Sharadchandra Pawar College of Engineering and Technology, Someshwarnagar

Department of Computer Engineering

Presentation on:

"Diagnosing Respiratory Conditions Via Lung Sounds using CNN-LSTM"

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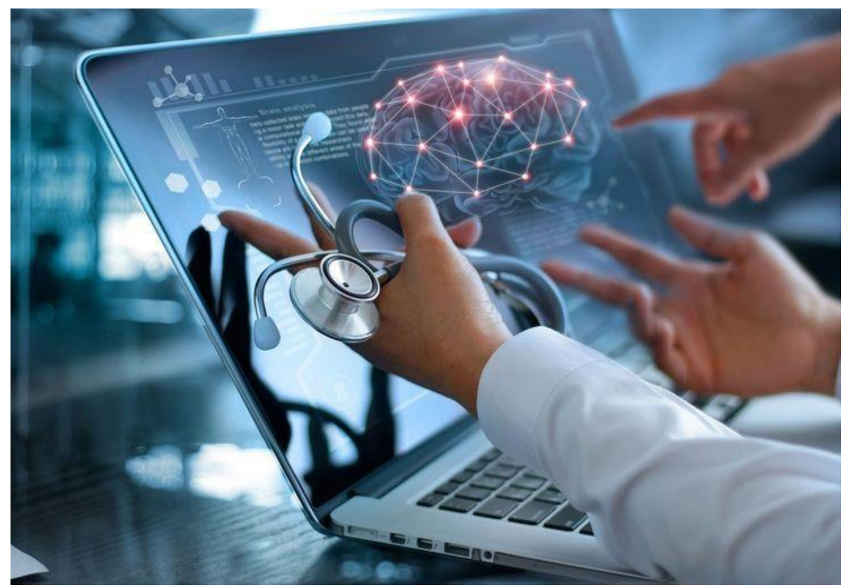
Diagnosing Respiratory Conditions Via Lung Sounds using CNN-LSTM



Contents

Abstract

- In order to analyze respiratory sounds on a computer, we developed a cost-effective and easy-to-use Algorithm that can be used with any device.

- We employed two types of machine learning algorithms; Gammatone cepstrum coefficients(GTCC) & Short-Time Fourier Coefficients (STFC) features in a Convolutional Neural Network with a **CNN-LSTM** algorithm.

- We prepared four data sets for CNN-LSTM algorithm to classify respiratory audio:

(1)Healthy versus pathological classification; (2) rale, rhonchus, and normal sound classification; (3) singular respiratory sound type classification; and (4) audio type classification with all sound types.

Introduction

- Lung Auscultation: A widely used diagnostic method by pulmonary experts to assess the respiratory system's condition.

- Detection of Lung Sounds: Various sounds are heard when examining different areas on the front and back of the chest.

- Significance of Lung Sounds: They reveal anatomical issues in the lungs and offer reliable insights into respiratory health, making them a valuable tool for diagnosing respiratory disorders.

- Global Impact: According to the World Health Organization (WHO), around 10 million people die annually from respiratory diseases.

Motivation

The aim of this project is to classify the Lung Sounds based on the different features present in that, also have to Classify the disease for better performance.

Objective

- **Develop a Cost-Effective and Accurate System:** Create a system for classifying lung sounds that is affordable, precise and requires minimal computational resources.

- **Automate Respiratory Sound Analysis:** Address the increasing demand for automated tools due to the high global burden of respiratory diseases, improving accessibility and efficiency in diagnosing respiratory conditions.

- Medical professionals looking to quickly assess respiratory conditions in clinical and remote settings.

- Training datasets and improving machine learning models for more accurate respiratory sound classification.

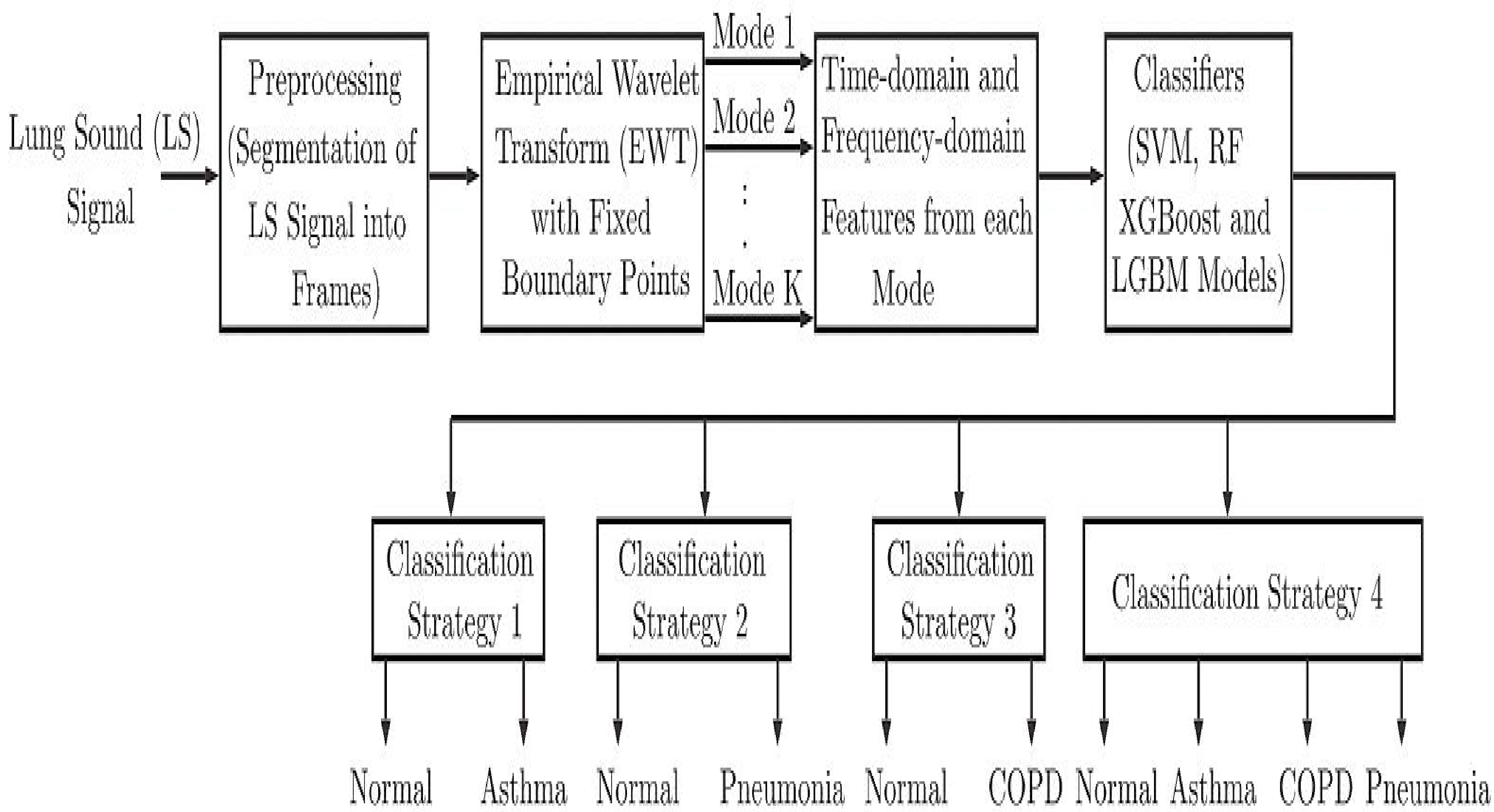
Literature Survey

Ref No	Title of Paper	Authors Name	Publication	Remark
1	Investigating into segmentation methods for diagnosis of respiratory diseases using adventitious respiratory sounds	Liqun Wu, Ling Li	2020 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)	Examines segmentation techniques and machine learning for respiratory disease diagnosis, achieving 88% accuracy.
2	A Respiratory Sound Database for the Development of Automated Classification	B.M.Rocha, D. Filos, L. Mendes, I. Vogiatzis,	IFMBE Proceedings	Introduces a large database for classifying respiratory sounds in clinical and non-clinical settings
3	Automated Detection of Pulmonary Diseases From Lung Sound Signals Using Fixed-Boundary-Based Empirical Wavelet Transform	Rajesh Kumar Tripathy, Shaswati Dash, Adyasha Rath, Ganapati Panda, Ram Bilas Pachor	*IEEE Sensors Letters*, Vol. 6, No. 5, May 2022	Proposes a method using wavelet transforms and machine learning to detect pulmonary diseases with high accuracy

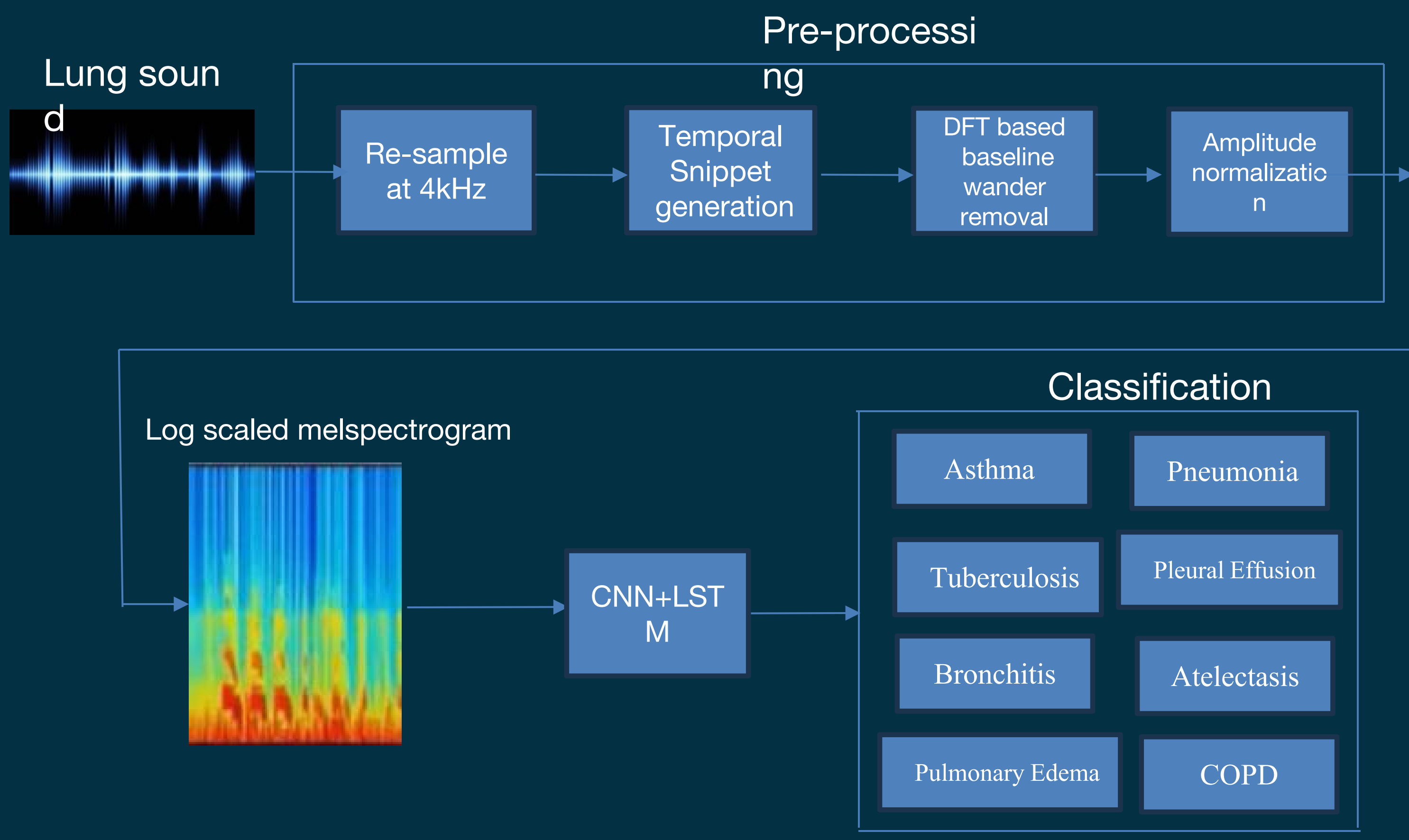
Problem Statement

- Respiratory diseases are a leading cause of death globally, and traditional lung auscultation is subjective and limited. Current diagnostic algorithms are costly and complex, lacking real-time performance. There is a need for an efficient, low-cost, and accurate system to classify lung sounds automatically, improving early diagnosis and treatment.

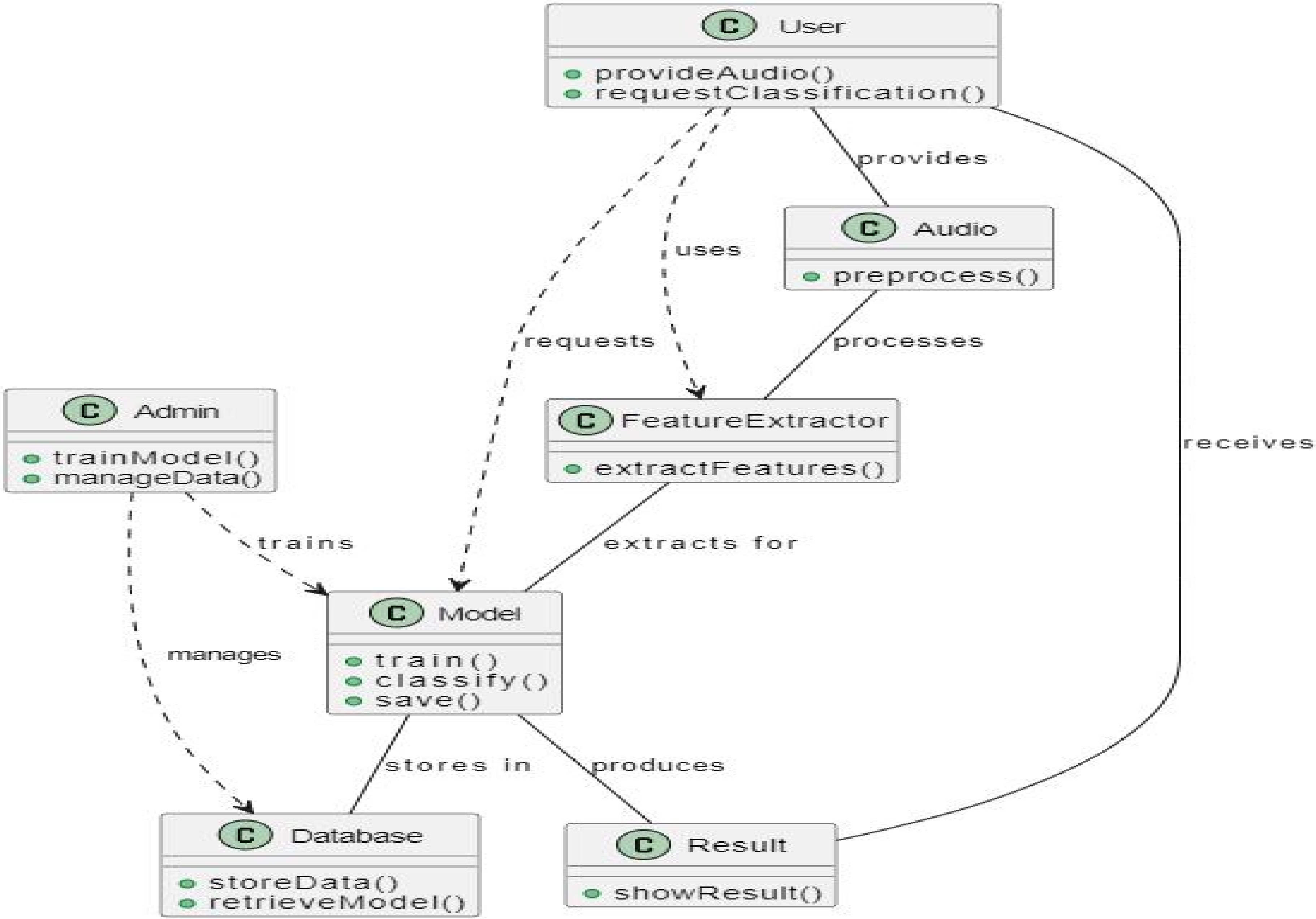
Existing System



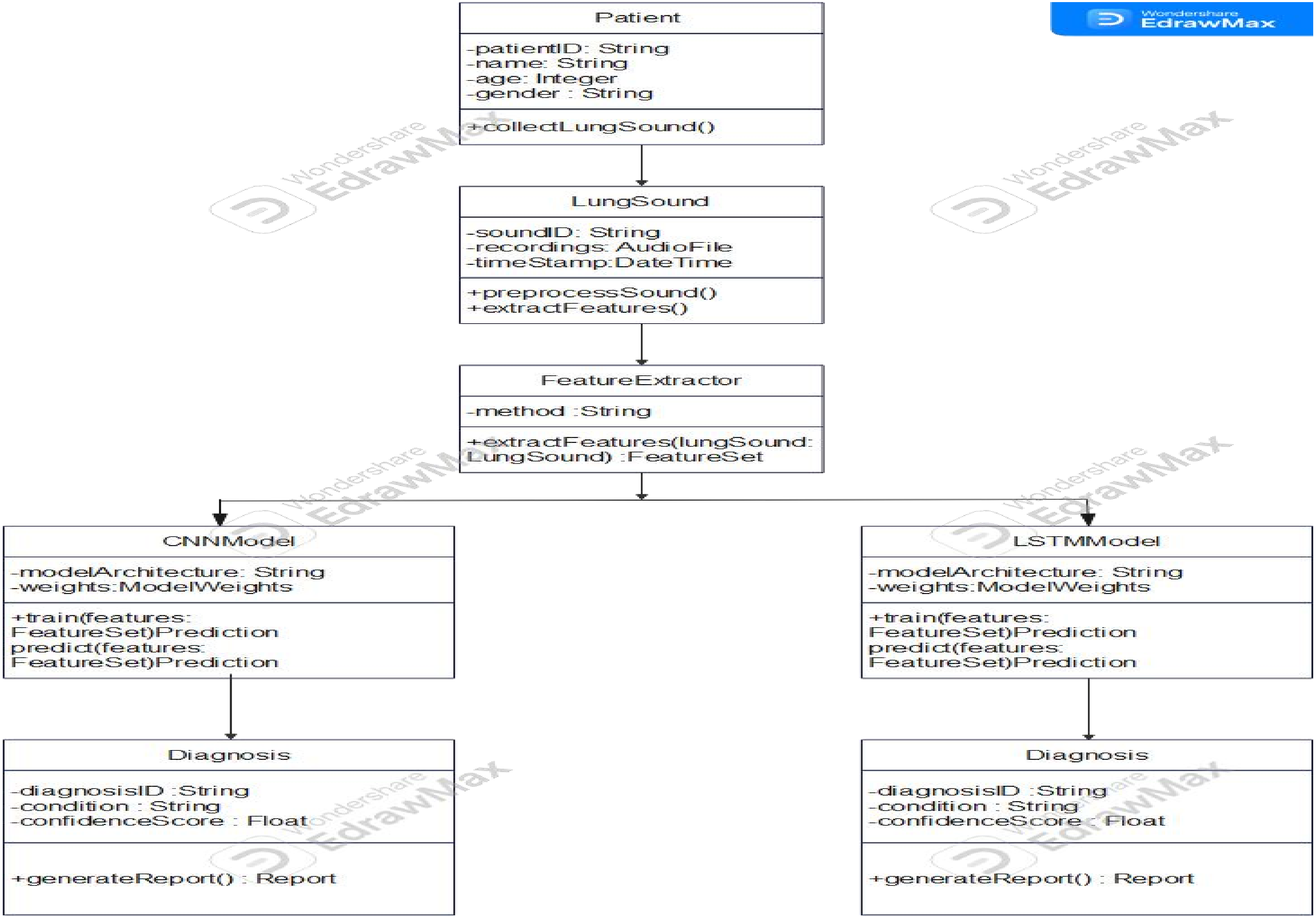
BLOCK DIAGRAM



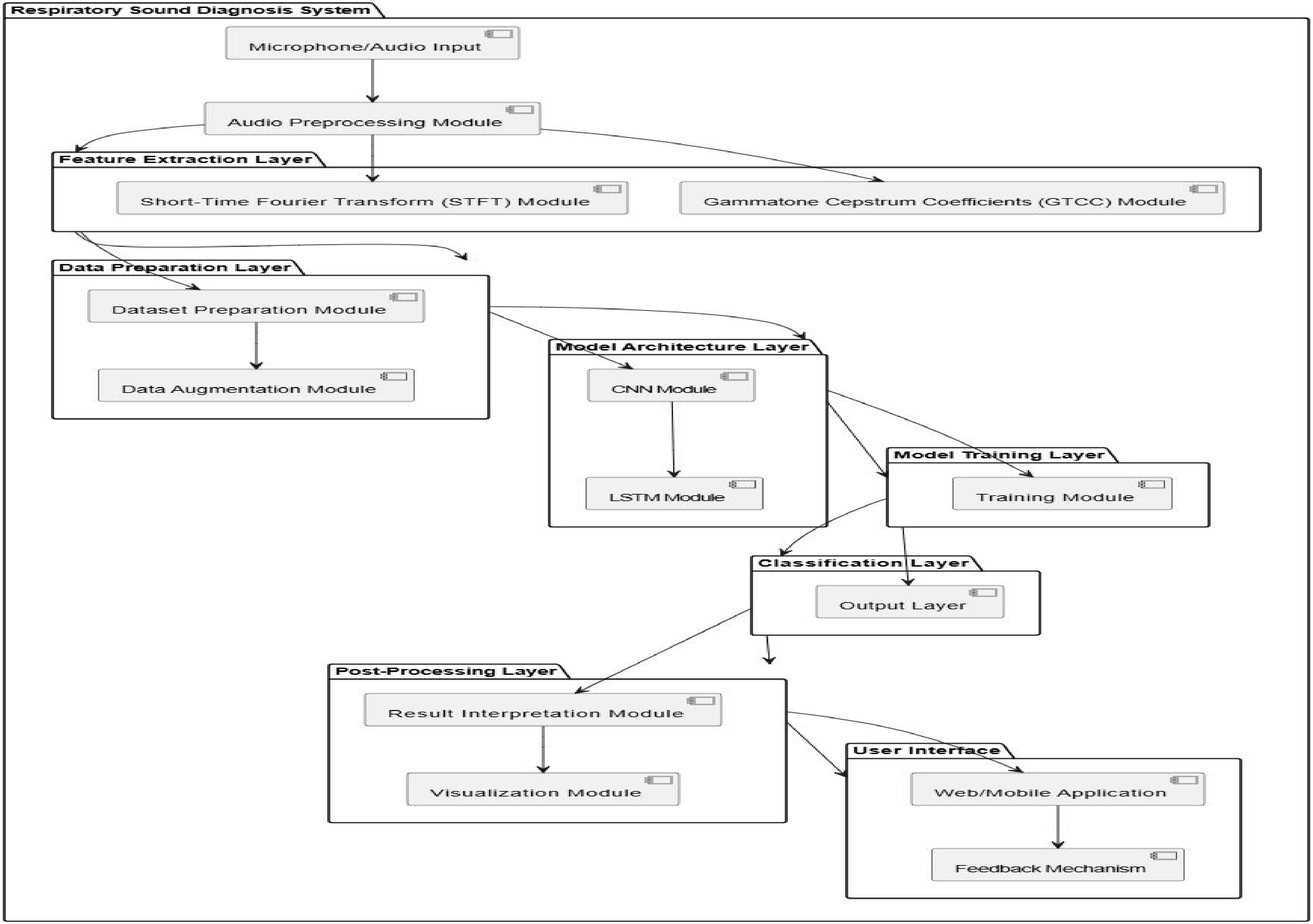
CLASS DIAGRAM



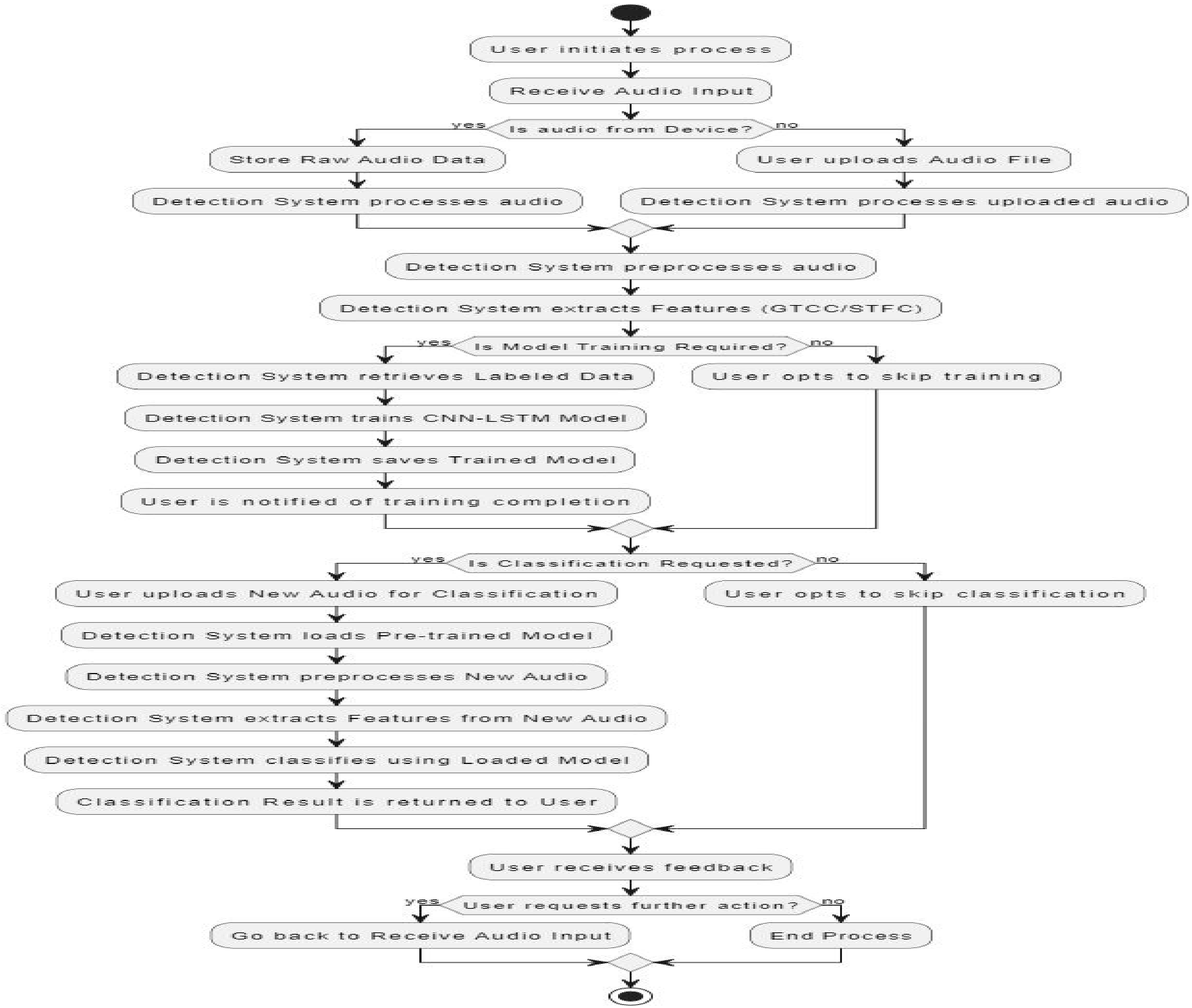
Object Diagram



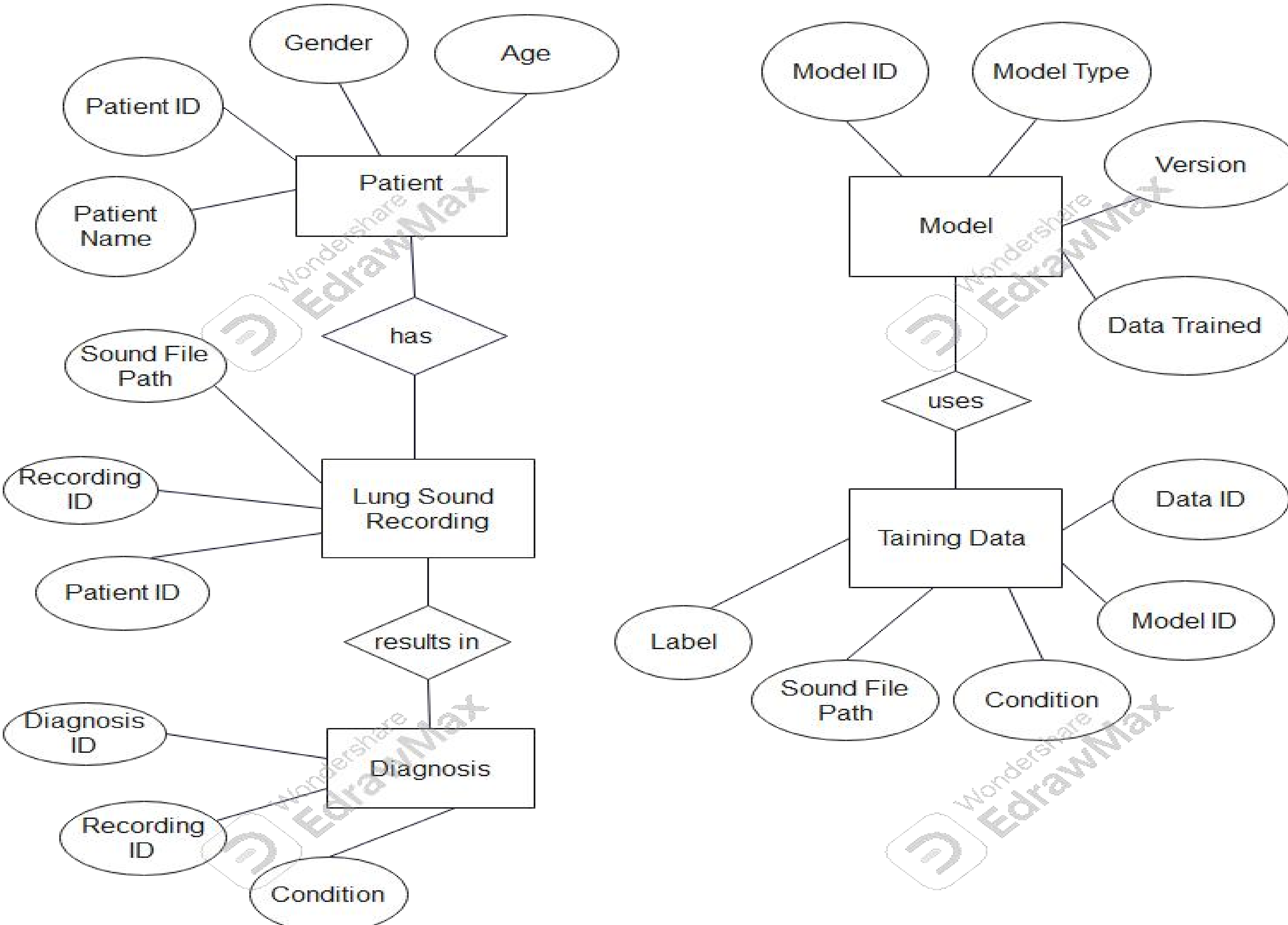
Component Diagram



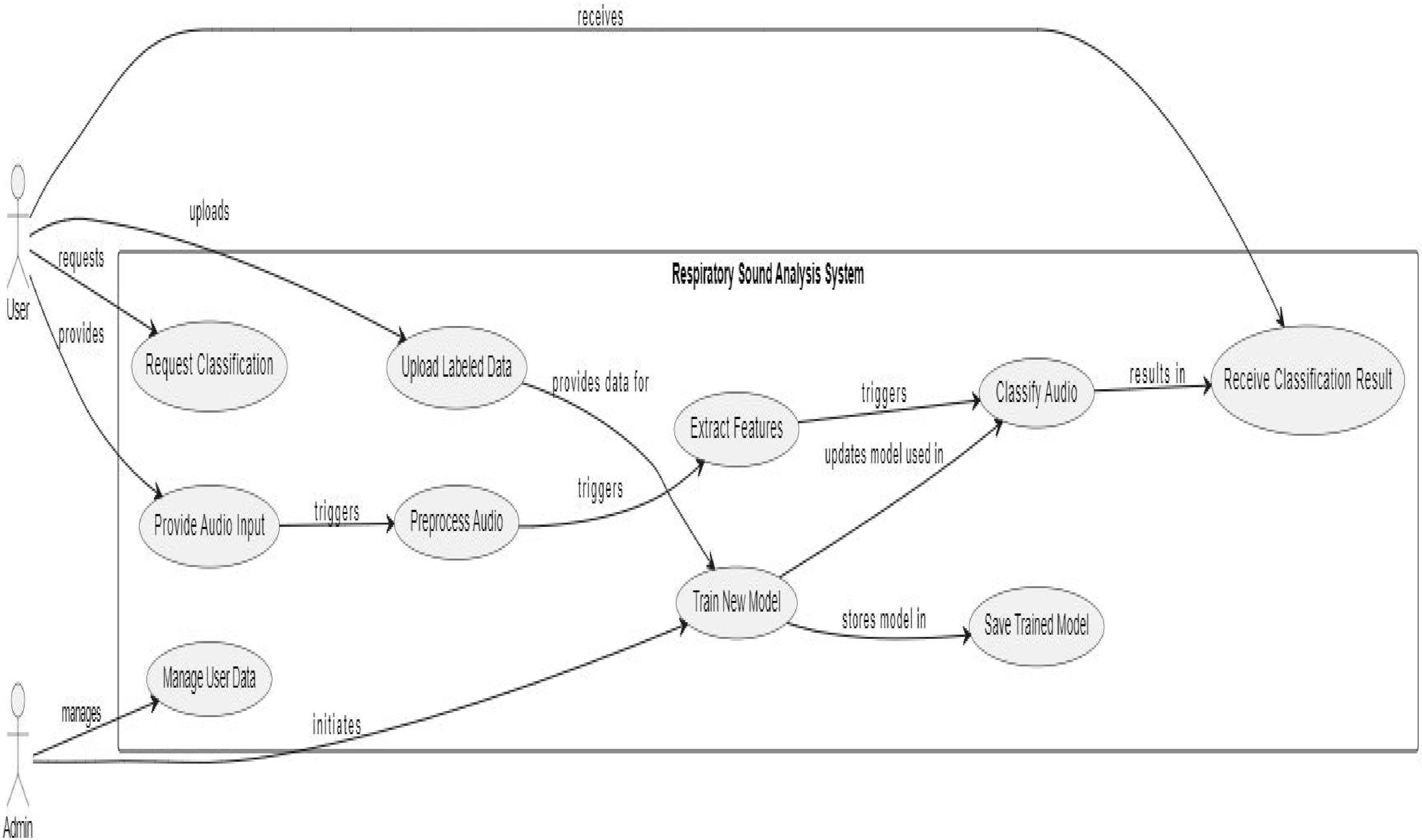
ACTIVITY DIAGRAM



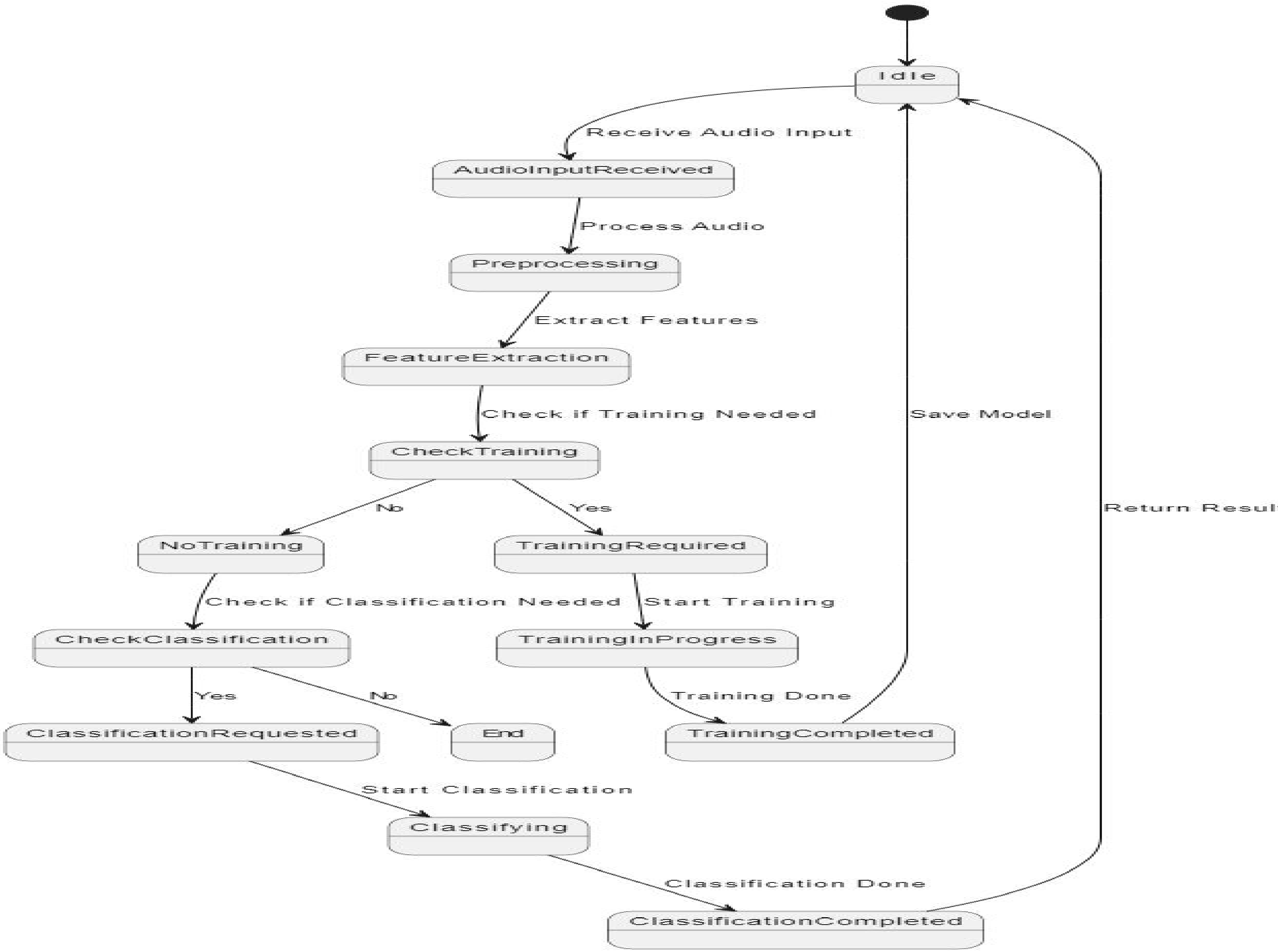
ER Diagram


Gender
Age
Patient ID
Patient
Patient Name
has
Sound File Path
Recording ID
Lung Sound Recording
Patient ID
results in
Diagnosis ID
Diagnosis
Recording ID
Condition
Model ID
Model Type
Version
Model
Data Trained
uses
Data ID
Taining Data
Model ID
Label
Sound File Path
Condition

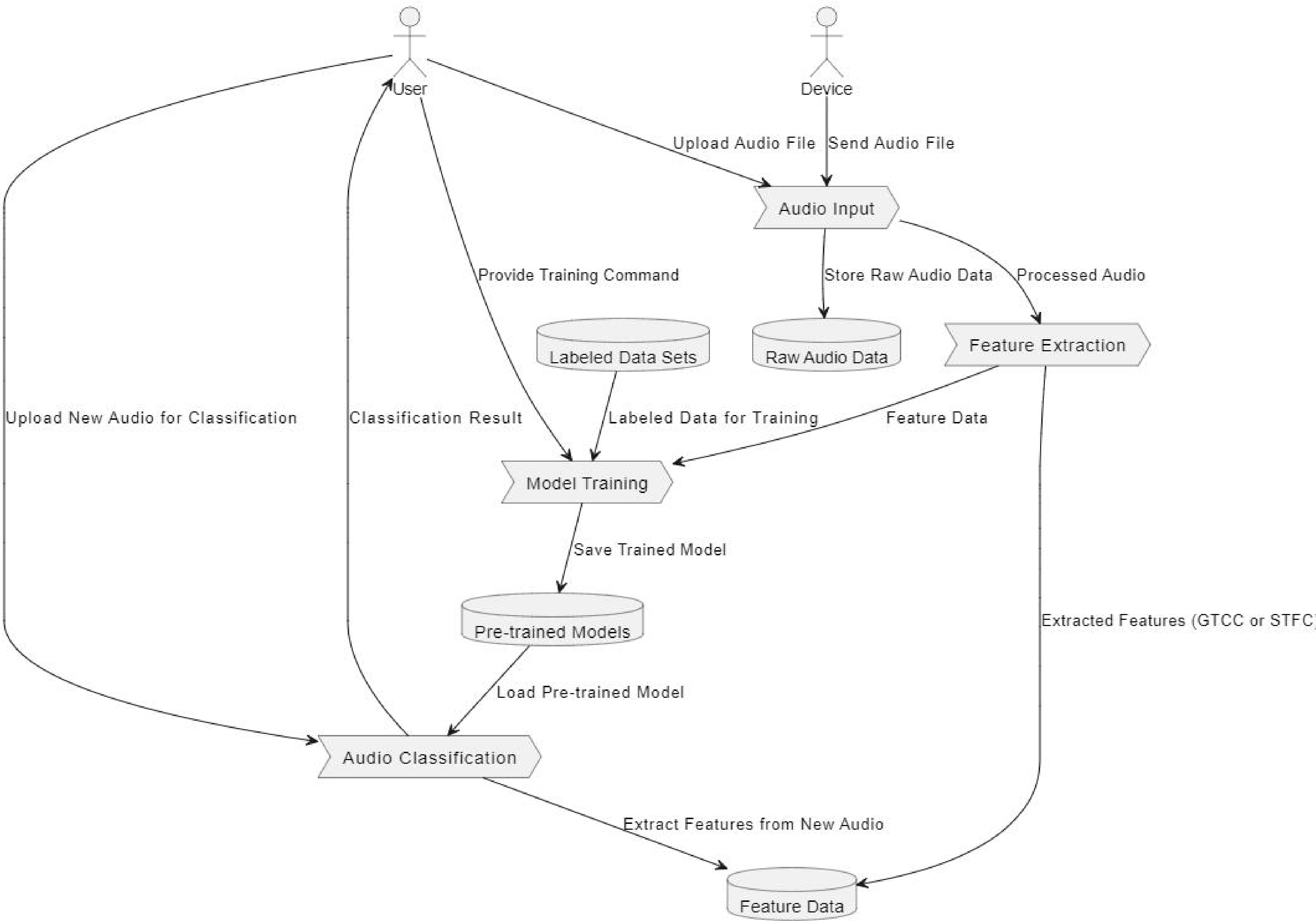
USE CASE DIAGRAM



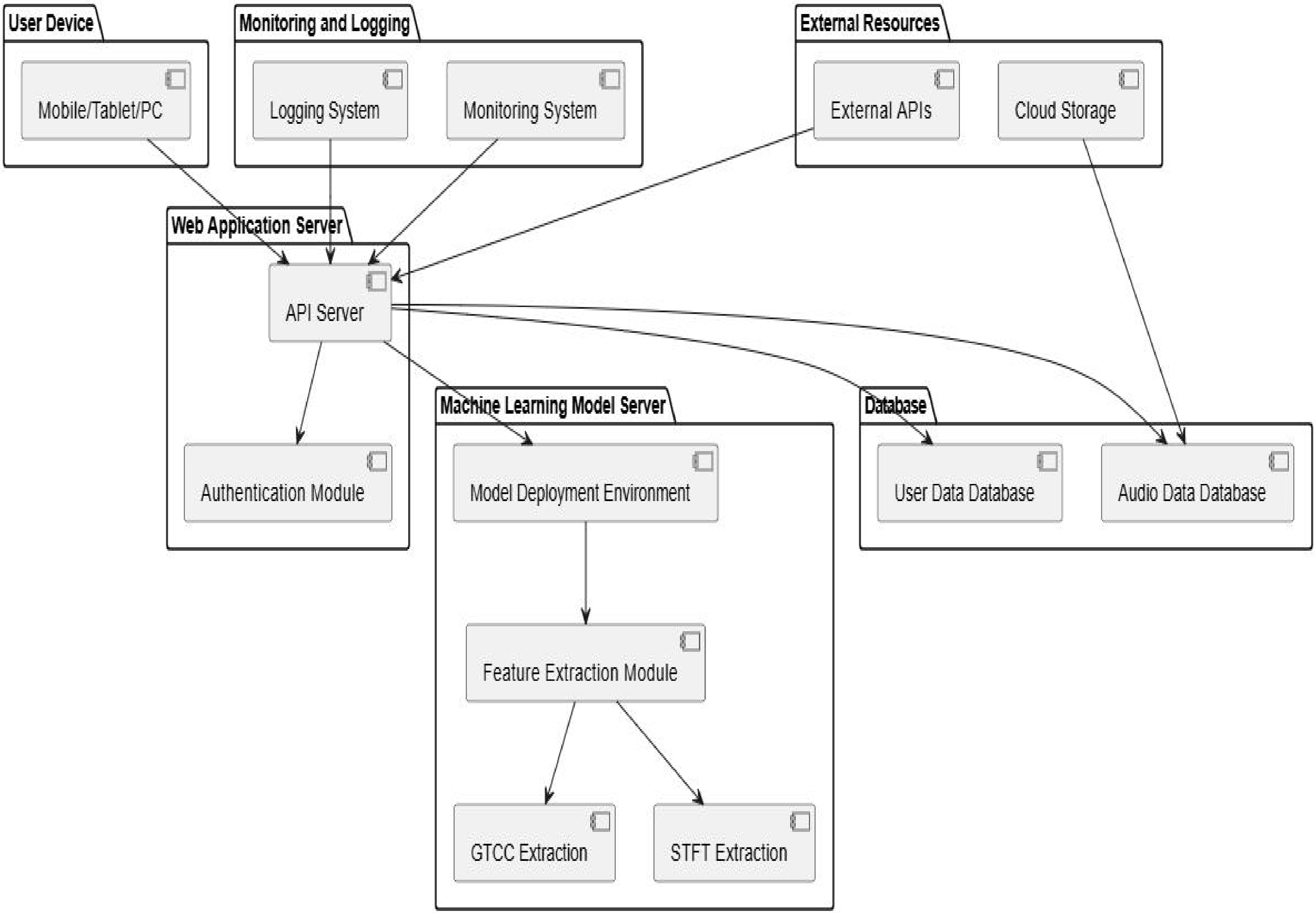
State Diagram



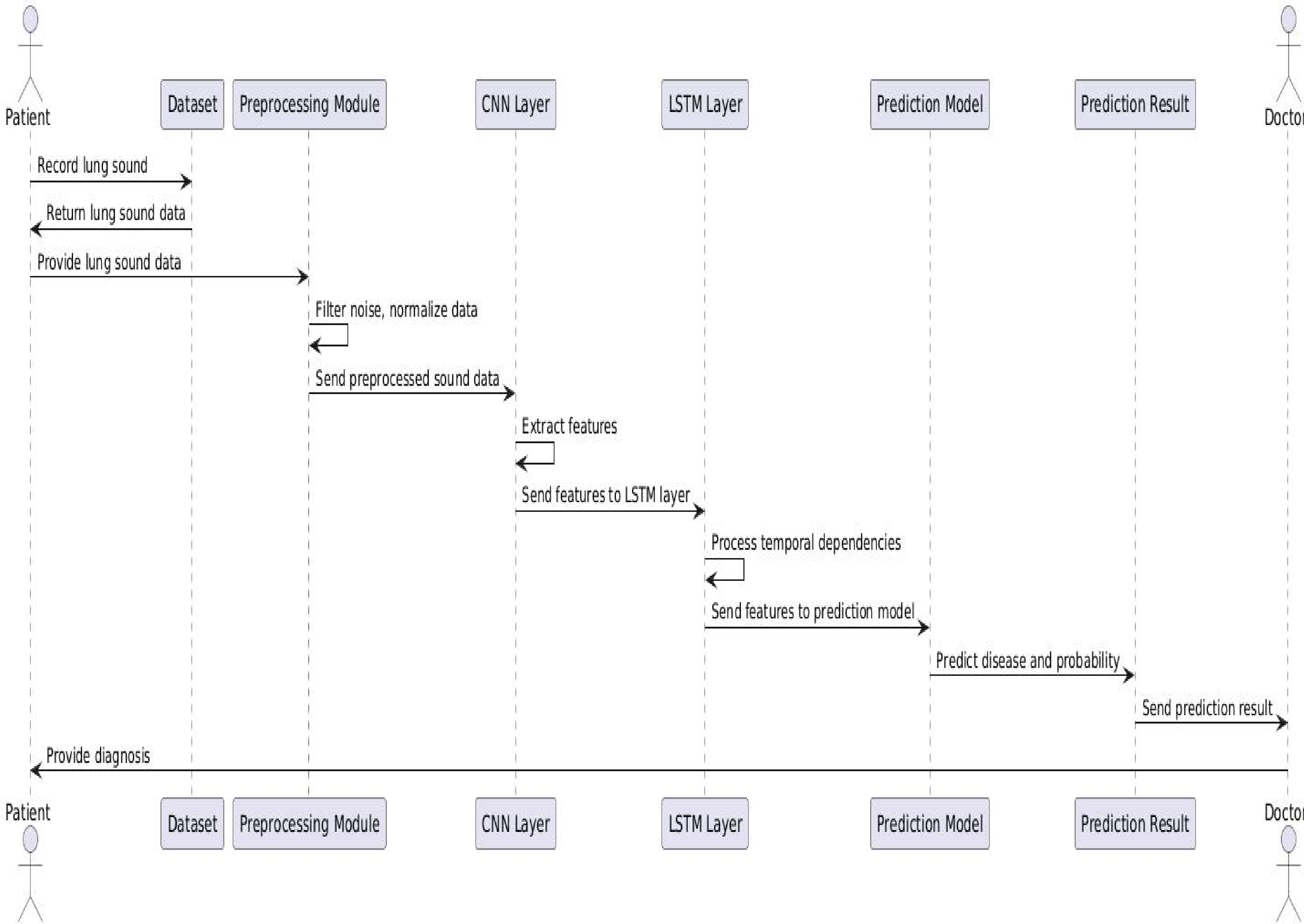
Dataflow Diagram



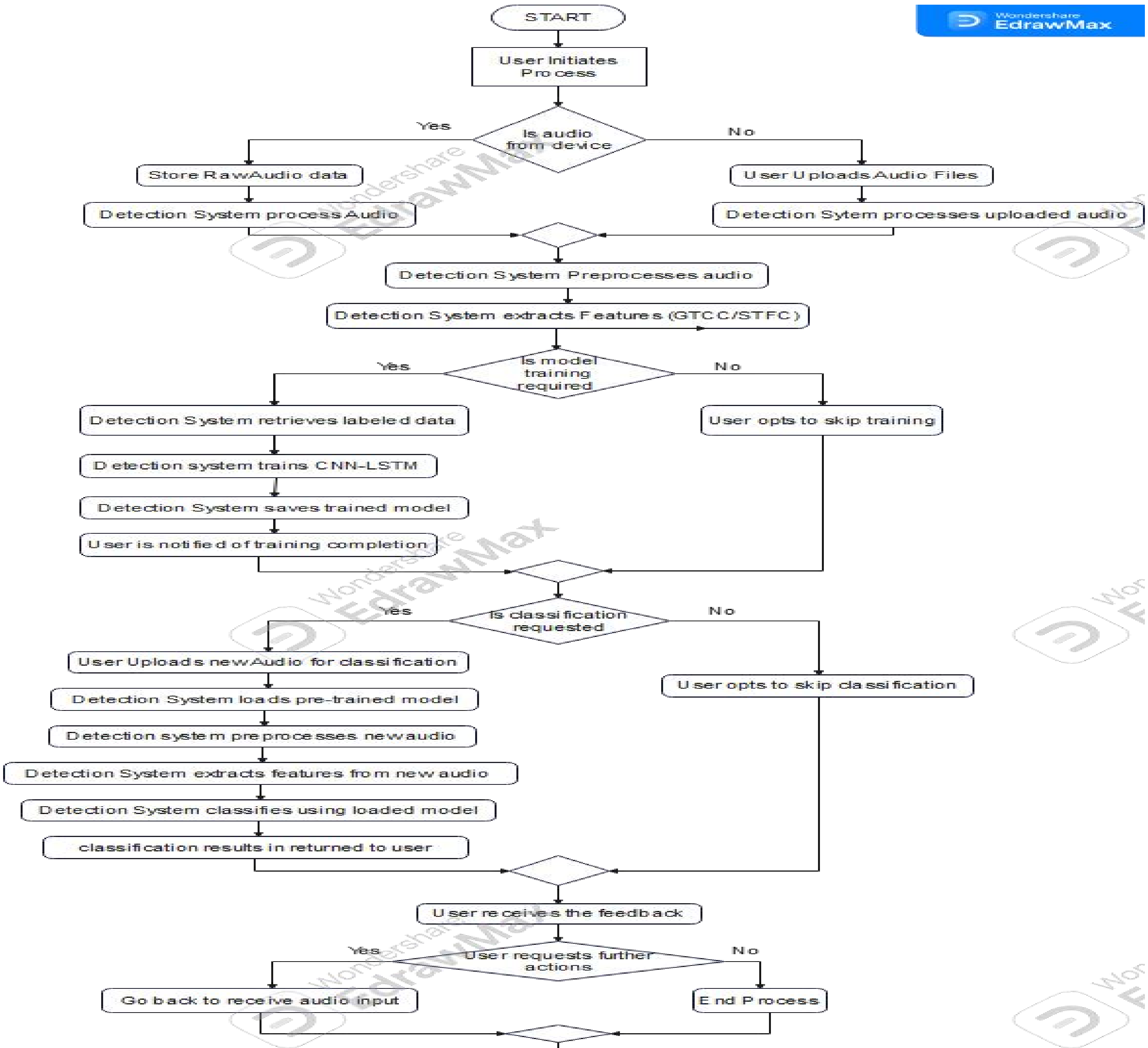
Deployment Diagram



Sequence Diagram



Flowchart Diagram



Component description

- **CNN-LSTM Architecture**: A hybrid architecture that combines convolutional neural networks (CNN) for spatial feature extraction from sound spectrograms and long short-term memory (LSTM) layers to capture temporal patterns in lung sound sequences.
- **Pre-processing**: Lung sounds are pre-processed using techniques such as log-scaled Mel spectrograms and temporal snippet generation to enhance the model’s efficiency.
- **Feature Extraction**: Key features extracted include Gammatone Cepstrum Coefficients (GTCC) and Short-Time Fourier Coefficients (STFC), which provide critical insights into the patterns of lung sounds.

Hardware & Software Requirement

- **Hardware Requirements:**

➢ Hard Disk: Greater than 500 GB
➢ RAM: Greater than 4 GB
➢ Processor: I3 and Above

- **Software Requirements**:

➢ Front End – Anaconda IDE
➢ Backend – SQL
➢ Language – Python 3.8

Advantages

- Improved Accuracy
- Scalability and Flexibility
- Reduced Human Error
- Low cost

Disadvantages

- Limited Clinical Validation.

- Generalization Issues.

- Computational Constraint

Application

- **Clinical Diagnostics**: Can be used by healthcare professionals for quick, real-time lung sound analysis in clinical settings, helping in early detection of conditions like pneumonia, asthma, COPD, and tuberculosis.

- **Remote Monitoring**: The system is suitable for remote healthcare applications where lung sounds can be classified without the need for expensive equipment.

- **Medical Research and Training**: This system can be used for improving machine learning models and datasets for respiratory condition classification, aiding in research and educational training for medical professionals

References

1. Tripathy, R. K., Dash, S., Rath, A., Panda, G., & Pachori, R. B. (2022). "Automated Detection of Pulmonary Diseases From Lung Sound Signals Using Fixed-Boundary-Based Empirical Wavelet Transform." IEEE Sensors Journal [12+source].

2. Wu, L., & Li, L. (2020). "Investigating into segmentation methods for diagnosis of respiratory diseases using adventitious respiratory sounds." Proceedings of IEEE [6+source].

3. Rocha, B. M., et al. (2019). "A Respiratory Sound Database for the Development of Automated Classification." IFMBE Proceedings [5+source].

Thank you