

# TEAM XNNOV473RS!

## THEME HEALTH CARE

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



# PROBLEM STATEMENT

## THE ISSUE

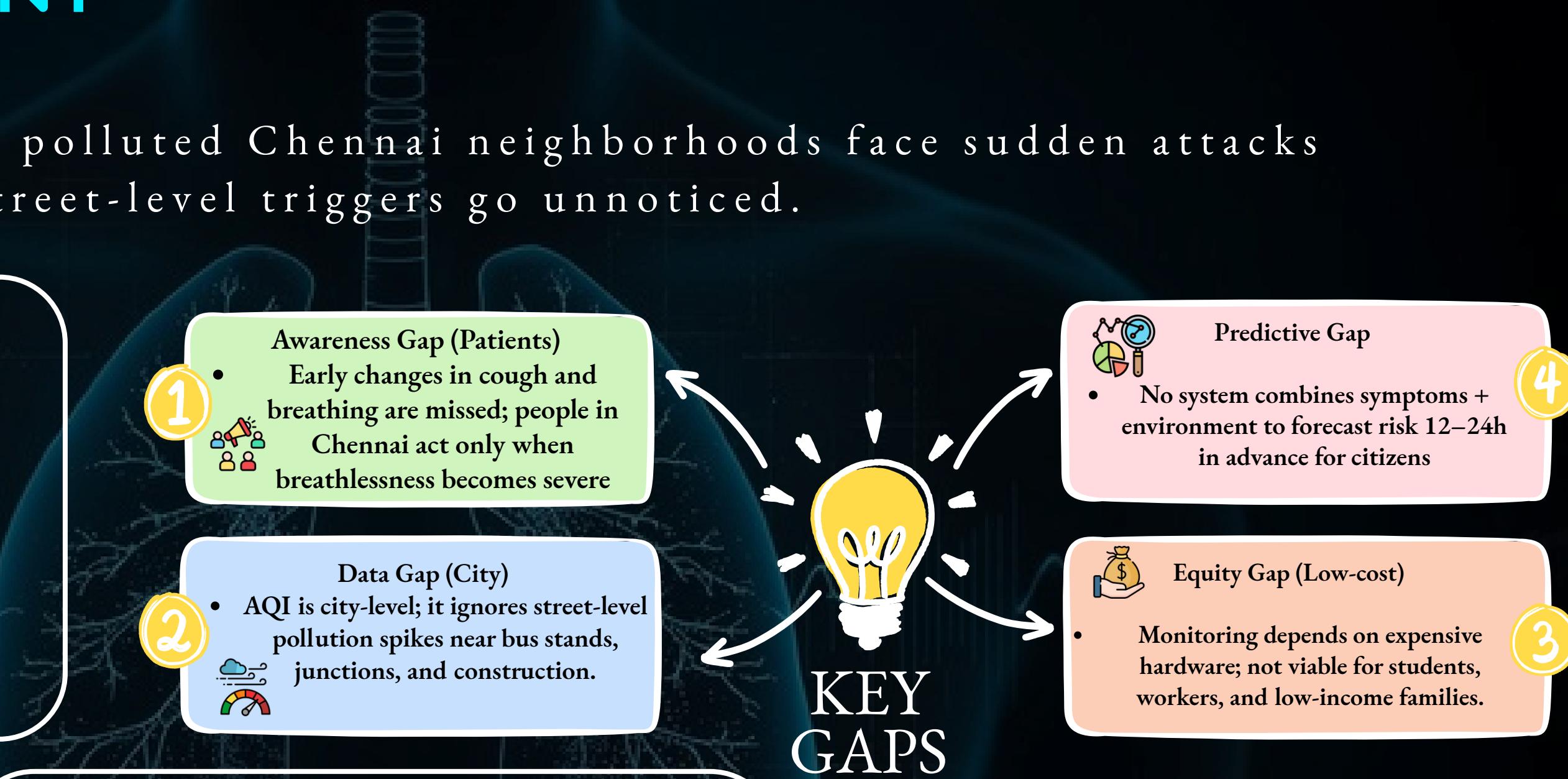
Asthma and COPD patients in polluted Chennai neighborhoods face sudden attacks because early symptoms and street-level triggers go unnoticed.

### 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



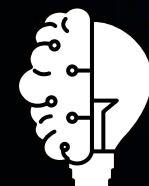
#### Biometric sensing

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

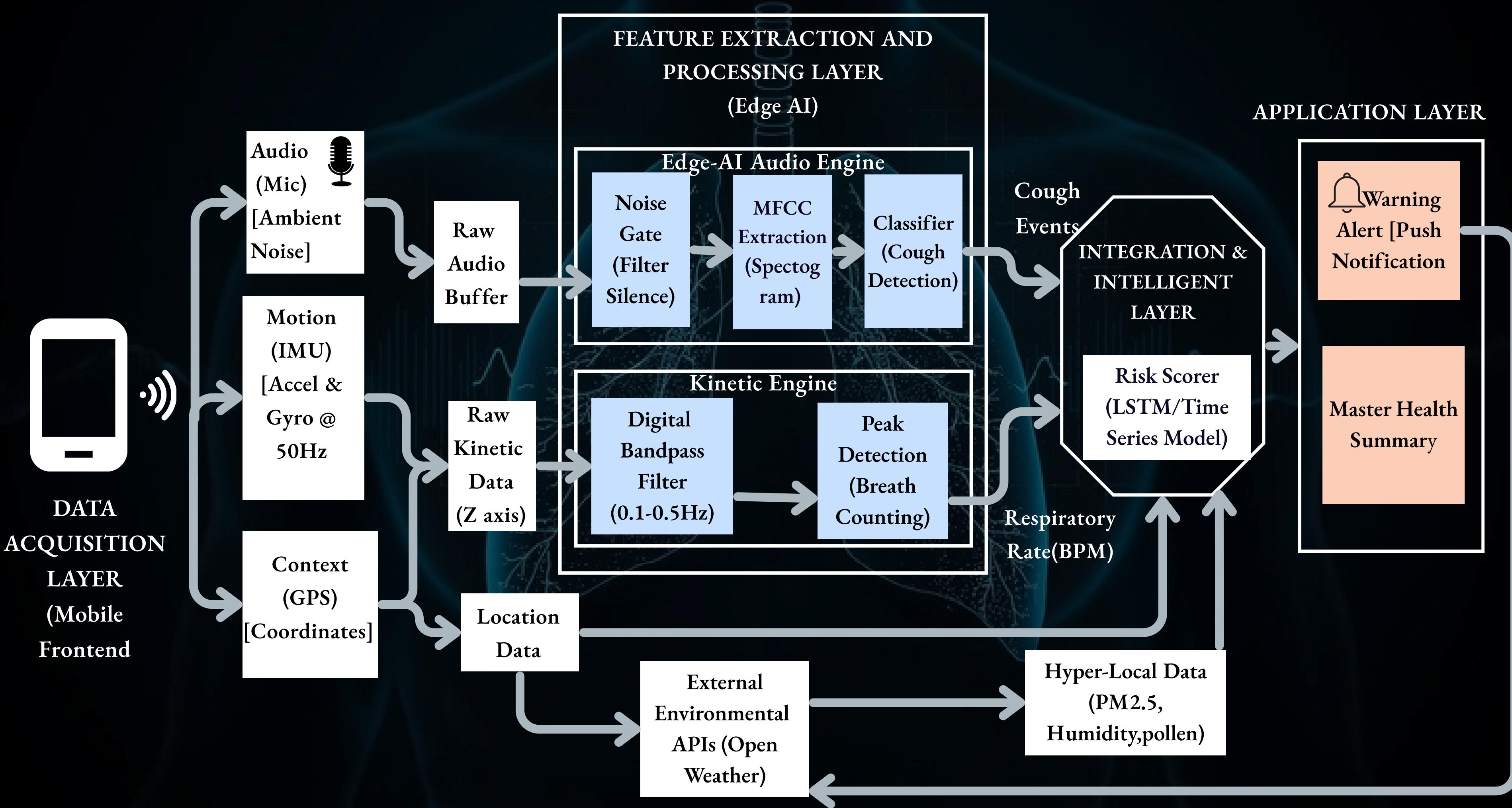
➤ Early risk prediction

➤ 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

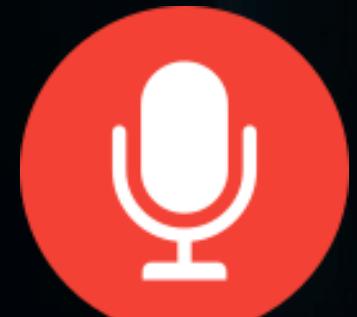
User queries

# TECH STACK

## DATA SOURCE



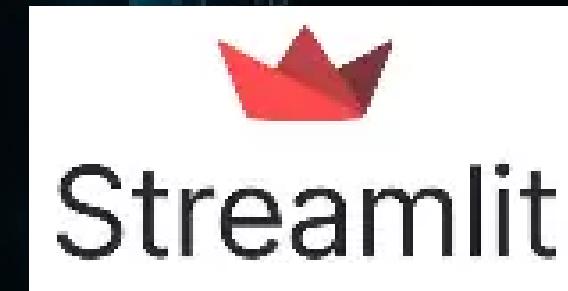
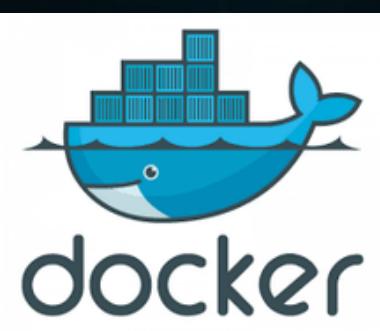
Smartphone Accelerometer



Smartphone Microphone



## DEPLOYMENT



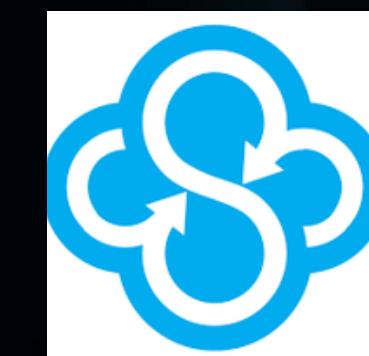
## MACHINE LEARNING



## VOICE & INTERACTION



## SECURITY & PRIVACY



Encrypted Cloud Sync

# IMPLEMENTATION DETAILS

## RespiSense: Integrated Respiratory Intelligence

*Multi-Modal Monitoring: Kinematic & Acoustic Correlation*

 Passive Check (Vitals)  Active Mode (Cough)

### Chest Motion Analysis

Upload Phyphox CSV

 Drag and drop file here  
Limit 200MB per file - CSV

 abnormal\_tachypnea.csv 0.8MB

Respiratory Rate

16.5 BPM

 Normal

Heart Rate

72.0 BPM

AI Diagnosis

 Abnormal Pattern

 Risk: 71%

### Master Health Summary & Risk Assessment

Total Risk Index

35%

 MONITORING: Some data detected. Results will update as you upload more files.

 Note: This is an AI-assisted prototype for KIHacks and not for clinical diagnosis.

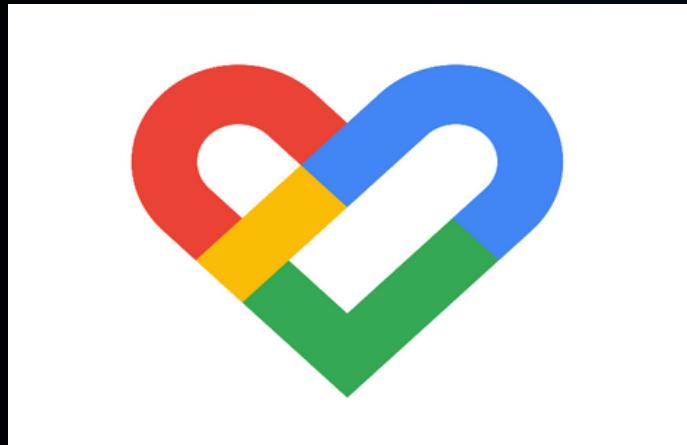
IMPLEMENTATION

[Github repository](#)

[Prototype demo](#)

# MARKET STUDY & BUSINESS MODEL

## EXISTING CARE MODALITIES



Google fit



Philips Respironics Alice Night  
One Home Sleep Testing Device



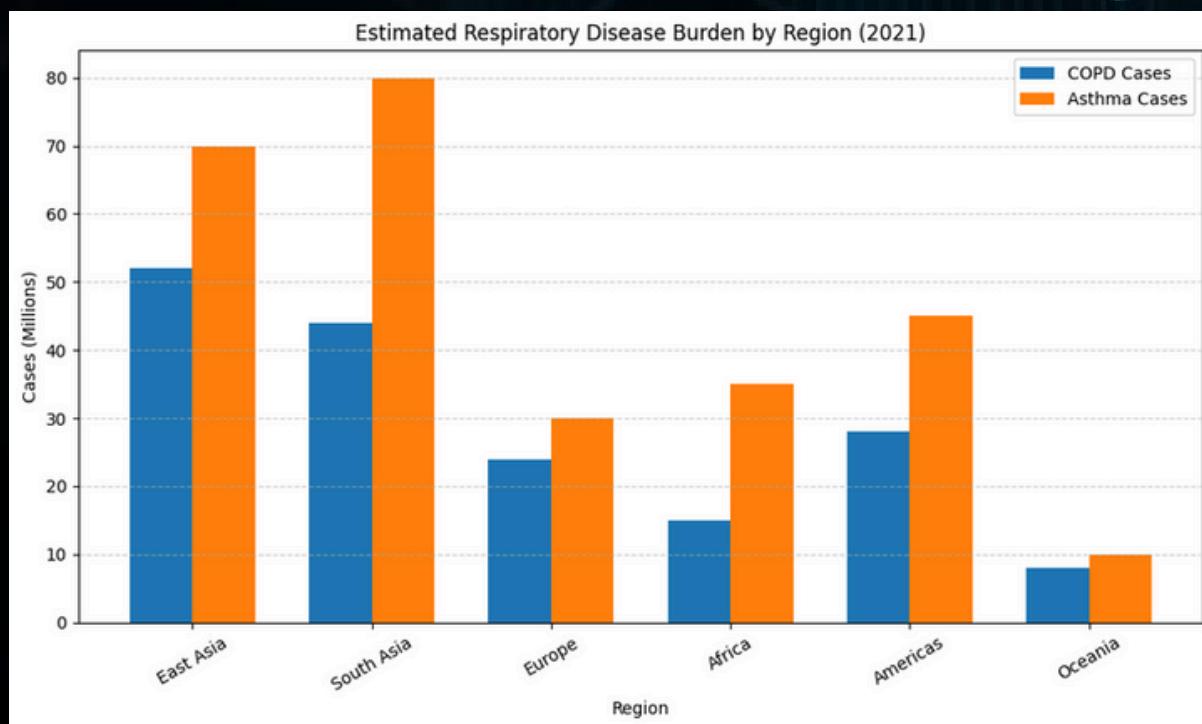
Apple watch



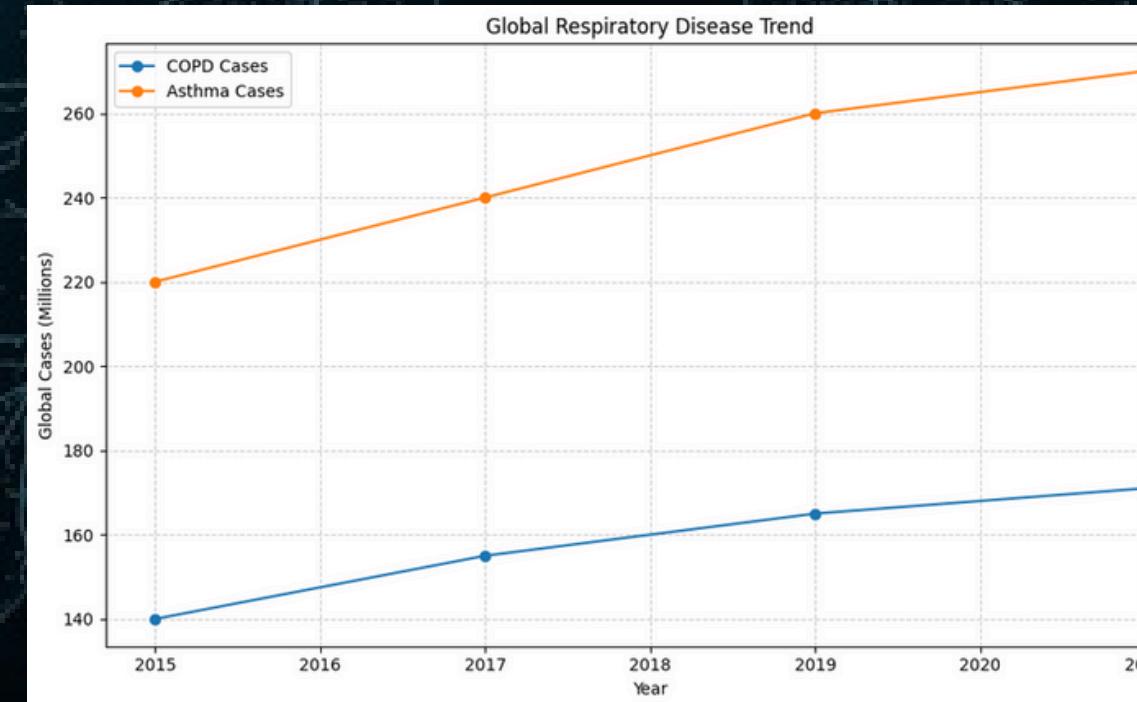
Nuvo air



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

## BETTER MODEL & DATA

- Expand real-world cough data (rooms, distance, devices, noise)
- Optimize CNN/CRNN on log-mel features.



## VOCAL BIOMARKER

- Fuse acoustic, kinematic, vocal, and environmental signals with Gemini clinical logic to infer hidden trigger zones.
- Deploy Resistant voice agent: proactive nudges + on-demand coaching on Android.e.

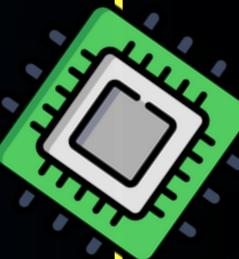
## RISK PREDICTION MODULE

- Combine cough trends with AQI & humidity for flare-risk estimation
- Explore short-term (6–12 hr) prediction using time-series models



## ON-DEVICE DEPLOYMENT

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



## EVALUATION & UX

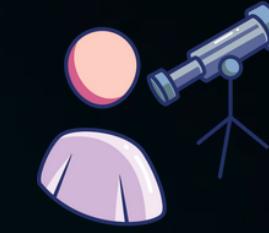
- Validate cough counts against labelled data and recent benchmarks
- Rapid user testing for permissions, alerts, and app flow



# CHALLENGES



# SCOPE



## DATA VARIABILITY & NOISE

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

## ON-DEVICE CONSTRAINTS

## 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 (future): Voice-based strain detection + RespiSstant coaching

# 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.