■ Abstract

Respiratory diseases such as **Asthma** and **Pneumonia** remain underdiagnosed in rural India due to limited access to diagnostic tools and specialists. Medical research confirms that **cough sound acoustics contain disease-specific biomarkers** suitable for non-invasive screening.

CoughLens AI is a **voice-first, AI-powered respiratory screening platform** that analyzes cough audio using lightweight deep learning models. The system enables multilingual, low-resource screening with explainable results and secure medical reporting.

■ Problem Statement

Early respiratory disease detection is difficult in rural regions due to lack of spirometry, imaging facilities, delayed clinical access, low awareness, and language barriers. Treatable conditions often escalate into severe complications, highlighting the need for an accessible, non-invasive screening solution.

■ Research Validation

Studies spanning decades demonstrate that cough sounds exhibit distinct acoustic patterns across respiratory conditions. IEEE and MDPI research confirms that lightweight CNN-based models can reliably classify asthma and pneumonia from cough audio, even in low-resource environments.

■ Proposed Solution

CoughLens AI records cough audio via phone or web, extracts acoustic features, applies deep learning models, and delivers results through voice explanations. Medical-style PDF reports are generated and securely stored, supporting Telugu, Hindi, and English for rural accessibility.

■ AI & ML Methodology

The system uses Mel-Spectrograms and MFCC features with a hybrid model architecture combining CNN classifiers, pretrained audio embeddings, and biomarker detectors for wheeze and crackle sounds. This approach improves accuracy, robustness, and explainability.

■ Expected Impact

CoughLens AI enables early screening without hospitals, reduces misdiagnosis, empowers ASHA workers, and supports faster clinical referrals. Screening accuracy is expected to reach **90–95%** with biomarker integration.

■■ Ethical Responsibility

The platform is strictly a screening tool and does not replace professional medical diagnosis. Privacy-first design, clear disclaimers, and referral guidance ensure responsible deployment.

■ Conclusion

By combining validated medical research, deep learning, and voice-first design, CoughLens AI transforms cough-based screening into a deployable, socially impactful healthcare solution for rural communities.