Ganpat University
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U.V. Patel College of Engineering

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SmartCity

SmartCity

Empowering Citizens with AI to Monitor and Improve Urban Infrastructure

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Outline

1.Introduction
- Overview of SmartCity
- Purpose of the Platform

2.Current Challenges
- Inefficient Reporting
- Delayed Resolutions

3.Proposed Solution
- AI-Based Road Damage Detection
- Geotagging & Complaint Tracking

4.Key Features
- AI-Powered Detection
- Interactive Map
- User Engagement

5.Prototype
- Prototype
- Model Demo
- Use case diagram

6.Tech Stack
- Frontend: React.js
- Backend: Node.js
- Database: MySQL, Redis
- Object Detection: YOLOv8

7.Complaint Verification Process
- Image Analysis with YOLOv8
- Automatic Filtering

8.Government Portal
- Complaint Management
- Status Tracking

9.Impact & Benefits
- Faster Complaint Resolution
- Community Engagement
- Environmental Sustainability

10.Redeem Points System
- User Rewards
- Boosts Participation

11.Conclusion
- Smarter Cities
- Improved Infrastructure
- Future Scope

Introduction

- The **SmartCity** is a community-driven platform that empowers citizens to report road damage caused by adverse weather conditions such as rain.
- Through the application, users can upload pictures of road damage along with their geolocation (latitude and longitude) data.
- This information will be available for government authorities and the general public to view on a real-time dashboard.
- This will generate a highlights map, showing all reported road damage locations, helping users to navigate and avoid damaged roads while traveling.

Current Challenges

- **Inefficient** reporting processes (phone calls, paper forms)
- **Lack of centralized** tracking system
- **Delays** in addressing issues
- **Poor communication** between citizens and authorities
- **Difficulty prioritizing** complaints

The Need for Change

- **Increase responsiveness** to citizen concerns
- **Improve road** maintenance efficiency
- Enhance **transparency** in issue resolution
- Enable data-driven **decision making** for road repairs
- Strengthen **community engagement** in maintaining infrastructure

Our App Solution:

- A community-driven web application that enables public reporting of road damage with features for geotagging, image uploads, and status tracking. Damaged roads lead to increased accidents, vehicle damage, and reduced quality of life.

Key Features:

- **AI-Powered Detection**: Automatically identify road damage from user-uploaded photos.
- **Interactive Map**: View reported issues across the city, helping authorities prioritize based on location and severity.
- **User Engagement**: Encourage citizens to participate actively, track issues, and receive notifications on status updates

User Interface

Intuitive Design

The interface is designed to be user-friendly, with clear instructions and easy navigation.

Map Integration

Users can see the location of their complaint on an interactive map, which helps them visualize the issue.

Responsive Layout

The interface adapts to different screen sizes, ensuring optimal viewing on desktops, laptops, tablets, and mobile devices.

Photo Upload and Location Detection

1 **Automatic Location**

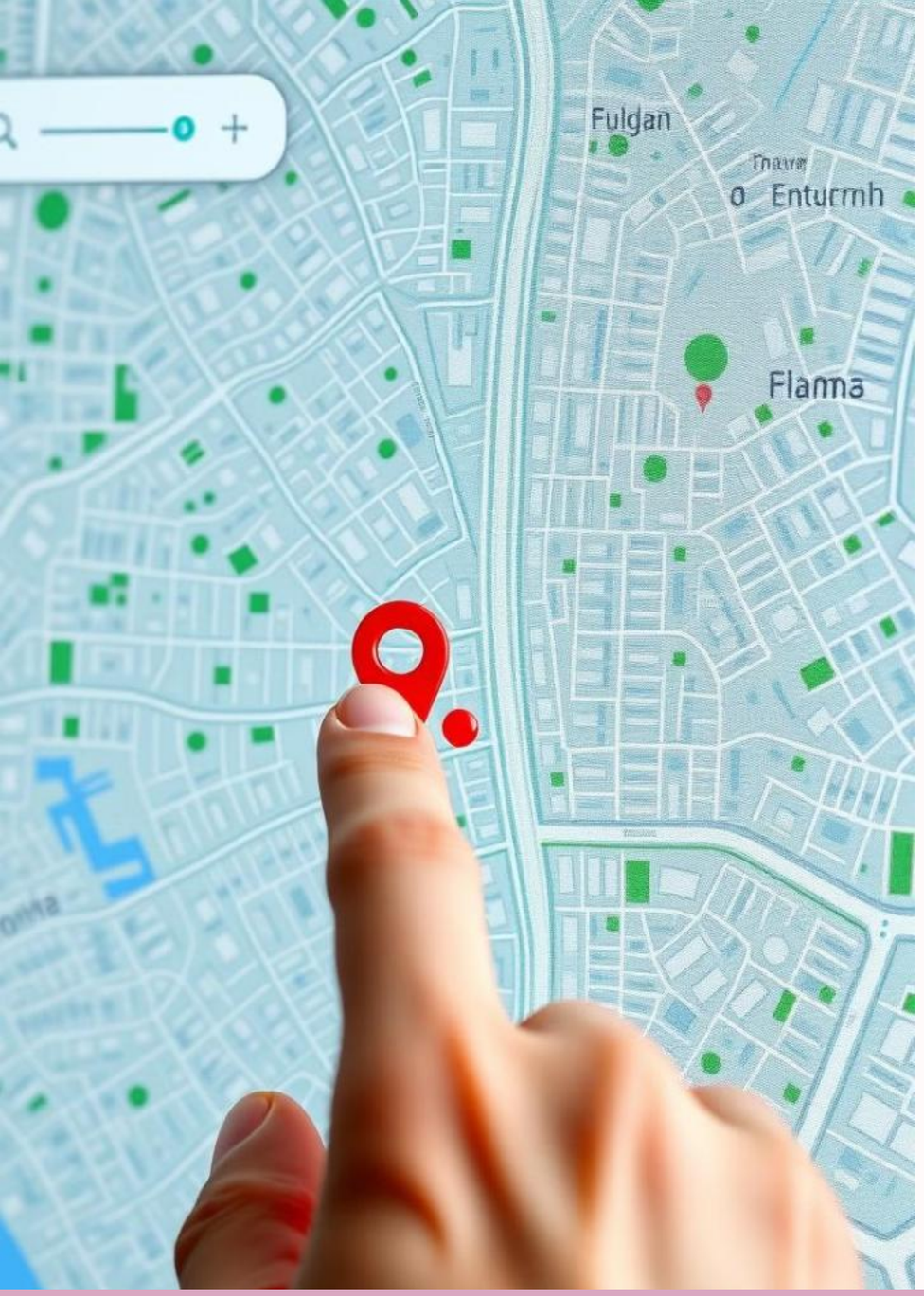
The system automatically detects the longitude and latitude of the uploaded photo using GPS data.

2 **Precise Location**

Accurate location information is crucial for quickly identifying the area needing attention.

3 **Image Analysis**

The system can analyze the image to identify potential road issues that may not be immediately apparent.



Manual Location Pinning

1

Pin Placement

Users can manually place a pin on the map.

2

Map Navigation

Users can zoom and pan the map.

3

Detailed Information

Users can provide additional details about the location.

Complaint Registration

SmartCity

- Dashboard
- Users
- Cases
- Case Report
- Rewards

Settings

Sign Out

Admin
admin@smartcity.com

Capture Image

Choose File No file chosen

Type of Issue

Select an issue

Severity

Low

Description

Describe the issue...

Location

Latitude

23.0490112

Longitude

72.5843968

Submit Report

Backend Complaint Verification with YOLOv8

Image Analysis

The YOLOv8 object detection model analyzes the uploaded photos to identify and classify road defects.

Verification

The system verifies the presence of road issues based on the YOLOv8 model's output, ensuring accuracy and efficiency.

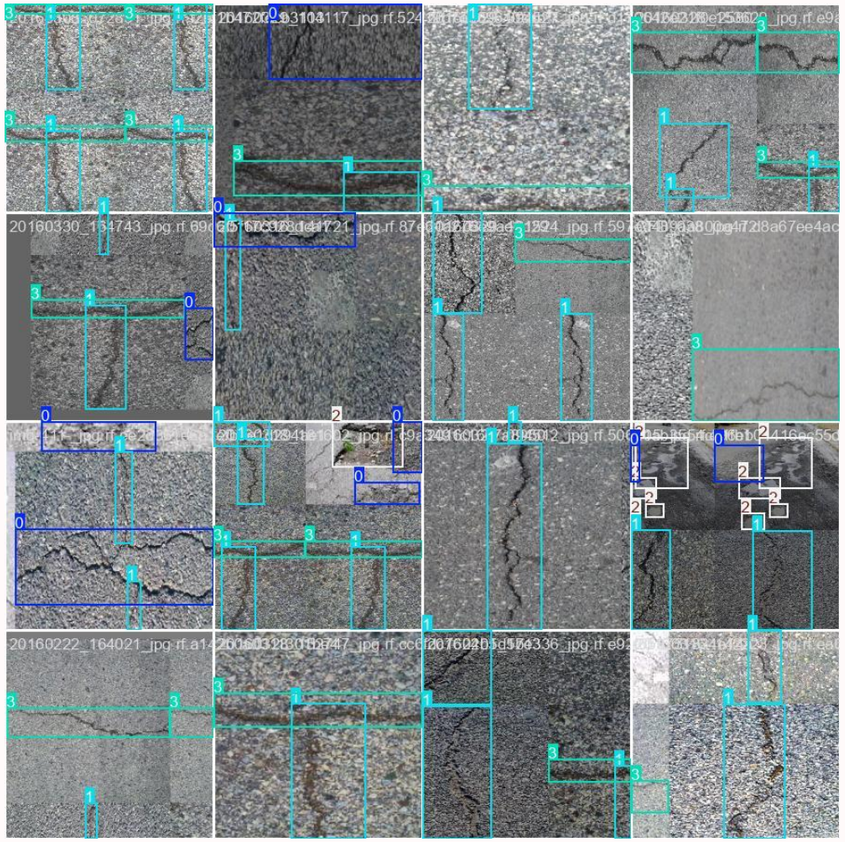
Automated Filtering

Complaints with valid road issues are prioritized for resolution, while false or irrelevant complaints are filtered out.

Dataset Details

The **Smart Crack Identification Dataset** is used for training and evaluating the YOLOv8 model:

- **Dataset Composition:(Total Images-8187)**
  - **Training Set:** 88% of the dataset (7,224 images)
  - **Validation Set:** 7% of the dataset (602 images)
  - **Test Set:** 4% of the dataset (361 images)
- **Preprocessing:**
  - **Resize:** Images are stretched to 640x640 pixels.
  - **Augmentations:**
    - **Saturation:** Adjusted between -34% and +34%
    - **Brightness:** Adjusted between -25% and +25%



Why Use AI In SmartCity?

1. Eliminating Fake Complaints
   - ✅ AI-powered verification – Detects fake complaints by analyzing image authenticity. ✅ Prevents misuse – Filters out repeated or non-relevant reports. ✅ Reduces manual work – No need for human verification of every report.
2. AI Automates Everything for Users in Future AI Upgrades
   - 📸 Just Take a Picture – AI does the rest!
   - Auto-detects road damage (potholes, cracks, etc.)
   - Geotags the location – No need for manual entry.
   - Classifies issue type & severity
   - Sends complaint directly to the right department
3. Faster & More Efficient System
   - ⚡ Real-time issue detection – AI processes complaints instantly. ⚡ Reduces response time – Faster issue resolution by authorities. ⚡ Data-driven decision-making – Government gets insights on most damaged roads.

💡 AI makes SmartCity smarter, reducing fake reports, saving time, and improving road safety!

Government Portal

1

Complaint Management

Government officials can access and manage all registered road complaints through a dedicated portal.

2

Status Tracking

The portal allows tracking the status of each complaint, from registration to resolution.

3

Data Visualization

The system provides interactive maps and charts for visualizing the distribution and resolution of complaints.

Complaint Resolution Tracking

Complaint Acknowledgment

The system acknowledges the receipt of the complaint and provides a unique ID number.

Team Assignment

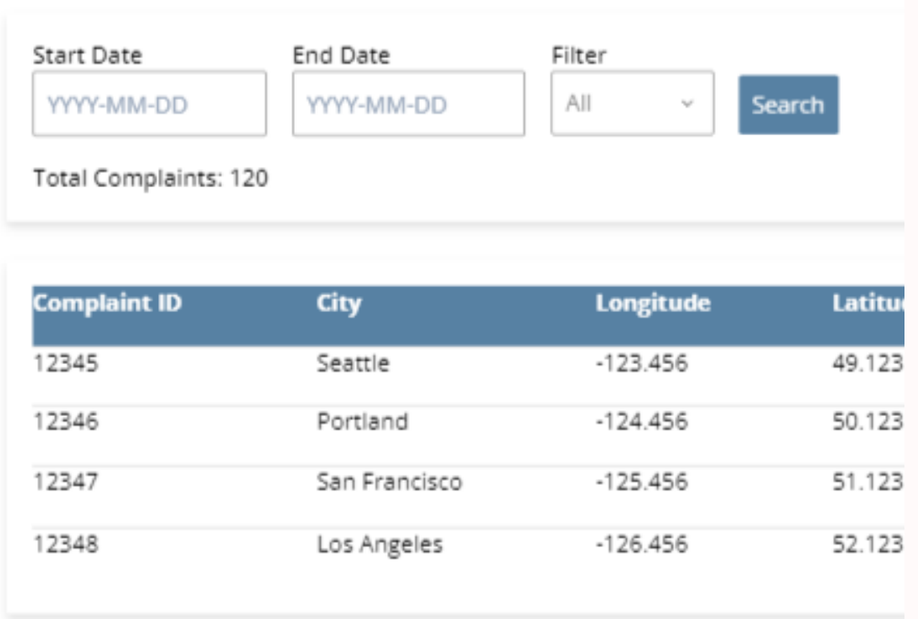
The complaint is assigned to a team or individual responsible for addressing the issue.

Resolution Process

The assigned team investigates, plans, and executes the necessary repairs or solutions.

Complaint Closure

The system closes the complaint once the issue is resolved and verified by the team.



Reporting and Printing

1

Data Aggregation

The system aggregates data from resolved complaints to generate insightful reports.

2

Report Generation

Reports can be customized to show specific data points and timeframes.

3

Print Functionality

Reports can be printed for official documentation and record-keeping.

Prototype

SmartCity

Dashboard Map Create a report Log in Sign up

Report infrastructure issues, improve your community

Our app makes it easy to report infrastructure issues and connect with your community.

Get Started

How it works

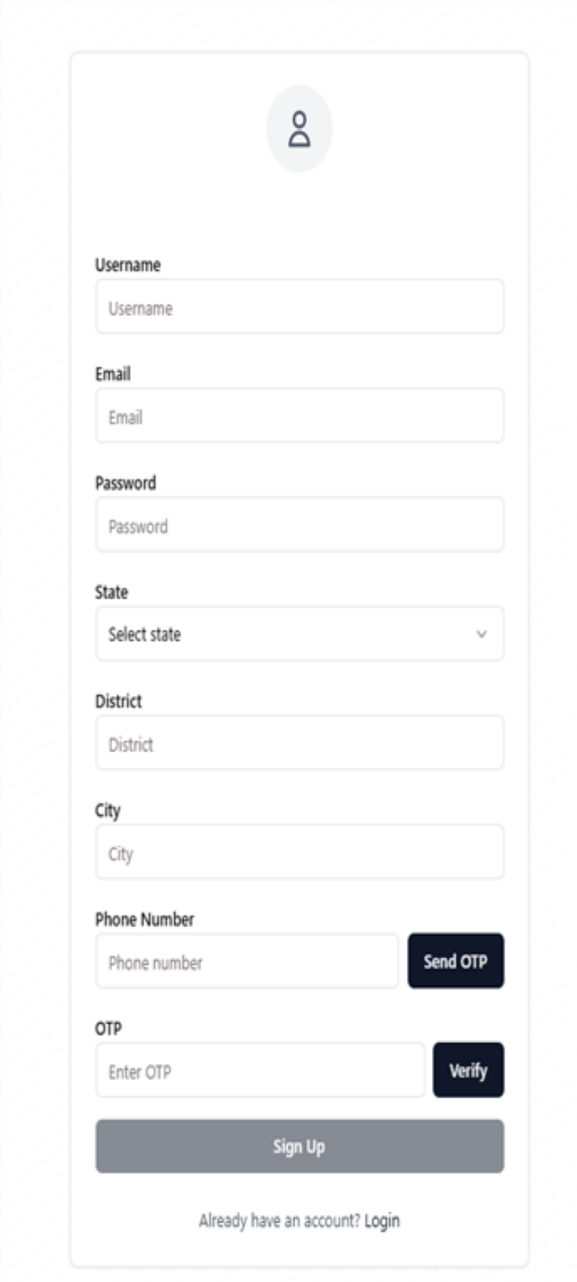
Report Issues
Snap a photo and provide details about the issue

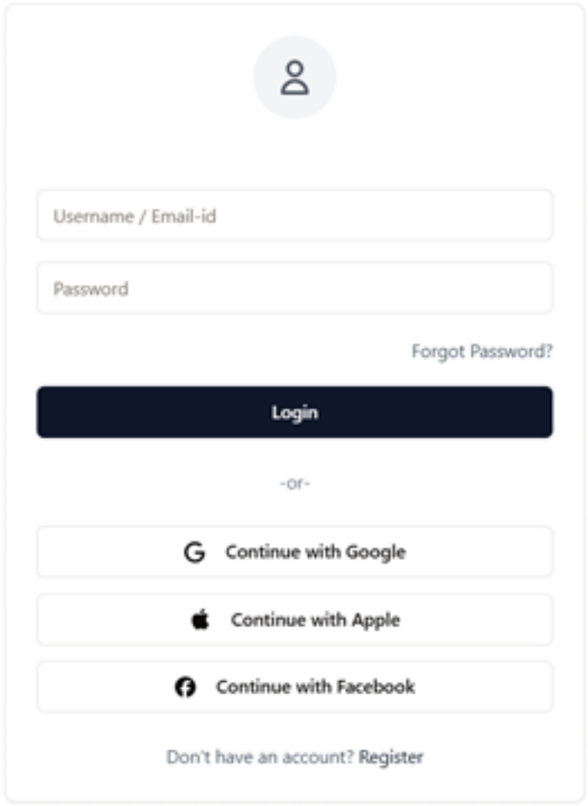
Explore Map
Check out reports from other users

Community Chat
Join local groups to stay updated on issues

Volunteer
Help your neighbors by volunteering

Prototype

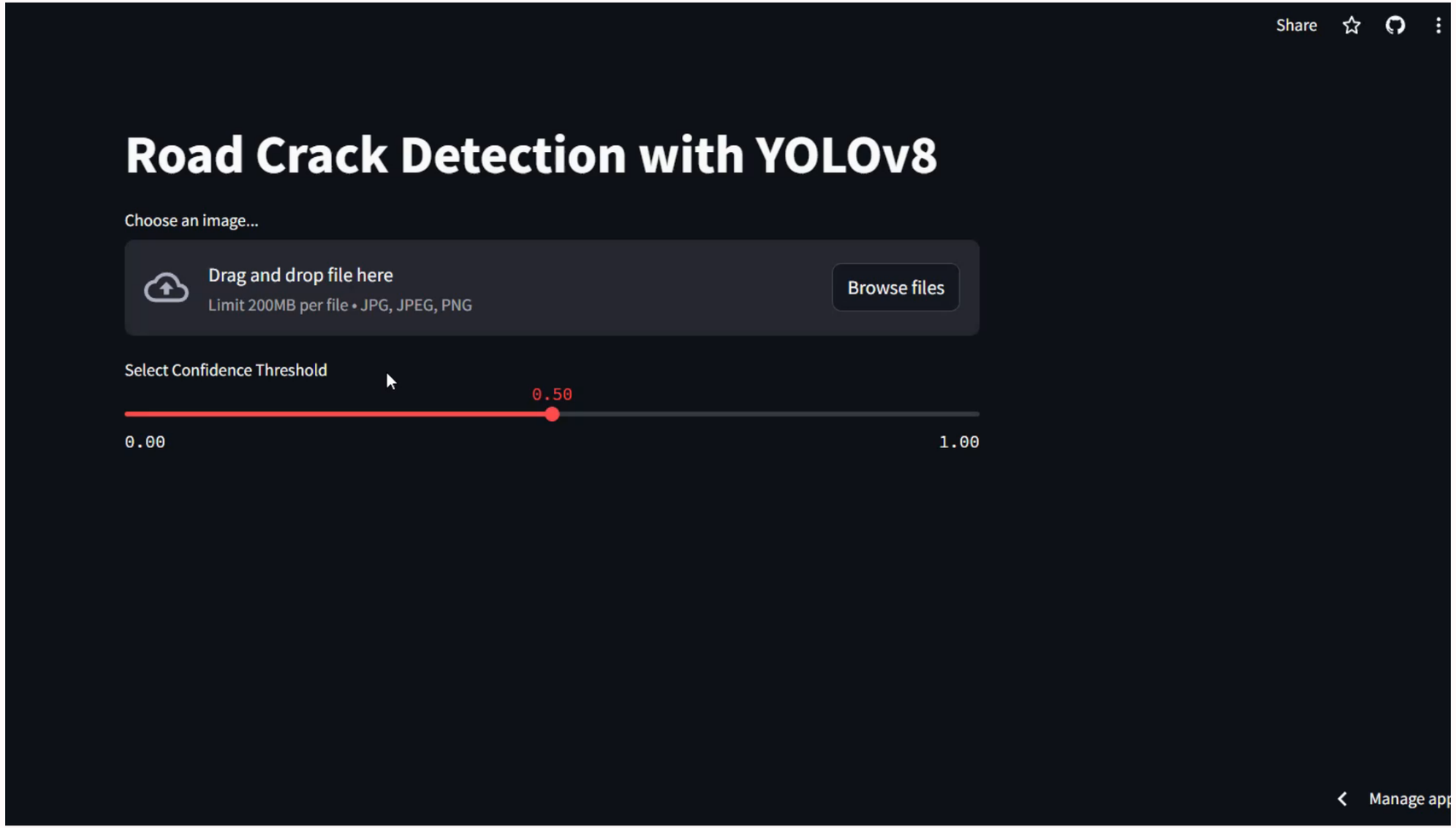

Username
Username
Email
Email
Password
Password
State
Select state
District
District
City
City
Phone Number
Phone number
Send OTP
OTP
Enter OTP
Verify
Sign Up
Already have an account? Login


Username / Email-id
Password
Forgot Password?
Login
-or-
Continue with Google
Continue with Apple
Continue with Facebook
Don't have an account? Register

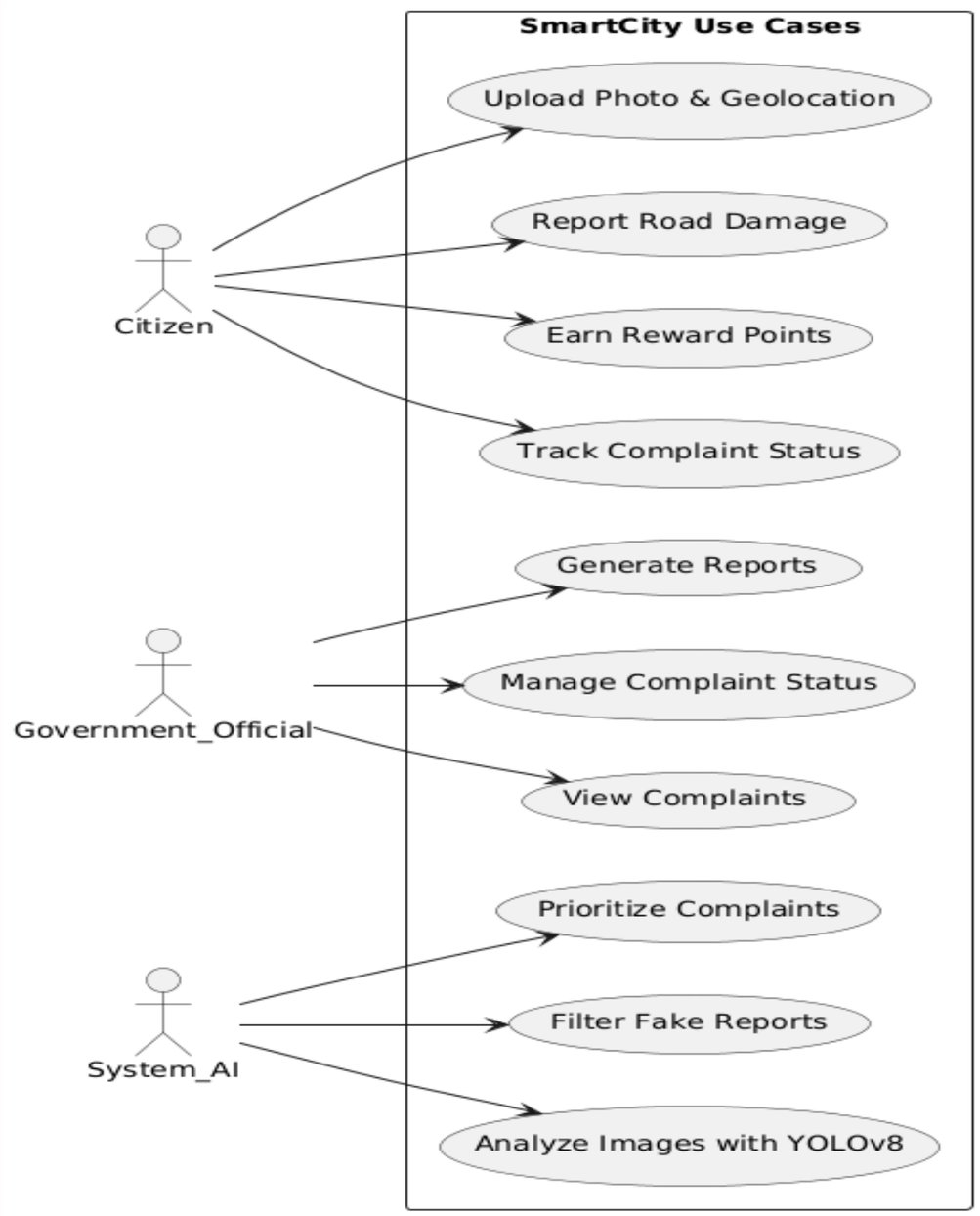
Prototype


SmartCity
Dashboard
Users
Cases
Case Report
Rewards
Settings
Sign Out
Admin
SmartCity
Dashboard
Map
Create a Report
Dashboard
Export
Total Users
5000
Total Cases
4500
Solved Cases
3000
Pending Cases
1500
High Priority
5000
Medium Priority
5000
Low Priority
5000
Solved vs Pending Cases
100
75
50
25
0
Jan
Feb
Mar
Apr
May
June
July

Model Demo


Share
Road Crack Detection with YOLOv8
Choose an image...
Drag and drop file here
Limit 200MB per file • JPG, JPEG, PNG
Browse files
Select Confidence Threshold
0.50
0.00
1.00
Manage app

Use case diagram



Tech Stack

Front-end

•React.js 18.x
•Redux Toolkit
•Material-UI (MUI) v5
•Mapbox GL JS (Maps)
•Vite (Build Tool)

Back-end

•Node.js 20.x
•Express.js 4.x
•Passport.js (JWT + OAuth2.0)
•Bull + Redis (Background Jobs)

Database

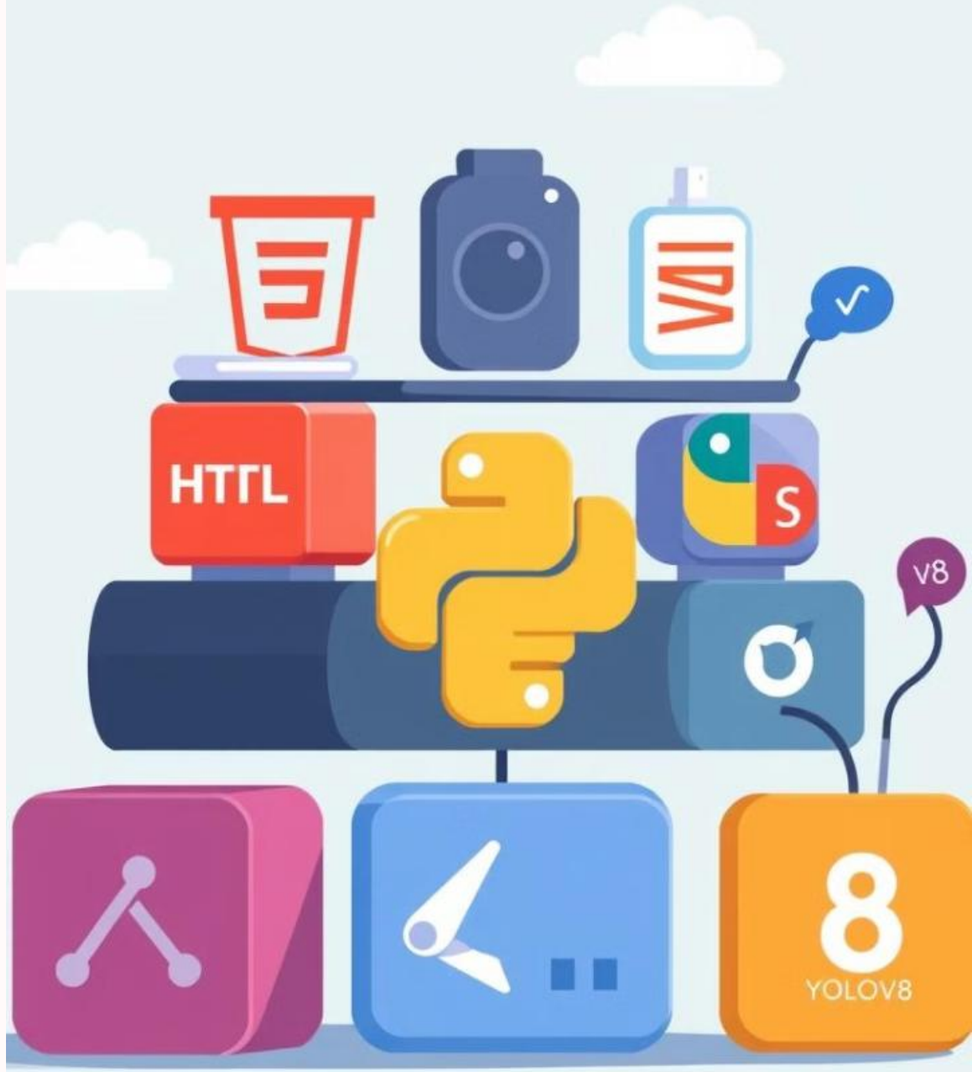
•MySQL 8.0 (Primary Database)
•Redis 7.x (Caching)
•Elasticsearch (Search & Geospatial)

Object Detection

•YOLOv8/YOLOv9tr
•TensorFlow Serving
•OpenCV

Infrastructure & DevOps

•Docker & Kubernetes (EKS)
•GitHub Actions (CI/CD)
•AWS ALB & CloudFront (Load Balancer & CDN)
•Prometheus + Grafana (Monitoring)



SWOT Analysis

Strengths:

- Community-driven with user incentives
- Integration with local governments for quicker repairs
- AI-powered verification for accuracy
- Precise geotagging for efficient reporting
- Scalable to cover more infrastructure issues

Weaknesses:

- High initial development and operational costs
- Dependent on internet connectivity and government cooperation
- Privacy concerns over data collection
- Need for user education to avoid misuse

Opportunities:

- Rising demand for smart city solutions
- Potential for government and corporate partnerships
- Expansion to other infrastructure issues (e.g., drainage, street lights)
- New revenue streams (ads, premium features)

Threats:

- Privacy and trust issues among users
- Competition from similar civic reporting platforms
- Potential for misuse or false reporting
- Dependency on prompt government response

Comparison of Road Complaint Platforms in India

Feature	SmartCity	FixMyStreet (Other Country)	Traditional Reporting	Meri Sadak (PMGSY Roads)	Rajmarg Yatra (National Highways)	e-Nagar (Urban Local Bodies)
AI-powered verification	✅	❌	❌	❌	❌	❌
Geotagging	✅	✅	❌	✅	✅	✅
Multi-issue reporting	✅	✅	❌	❌	❌	✅
User incentive program	✅	❌	❌	❌	❌	❌
Real-time status updates	✅	✅	❌	✅	✅	✅
Integration with govt systems	✅	❌	✅	✅	✅	✅

Impact and Benefits

1. **Enhanced Civic Engagement**

•Empowers Citizens
- Active participation in reporting infrastructure issues
- Direct role in improving local environment
- Increased sense of community ownership

•Fosters Accountability
- Real-time tracking of report progress
- Improved transparency in local governance
- Builds trust between citizens and authorities

2. Improved Infrastructure Management

•Faster Response Times
- AI-powered verification reduces processing time by up to 60%
- Geotagging ensures precise issue location
- Quicker repairs improve public safety

•Efficient Resource Allocation
- AI-driven prioritization of critical issues
- Up to 30% reduction in resource wastage
- Focus on high-impact repairs

Impact and Benefits

3. Aid to Political Accountability

- Political Insight
  - Data-driven showcase of infrastructure improvements
  - Quantifiable metrics for election campaigns
- Election Campaign Tool
  - Voters can access verifiable data on local improvements
  - Informed decision-making based on tangible results
- Transparency in Governance
  - Political parties can present concrete achievements
  - Fosters trust and credibility in the political process

4. Economic and Environmental Benefits

- Reduced Vehicle Maintenance
  - Well-maintained roads can cut vehicle repair costs by up to 25%
  - Lower fuel consumption due to smoother road surfaces
- Environmental Impact
  - Potential 15% reduction in CO_2 emissions from improved traffic flow
  - Decreased material waste from timely infrastructure repairs

5. Supporting Sustainable Development

- Long-Term Growth
  - Contributes to efficient, resilient urban and rural development
- Data-Driven Urban Planning
  - Insights from reported issues guide future infrastructure development
  - Proactive approach to urban challenges

Redeem Points System – Why It’s Useful

- Why People Will Use It? (Indian User Mentality)
  - •Indians love rewards & discounts – Offering redeemable points for local restaurants, shopping malls, and stores attracts more engagement.
  - •Encourages participation – More reports = more points = more rewards.
  - •Gamification works – Earning badges, ranking on leaderboards, and getting incentives makes people more involved.
  - •Cashless savings – Users can redeem discounts without spending extra money.

- How It Works?
  - 1️⃣ Earn Points – By reporting road damage, confirming fixes, or daily logins. 2️⃣ Redeem Points – Exchange points for discounts on food, shopping, transport, etc. 3️⃣ Win Exciting Offers – Special seasonal offers to keep users engaged. 4️⃣ Partnered Businesses – Coupons for local vendors boost local economy.

- Why This Works for SmartCity?
  - ✅ Higher Engagement – More users will report road issues actively. ✅ Encourages Honesty – Users verify fixed issues for additional points. ✅ Supports Local Economy – Drives business to partner shops/restaurants. ✅ Government-Friendly – Shows higher citizen involvement in infrastructure improvement.

🚀 This system turns road reporting into an exciting & rewarding experience, making SmartCity more effective!

Conclusion

The **SmartCity** platform empowers citizens to actively participate in urban infrastructure maintenance by reporting road damage through an AI-based system. The solution leverages **YOLOv8** for automated image analysis and geotagging, ensuring accurate and verified complaints. With its community-driven approach, the app enhances **transparency, civic engagement, and efficient resource allocation**. Additionally, the **redeem points system** encourages participation while supporting local businesses. By integrating smart technologies, SmartCity contributes to **improving road safety, political accountability, and environmental sustainability**, making cities smarter and more resilient.

THANK YOU