

TEAM XNNOV473RS!

THEME HEALTH CARE

RespiSense AI
Your Personal Bio-Weather Station &
Intelligent Respiratory Profiler



PROBLEM STATEMENT

THE ISSUE

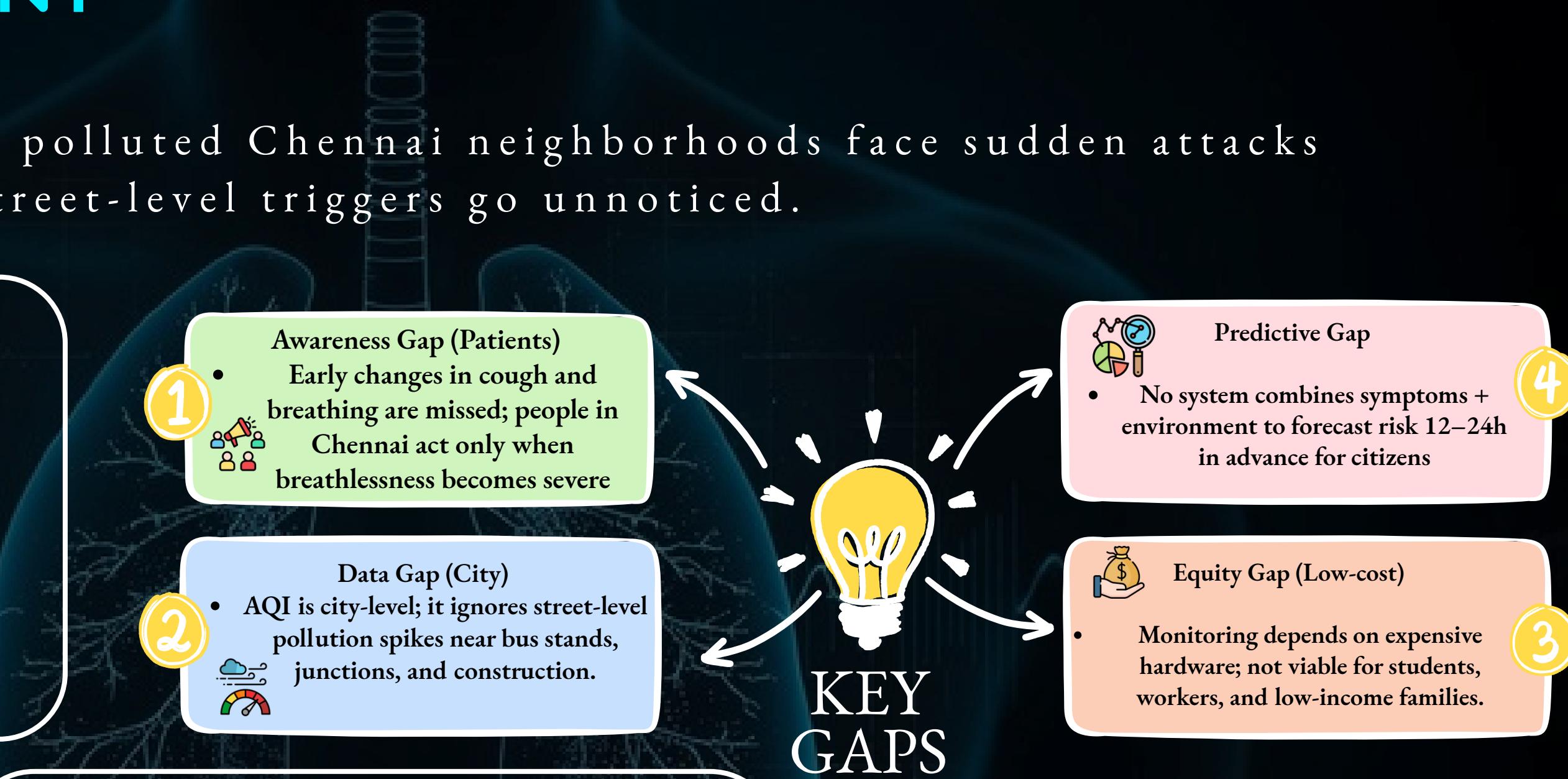
Asthma and COPD patients in polluted Chennai neighborhoods face sudden attacks because early symptoms and street-level triggers go unnoticed.

WHY THIS HAPPENS?

肺 Symptoms change quietly

触发器 Triggers are local (traffic corridors, construction zones, indoor dust pockets)

监测 Monitoring is late & costly -no affordable, everyday tool for citizens; only hospital visits



AWARENESS BEGINS AT BREAKDOWN !

Current respiratory care identifies failure, not risk.

PROBLEM : THE SILENT PROGRESSION OF LUNG DISEASE

- Reactive care
- Unnoticed early changes
- Unlocalized triggers
- Inaccessible monitoring

Today, Chennai has two disconnected signals:
What our lungs feel vs what the city's environment does.
No system fuses them for citizens.

TWO SIGNALS. ZERO INTEGRATION.

Physiology and environment are monitored in isolation — never together.

SOLUTION ABSTRACT

RESPISENSE Intelligence in every inhale

RespiSense AI is a smartphone-based, hardware-free respiratory intelligence system that correlates internal physiology with external environment to prevent flare-ups before symptoms appear.

FEATURES



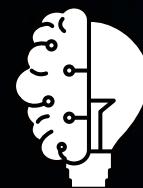
Biometric sensing

Heart Rate, Respiratory Rate, Heart Rate Variability, cough & vocal biomarkers via on-device IMU + audio



Context-aware analysis

Physiological trends + local air & pollen intelligence (AQI, allergens, humidity)



Predictive intelligence

Edge-AI + agentic data fusion to detect invisible trigger intersections



Proactive intervention

Context-aware voice guidance for avoidance & breathing control



Privacy & scalability

100% on-device, zero hardware, instant mobile deployment

IMPLEMENTATION EASE

Software-only solution leveraging existing smartphone sensors and transfer-learned edge models

EFFECTIVENESS

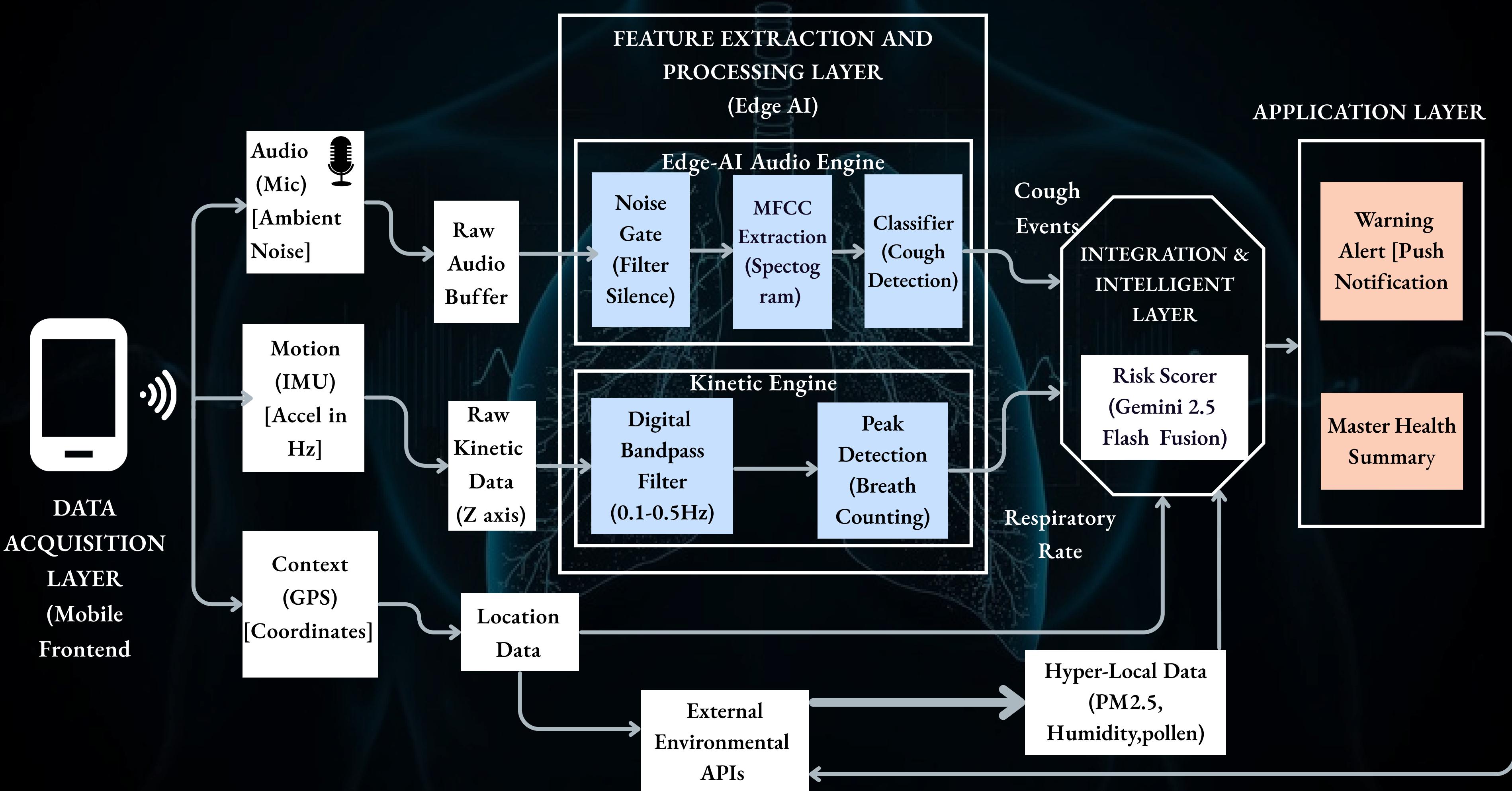
➤ Early risk prediction

➤ Invisible trigger visibility

➤ Preventive user intervention

➤ Reduced emergency exacerbations

ARCHITECTURE AND SYSTEM DESIGN



IMPLEMENTATION DETAILS

Data Acquisition (On-Device)

IMU

Chest vibration capture for HR, RR, HRV (SCG-based)

Microphone

Cough & voice signals

GPS

User location for environment lookup

Signal Processing & Feature Extraction

Filtering

Butterworth Bandpass (Respiratory & Cardiac bands)

Time/Frequency Analysis

Peak detection → Rate estimation

Audio Features

MFCCs, jitter, shimmer

Feature-Level Intelligence

Physiological Metrics

HR, RR, HRV, cough frequency

Environmental Metrics

PM2.5, pollen, humidity

Edge AI Inference

Transfer-learned CNNs (MobileNetV2)

- Cough detection
- Breathing anomaly classification

Trend Analysis

Rolling time-window evaluation

Intelligence layer

Identifies invisible trigger intersections

Correlates internal physiology + external environment

Context-Aware Intervention (Resistant)

Proactive alerts

Guided actions

User queries

TECH STACK

DATA SOURCE



- Smartphone Accelerometer
- Smartphone Microphone
- Google Maps API
- Google Weather API
- PhysioNet
- Phypox

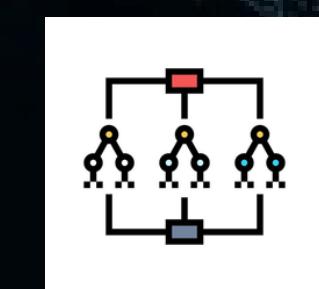
VOICE & INTERACTION



★ Gemini 2.5 Flash

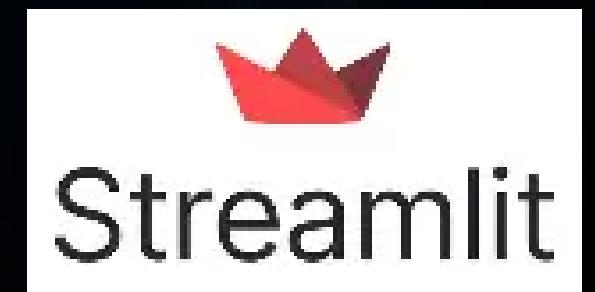
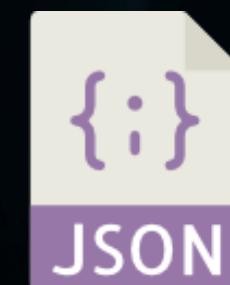
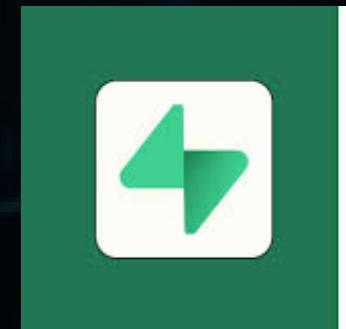
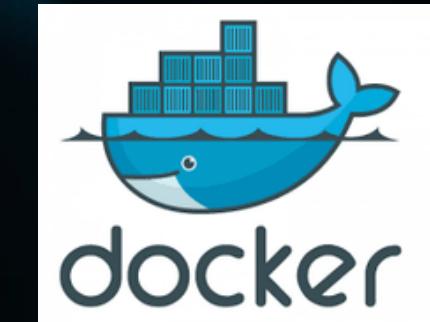


MACHINE LEARNING



Random Forest Classifier

DEPLOYMENT



IMPLEMENTATION DETAILS

Breathing Pattern Classifier

- MobileNetV2 CNN on spectrograms ($224 \times 224 \times 3$)
- Trained on minimum demo samples (expandable)
- Risk score: 0-100% confidence

Voice Pathology Classifier

- 81% test accuracy on VOICED dataset
- 208 voice samples validated
- Detects jitter >2.5% for inflammation

Cough Detection

- Joblib ML model for acoustic event detection
- Real-time counting with confidence scores

Environmental Integration

- Live AQI, PM2.5, humidity, pollen via GoogleWeather
- Location-based hyper-local data (Chennai validated)

Gemini Clinical Fusion

- Generates structured risk reports
- Identifies "invisible trigger intersections"

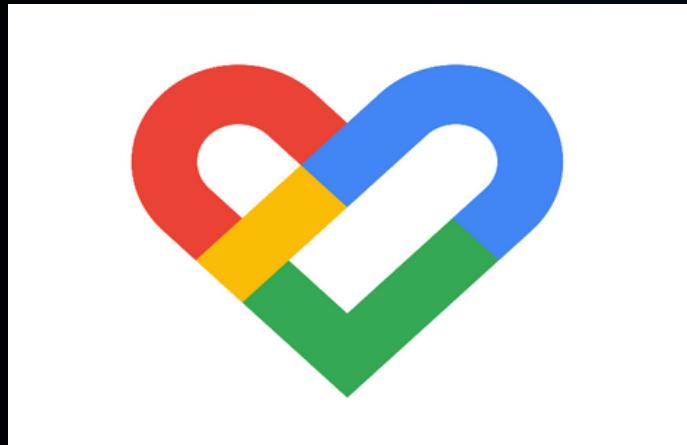
IMPLEMENTATION

[Github repository](#)

[Prototype demo](#)

MARKET STUDY & BUSINESS MODEL

EXISTING CARE MODALITIES



Google fit



Philips Respironics Alice Night
One Home Sleep Testing Device



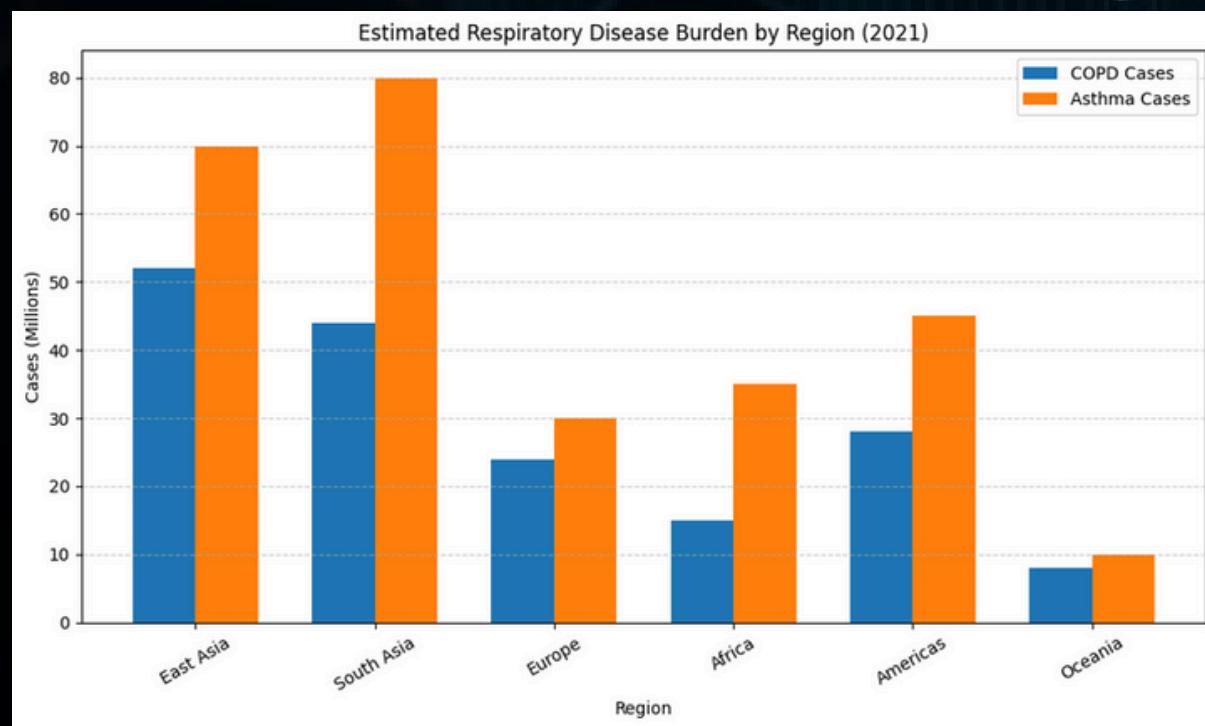
Apple watch



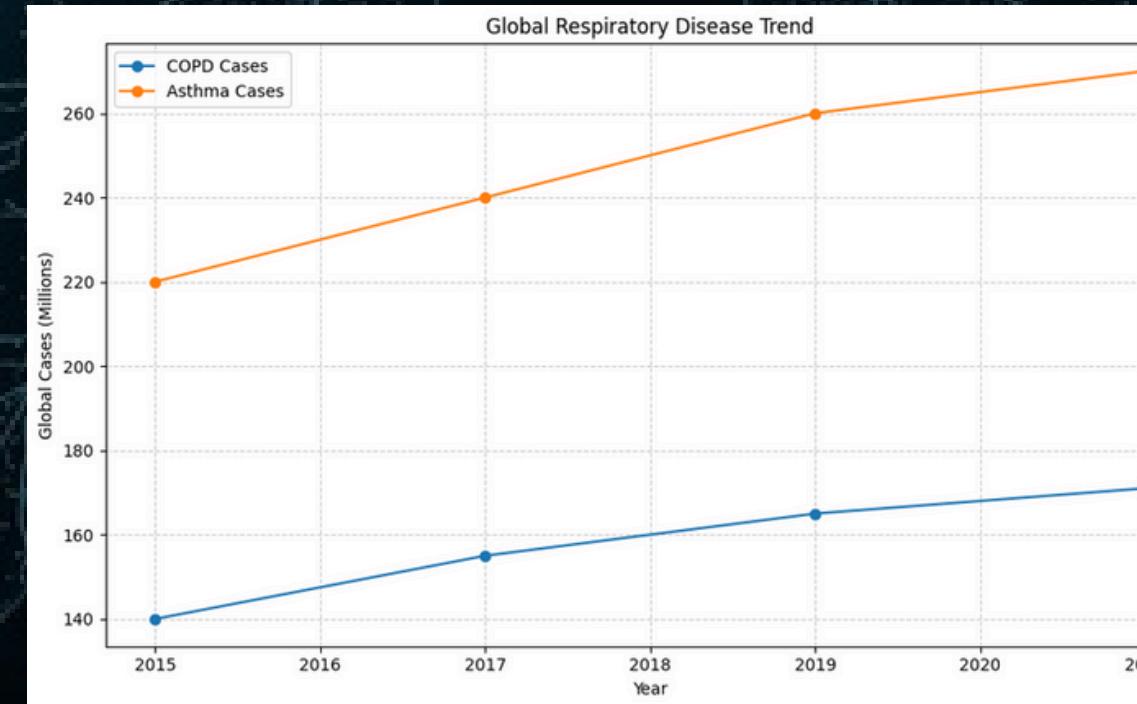
Nuvo air



ResMed air med



Respiratory Disease Burden by Region



Global Respiratory Disease Trend

Rising COPD and asthma rates signal a massive, unmet need for scalable respiratory monitoring—especially in South and East Asia

A growing global disease burden demands recurring solutions, making subscription-based, analytics-driven models the future.

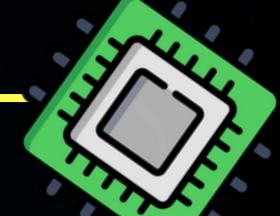
Regional disease disparities unlock tiered pricing and B2B2C strategies—driving access, adoption, and sustainable growth.

FUTURE ROADMAP



RESPISTANT - VOICE AGENT

- Proactive audio alerts to warn respiratory risk before symptoms appear
- Voice-activated breathing coach → real-time guidance based on physiological stress and environmental triggers



ON-DEVICE DEPLOYMENT

- Convert model to TensorFlow Lite + MediaPipe Audio on Android
- Minimal app that can handle live cough counter, daily summary, time-windowed listening



RESPIBOT - CHATBOT

- Gemini-powered conversational interface → answers personalized natural language questions
- Provides context-aware, explainable recommendations



SECURITY LAYER

- End-to-end encryption for all physiological data
- HIPAA-compliant data handling for secure Gemini API calls in clinical report generation

CHALLENGES



DATA VARIABILITY & NOISE

- Real-world coughs vary by room, distance, device
 - Background sounds increase false positives
- Battery, background execution, privacy limits

ON-DEVICE CONSTRAINTS

SCOPE



CURRENT SCOPE

- Passive cough monitoring via smartphone
 - Scheduled / night-time listening
- ## NEAR-TERM EXPANSION
- Environmental context (AQI, humidity)
 - Population-level flare risk trends

UNIQUE SELLING POINTS



- Smartphone-only — no wearables or extra hardware
- Passive, continuous monitoring (no user effort)
- Integrates cough + environment for early risk insight
- Vocal biomarker : Voice-based strain detection
- Respisstant - Voice agent

RESEARCH AND REFERENCES

INDUSTRY OUTLOOK

- Rising COPD/asthma burden and demand for home respiratory monitoring.
- Growing use of AI and smartphones for cough and lung-health tracking.

FINDINGS

- 78% need early prediction before respiratory emergencies
- 69% lack access to continuous respiratory monitoring
- 74% want home-based, non-invasive solutions

USER INSIGHTS

- Patients struggle to track daily cough trends and flare triggers.
- Need low-cost, simple, privacy-aware monitoring on phones.

REFERENCES

WHO – Chronic Respiratory Disease Reports
COPD Global Burden Study (GBD)
AI-based Respiratory Sound Classification – IEEE
Remote Patient Monitoring Frameworks

CLINICIAN INSIGHTS

- Hospital devices are accurate but expensive and not home-friendly.
- Doctors want early-warning “flare risk” scores, not just raw counts.

TECHSPRINT/MARKET VOICE

- Focus on on-device AI (TensorFlow Lite) and offline use(Future scope).
- Interest in explainable alerts and future voice agent (RespiSstant) integration.

TAKE A LOOK AT XNNOV473RS!

ROLE	NAME	STREAM/ DEPT	YEAR	COLLEGE
Team lead - Backend developer	Harinisri Ramesh	Biomedical Engg	UG III	SSNCE
Backend & ML Engineer	Harini V	Biomedical Engg	UG III	SSNCE
Web & Frontend Developer	Shivani M	Biomedical Engg	UG IV	SSNCE
AI Engineer & Research Lead	Sivasakthi B	Biomedical Engg	PG II	SSNCE