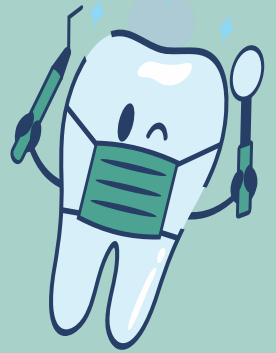




# Voice Against Oral Cancer



**Big Idea:** Using Artificial Intelligence (AI) to bridge the healthcare gap between different economic and low- resource environments

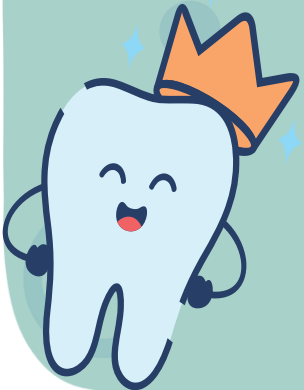
**Essential Question:** How can an AI and computer vision-based screening tool help enable early oral cancer detection in communities with limited medical infrastructure ?

**Team Members:** Srija R; Udita L; Bihu Pati; Shreya M; Prapti M

Presented by:

**Santamayee Girls' High School**

Purulia, West Bengal, India



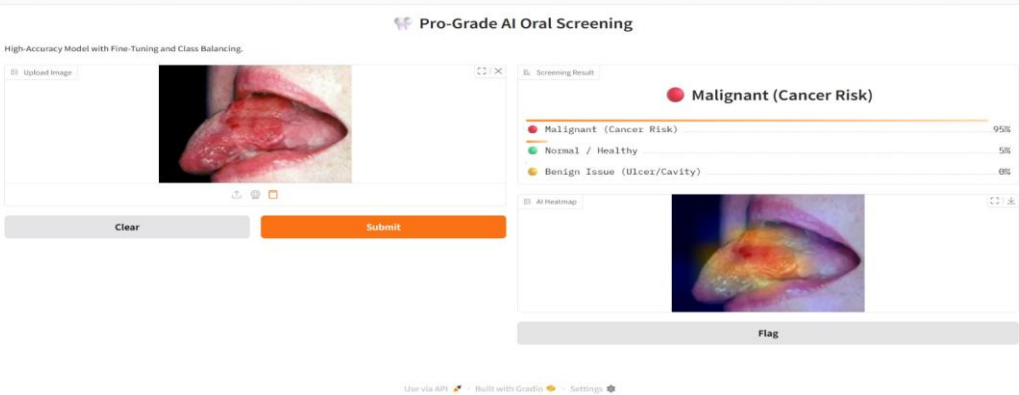
# The Problem

## Critical Challenge in Rural India

- Oral cancer accounts for significant cancer deaths in India, particularly in rural areas where:
  - High tobacco use is prevalent
  - Medical infrastructure is limited
  - Awareness about symptoms is low
  - Access to dental specialists is scarce

Late Detection = Lower Survival Rates

Most patients seek help at Stages III-IV when treatment is expensive and outcomes are poor



Our Mission: Enable early, accessible screening using AI technology

## Objectives of the Project;

There is a critical need for a **simple, low-cost, and technology-assisted screening tool** that can aid early detection at the community level.

- To design an AI-driven model capable of identifying early signs of oral cancer from oral cavity images.
- To create a screening module that can be operated using basic digital devices.
- To support rural healthcare systems by enabling early and preventive diagnosis.
- To demonstrate the role of student-led innovation in solving real-world healthcare challenges.

## Join Us in Saving Lives

*Technology + Community + Student Innovation = Health Equity*

This student-led project demonstrates how accessible AI can address critical healthcare challenges and promote early cancer detection in underserved communities worldwide.

## DEATH IN 55% CASES DIAGNOSED

➤ **1 lakh** new oral cancer cases are reported every year

➤ **50,000** lives are lost to oral cancer every year

➤ Tobacco and areca nut increase the risk of oral cancer

➤ In India, as youngsters use tobacco and areca nut, there is a high burden of people under 50 with oral cancer

➤ Tata Memorial Hospital

followed 100 patients over three years to estimate the individual burden of oral cancer

➤ Loss of productivity to society was ₹31 lakh per early-stage case and Rs 72 lakh per advanced-stage cancer

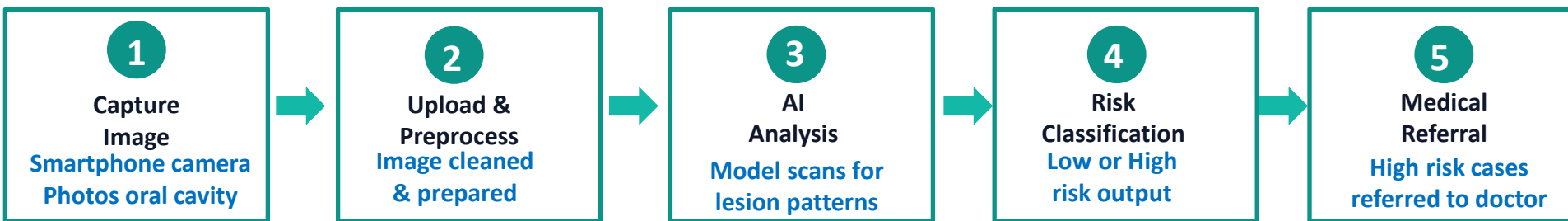
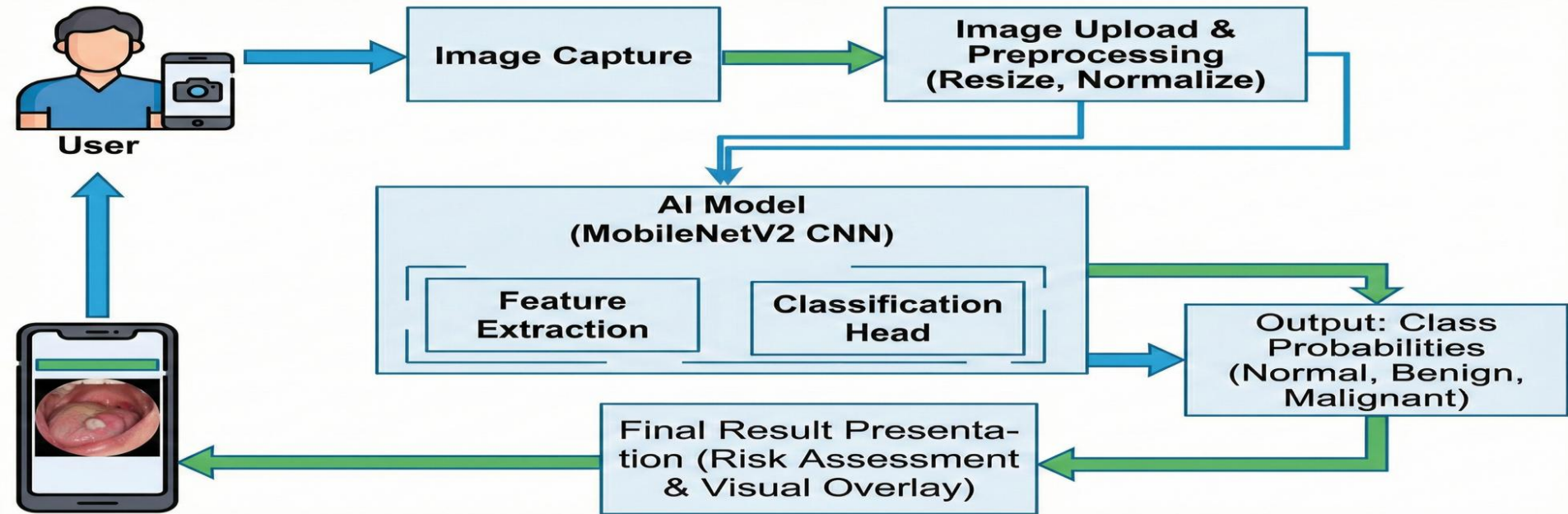
➤ The team thus worked out that total cost of lost productivity due to premature oral cancer mortality in 2022 was **\$5.6 billion**



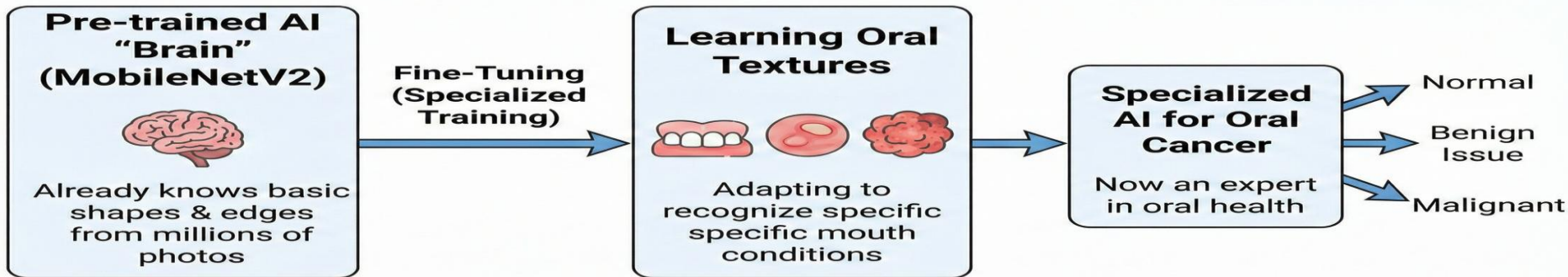
This project addresses the critical high mortality rate of Oral Squamous Cell Carcinoma (OSCC) in rural regions. The core issue is not the disease itself, but its late diagnosis; most patients seek attention at Stages III or IV when survival rates decrease drastically and treatment becomes expensive.

We were motivated by the disparity in healthcare access. In our country, the highest incidence of oral cancer occurs in rural populations with high tobacco usage, yet these same communities have the least access to dental specialists.





*The AI does not diagnose — it supports health workers by identifying cases that need medical attention*



## The AI's "Highlight Pen" (Grad-CAM)



# Our Solution: AI-Powered Screening

## Accessible Technology

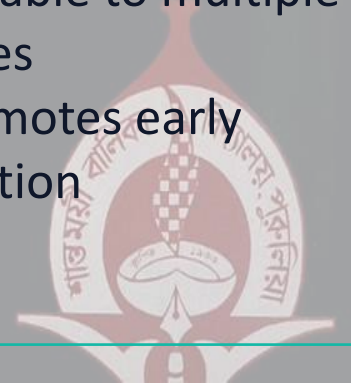
- Uses smartphone cameras
- Open-source AI tools
- No expensive equipment needed
- Works in low-bandwidth areas

## Smart AI Analysis

- Trained on oral lesion images
- Identifies early warning signs
- Quick risk assessment
- Supports health workers

## Community Impact

- First-level screening tool
- Guides medical referrals
- Scalable to multiple villages
- Promotes early detection



# Technical Approach

## AI Model Architecture

### MobileNetV2 Deep Learning Model

Optimized for mobile devices and low-bandwidth settings

### Transfer Learning

Pre-trained model fine-tuned on oral lesion images (last 30 layers retrained)

### Explainable AI (Grad-CAM)

Shows which image areas influenced the AI's decision

### Tools Used

Python 3 • Kaggle datasets • Google Colab • Gradio interface

## What Makes It Special?

- ✓ Lightweight - runs on basic smartphones
- ✓ Fast - provides results in seconds
- ✓ Transparent - doctors can see AI reasoning
- ✓ Accessible - open-source tools used
- ✓ Scalable - easy to deploy in new locations



# Data Collection & Training

## Dataset

- Publicly available medical image datasets
- Contains healthy oral cavities and various lesion types
- Includes leukoplakia, erythroplakia, ulcers, and tumors
- Images preprocessed through:
  - Resizing for consistency
  - Normalization
  - Noise reduction



AI model is being prepared

## Model Training Process

### 1. Image Analysis

Model learns visual patterns distinguishing normal vs. suspicious tissue

### 2. Feature Extraction

Identifies color changes, irregular shapes, texture differences

### 3. Pattern Recognition

Trained to recognize early warning signs of malignancy

### 4. Continuous Improvement

Model accuracy improves with expanded datasets over time

# Impact on Rural Communities

## Early Detection

Catch cancer at  
treatable stages

## Low Cost

No expensive  
equipment needed

## Fast Results

Screening in  
seconds

## Rural Reach

Accessing screening  
where specialists  
are scarce

This tool enables village health camps, school programs, and community outreach to perform rapid screening and encourage timely medical consultation

# Ethical & Responsible AI

*We designed this system with strong ethical principles:*



## No Automated Diagnosis

The AI provides risk assessment only — medical professionals make final diagnosis decisions

## Privacy Protection

Image data handled with privacy-conscious protocols; no personal data stored unnecessarily

## Mandatory Referrals

All high-risk cases include clear recommendation for professional medical examination

## Transparent Classification

Results clearly explained as 'Low Risk' or 'High Risk (Consultation Recommended)'

## Human-AI Collaboration

System designed as support tool for health workers, not replacement for doctors

## Continuous Improvement

Model designed for ongoing learning and accuracy enhancement with new data

# Student-Led Innovation

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## From Learning to Impact

*We learned AI and computer vision concepts in school, then asked:*

*"How can we use this knowledge to help our community?"*

We chose oral cancer screening because:

- It's a critical health problem in rural West Bengal
- Early detection dramatically improves survival
- Technology can bridge the healthcare gap
- Students can contribute meaningful solutions

## Skills We Developed

### Technical Skills

- Deep learning model training
- Computer vision techniques
- Python programming
- Data preprocessing and analysis

### Soft Skills

- Problem identification and framing
- Ethical technology design
- Community engagement
- Teamwork and collaboration

# Commitment to Inclusion

*Our team represents the communities we serve*

## Economic Diversity

- ✓ Students from low-income households
- ✓ Families dependent on daily wages
- ✓ Beneficiaries of meal support programs
- ✓ Technology access through school

## Language Inclusion

- ✓ Bilingual learning environment
- ✓ English and Bengali instruction
- ✓ Concepts taught in multiple languages
- ✓ Plans for multilingual interface

## Learning Differences

- ✓ Differentiated roles for all students
- ✓ Contribution based on strengths
- ✓ Inclusive participation model
- ✓ Everyone adds value

**We position underserved students as innovators and problem-solvers, not just beneficiaries**

# Sustainability & Future Growth

## Built for Long-Term Impact

### Existing Resources:

- Student leadership across grades
- Teacher mentorship program
- School computer labs and devices
- Open-source software (no licensing costs)
- Community health worker partnerships
- Embedded in school innovation programs

### How We'll Sustain:

- Peer mentorship model (seniors train juniors)
- Documentation for future student teams
- Community spaces for health camps
- Reusable digital awareness materials

## Growth Plans

### With support, we will:

#### 1. Improve Technology

- Expand training dataset
- Increase model accuracy
- Test across diverse populations

#### 2. Scale Reach

- Extend to more schools
- Deploy in additional villages
- Create multilingual interface

#### 3. Strengthen Operations

- Maintain cloud computing access
- Develop training resources
- Support community health workers

# UN Sustainable Development Goals

*Our project contributes to multiple global goals:*

3

Good Health & Well-Being

Early cancer detection  
saves lives

4

Quality Education

Student-led learning  
and skill building

9

Innovation & Infrastructure

Tech solutions for  
healthcare gaps

10

Reduced Inequalities

Healthcare access for  
underserved  
communities

## Future Vision & Next Steps

Mobile App  
Development

User-friendly smartphone application  
for field workers

Telemedicine  
Integration

Connect screening results with remote  
medical consultations

Dataset Expansion

Larger, more diverse training data for  
improved accuracy

Partnership Building

Collaborate with public health agencies  
and NGOs

Training Programs

Educate health workers and students in  
new communities

Mass Screening Camps

Large-scale awareness and screening  
initiatives

- Please listen to our Podcast on the topic by clicking [here](#)
- Please watch our Students' reflection video by clicking [here](#)