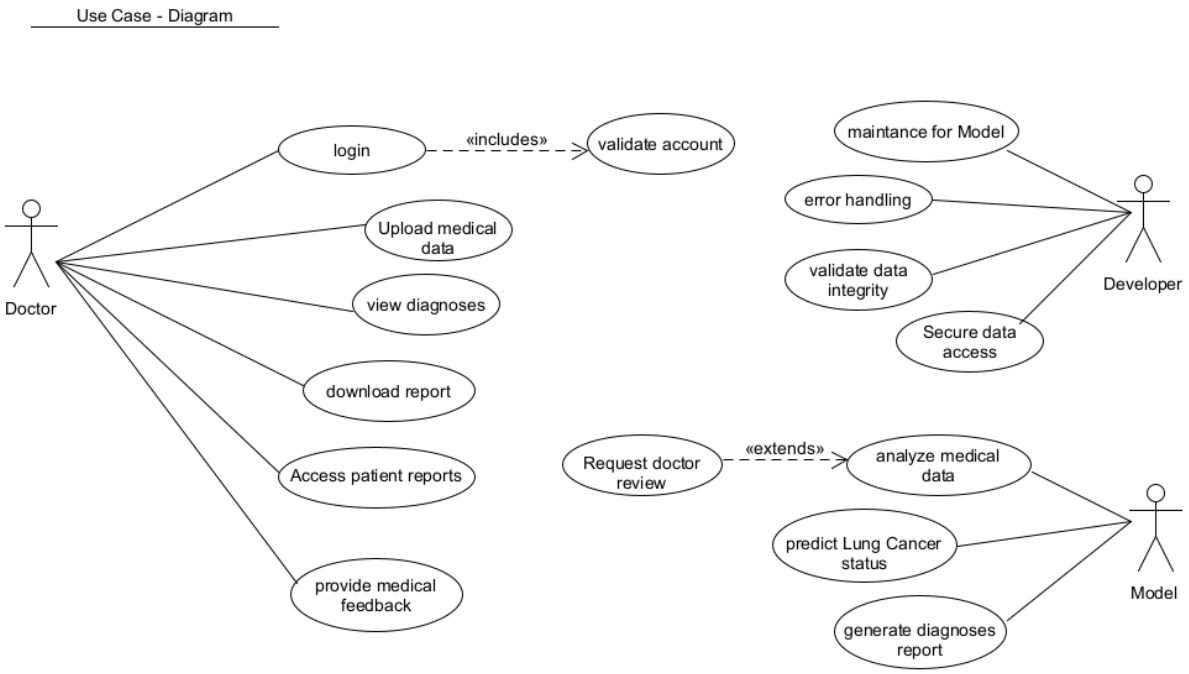
1- Use Case Diagram:



1.1 Login:

Use Case ID	1
Use Case Name	Login
Actors	Doctor
Preconditions	- The doctor is registered in the system. - The doctor has valid login credentials.

Normal flow	- The doctor navigates to the login page. - The doctor enters their username and password. - The system verifies the credentials. - If valid, the doctor is granted access and redirected to the system.
Postconditions	- If login is successful, the doctor gains access. - If login fails, access is denied, and the doctor may need to reset credentials.
Alternative Flow	If credentials are incorrect: • The system displays an error message: "Invalid username or password." • The doctor gets three attempts before temporary account lockout. - If locked out, the doctor must reset the password via email verification.
Exceptions	- Database Connection Failure: If the system cannot connect to the database, it shows "Login service unavailable. Please try again later." - Session Timeout: If the doctor does not log in within a specified time, the session expires, and they must re-enter credentials.

1.2 Upload medical data

Use Case ID	2
Use Case Name	Upload medical data
Actors	Doctor
Preconditions	- The doctor must be logged in. - The patient's data must be in an acceptable format (CSV, JSON).
Normal flow	- The doctor selects "Upload Medical Data." - The system provides options to: • Upload a file (CSV, JSON). • Manually enter data. - The doctor uploads the file. - The system validates the data format and stores it.
Postconditions	- If successful, the system stores the data. - If failed, no data is stored, and the doctor must try again.
Alternative Flow	If the uploaded file is not formatted correctly: • The system rejects the file. • Displays: "Invalid file format. Please upload a valid CSV or JSON file." The doctor must correct and re-upload
Exceptions	- **File Too Large:** If the uploaded file exceeds the size limit, the system rejects it with an error message. - **Network Interruption:** If the network disconnects during upload, the doctor must retry.

1.3 View diagnoses

Use Case ID	3
Use Case Name	View diagnoses
Actors	Doctor
Preconditions	- The system has stored diagnosis reports.
Normal flow	- The doctor selects "View Diagnoses." - The system retrieves and displays diagnosis reports.
Postconditions	- If reports exist, they are displayed. - If reports are missing, the doctor is notified.
Alternative Flow	- if no reports exist, the system displays: • "No diagnoses available for this patient."
Exceptions	- **Database Failure:** If the system cannot retrieve reports due to a database error, an error message is displayed. - **Permission Issues:** If the doctor does not have permission to view certain reports, access is denied.

1.4 Download Report

Use Case ID	4
Use Case Name	Download report
Actors	Doctor
Preconditions	- A diagnosis report must be available.
Normal flow	- The doctor selects a patient's report. - The system generates a downloadable PDF file. - The doctor downloads the report.
Postconditions	- If successful, the doctor has a local copy of the report. - If failed, no download occurs, and an error is displayed.
Alternative Flow	if the report is missing or corrupted: • The system displays: "Report unavailable. Please try again later."
Exceptions	- **Insufficient Storage:** If the device has no storage space, the download fails. - **File Corruption:** If the report file is corrupted, it cannot be downloaded.

1.5 Provide Medical Feedback

Use Case ID	5
Use Case Name	Download report
Actors	Doctor
Preconditions	- The doctor has reviewed the diagnosis.
Normal flow	- The doctor selects "Provide Feedback." - The system prompts for comments. - The doctor submits feedback. - The system stores the feedback.
Postconditions	- If feedback is given, it is stored. - If feedback is missing, the system prompts for input.
Alternative Flow	If the doctor leaves the feedback blank: • The system displays: **"Feedback cannot be empty."** • The doctor must enter a comment.
Exceptions	- **System Crash:** If the system crashes before saving, feedback is lost. - **Database Error:** If the system fails to save feedback, an error is displayed.

1.6 Predict Lung Cancer Status

Use Case ID	6
Use Case Name	Predict lung cancer status
Actors	AI model
Preconditions	- The system must have patient medical data.
Normal flow	- The AI model processes the patient data. - It extracts key features. - The model predicts the cancer probability score. - The system displays results.
Postconditions	- If successful, the system presents the prediction. - If failed, the doctor must input more complete data..
Alternative Flow	If patient data is incomplete: • The system displays: "Error: Insufficient data for analysis."
Exceptions	- **Model Crash:** If the AI model fails, the system returns an error message. - **Unexpected Output:** If the model generates unexpected results, an alert is raised

1.7 Analyze Medical Data

Use Case ID	7
Use Case Name	Analyze medical data
Actors	AI model
Preconditions	- The system has patient medical records. - The AI model is trained on medical datasets.
Normal flow	- The doctor uploads patient medical data. - The AI model scans and analyzes the data. - The model identifies potential indicators of lung cancer. - The results are stored and made available for diagnosis.
Postconditions	- If successful, the system provides a structured analysis. - If unsuccessful, the doctor must manually analyze the data.
Alternative Flow	If the input data is incomplete, the model requests additional information.
Exceptions	- **Corrupted Data:** The input file is unreadable. - **Low Accuracy:** The model lacks confidence in its predictions.

1.8 Generate Diagnosis Report

Use Case ID	8
Use Case Name	Generate Diagnosis Report
Actors	AI model
Preconditions	The system has successfully analyzed patient data.
Normal flow	- The AI model compiles its findings. - A structured report is generated with key insights. - The doctor can review and download the report.
Postconditions	- If successful, the doctor receives a well-organized medical report. - If unsuccessful, manual report generation is needed.
Alternative Flow	If additional details are required, the doctor can request further analysis.
Exceptions	- **Report Formatting Error:** The system fails to generate a readable document. - **Missing Data:** Some required information is absent from the report.

1.9 Maintain Model

Use Case ID	9
Use Case Name	Maintain model
Actors	Developer
Preconditions	- The system has an existing AI model. - The developer has administrative access to modify the model.
Normal flow	- The developer navigates to the model maintenance section. - The developer uploads new training data if necessary. - The model undergoes retraining. - The system validates the model's new accuracy. - The updated model is deployed.
Postconditions	- If successful, the updated AI model is deployed. - If unsuccessful, the previous model remains in use.
Alternative Flow	If the new model performs worse than the previous version: • The system logs the issue. • The developer receives an alert to review the training process.
Exceptions	- **Data Format Error:** Training data is corrupted or incorrectly formatted. - **Model Training Failure:** The AI model fails to converge or reaches an invalid state. - **Deployment Failure:** The system cannot replace the old model due to server issues.

1.10 Error Handling

Use Case ID	10
Use Case Name	Error handling
Actors	Developer
Preconditions	- An error occurs during system operation. - The developer has system access to debug and fix issues.
Normal flow	- The system logs an error related to the AI model. - The developer reviews error logs. - The developer identifies the root cause of the issue. - The developer applies a fix. - The developer tests the fix to ensure resolution. - The system is updated with the corrected code.
Postconditions	- If successful, the system runs without errors. - If unsuccessful, the system may still have bugs, requiring further debugging.
Alternative Flow	If the error cannot be fixed immediately, a temporary solution is applied.
Exceptions	- **Unidentified Issue:** The developer is unable to diagnose the error. - **Fix Causes Additional Issues:** The implemented fix leads to other system failures.

1.11 Validate Data Integrity

Use Case ID	11
Use Case Name	Validate data integrity
Actors	Developer
Preconditions	- The system has patient data stored in a database. - The developer has access to check data integrity.
Normal flow	- The developer initiates a data validation check. - The system scans for missing, duplicate, or corrupted data. - If issues are found, the developer is alerted. - The developer cleans and corrects the data. - The system updates its records.
Postconditions	- If successful, the database remains accurate and reliable. - If unsuccessful, medical reports may contain inconsistencies.
Alternative Flow	If the system has an auto-correction mechanism, it attempts to fix minor issues automatically.
Exceptions	- **Data Loss:** Critical medical data is missing and cannot be recovered. - **Unauthorized Modification:** Data has been tampered with by an unauthorized user.

1.12 Secure Data Access

Use Case ID	12
Use Case Name	Secure Data Access
Actors	Developer
Preconditions	- The system stores sensitive patient data. - The developer has security clearance.
Normal flow	- The developer reviews current security protocols. - The developer updates encryption and authentication mechanisms. - The system applies security updates. - The developer tests for vulnerabilities. - The system logs security enhancements.
Postconditions	- If successful, patient data remains secure. - If unsuccessful, security vulnerabilities persist.
Alternative Flow	If an unauthorized access attempt is detected, the system alerts the developer and locks the account.
Exceptions	- **Data Breach:** An external attack bypasses security measures. - **System Downtime:** Security updates cause temporary unavailability.