Pneumonia Detection System – Functional Explanation

1. Overview

This is a desktop application built using Python (Tkinter) and Deep Learning (TensorFlow). It allows users to sign up, log in securely, upload chest X-ray images, and detect pneumonia. The system also generates a PDF report of predictions.

2. Key Libraries Used

- Tkinter – Graphical User Interface (GUI)
- PIL (Pillow) – Image processing and display
- SQLite3 – Database for user and test records
- bcrypt – Secure password hashing
- TensorFlow / Keras – Deep Learning model handling
- NumPy – Image array processing
- ReportLab – PDF report generation
- Logging – Tracking events and errors

3. Functional Blocks

- **Model Handling:** Loads and manages the deep learning model ('model.h5').
- **Database Setup:** Initializes and manages the SQLite database with users and test records.
- **Password Handling:** Uses bcrypt to securely hash and verify passwords.
- **Sign-Up Window:** GUI for new user registration with password validation.
- **Login Window:** GUI for existing users to log in securely.
- **Detection Window:** Allows uploading X-ray, running prediction, and generating report.

4. Process Flow

1. Start program → Login Window opens.
2. User can Sign Up or Log In.
3. After successful login → Detection Window opens.
4. Upload chest X-ray image.
5. System preprocesses the image and predicts pneumonia using the deep learning model.
6. The result is displayed and stored in the database.
7. User can generate a PDF report summarizing the test result.

5. Key Features

- Secure login using hashed passwords
- Deep learning-based pneumonia prediction
- Database record management for all tests
- PDF report generation for diagnosis results
- Error handling and logging
- Modern GUI using Tkinter and Pillow

6. Summary

The Pneumonia Detection System integrates AI and software engineering principles into a user-friendly desktop application. It demonstrates secure authentication, database interaction, deep learning-based medical image analysis, and automated reporting – providing a complete end-to-end solution.