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CivicSense: A Unified AI-Powered Platform for Smart Complaint Management, Stress Analysis, Predictive Governance, and Automated Citizen Engagement

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Abstract: *Managing public complaints in urban areas has become increasingly complex, often resulting in delayed responses and reduced citizen satisfaction. Existing systems depend largely on manual operations, provide limited real-time visibility, and lack the ability to anticipate critical situations such as rising stress levels in specific regions. To address these challenges, this paper presents CivicSense, an AI-enabled web application aimed at improving civic issue management through intelligent automation and analytical insights. The platform combines several key modules within a single system. It allows citizens to submit complaints with relevant details, including location, category, severity, and supporting media. An integrated stress analysis component evaluates complaint patterns to determine area-wise stress levels, while a verification mechanism helps identify invalid or misleading submissions. Additionally, an interactive dashboard offers administrators clear visual summaries of trends, distribution, and system performance. Built using Angular, ASP.NET Core, and SQL Server, the system also supports notifications and role-based access. The proposed solution enhances efficiency, improves data reliability, and enables authorities to respond proactively, making it a practical approach for modern urban governance.*

Keywords: *Smart City*

I. INTRODUCTION

Rapid urbanization has increased the number of civic issues such as water supply failures, road damage, and waste management problems, making efficient complaint handling essential. However, existing systems are often manual, lack transparency, and do not provide real-time insights, leading to delays and poor decision- making. These systems also fail to analyze complaint patterns, making it difficult for authorities to identify high-risk areas and take proactive action.To overcome these limitations, CivicSense is proposed as an AI-powered web platform that integrates complaint management with data analysis. It allows citizens to submit complaints with details such as area, category, severity, and media proof. The system analyzes complaint data to determine area-wise stress levels and detect invalid complaints, while providing real-time insights through a dashboard. With features like notifications and role-based access, CivicSense improves efficiency, transparency, and supports proactive urban governance.

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II. RELATED WORK

Many existing systems have been developed to improve civic complaint management and urban governance. Traditional systems mainly focus on complaint registration and tracking, offering basic features but lacking intelligent analysis, real-time insights, and predictive capabilities. Modern platforms have introduced online portals and mobile apps with features like location tagging and image uploads, improving accessibility. However, most of these systems still work reactively and do not analyze overall patterns or trends. Recent research has explored data analytics and machine learning to identify common issues and high-risk areas, but these solutions are often standalone and not part of a complete system. Similarly, AI-based methods for detecting fake complaints are limited in scope. To address these gaps, CivicSense provides an integrated platform combining complaint management, stress prediction, validation, and real-time analytics, enabling more efficient and proactive urban governance.

III. LITERATURE REVIEW

1. NLP Based Grievance Redressal System
Authors: Alok Pratap Singh, Ankur Goel, Aakansha Goel, Diksha Arya
Explanation:
This system uses Natural Language Processing (NLP) to analyze and classify public complaints collected from social media platforms like Twitter. It categorizes tweets into complaints, suggestions, and feedback using machine learning algorithms such as Naïve Bayes, Decision Tree, and Random Forest. The system helps government departments understand citizen issues in real time and improves service response efficiency.

2. Smart Government E-Services for Indian Railways Using Twitter
Authors: Mukta Goyal, Namita Gupta, Ajay Jain, Deepa Kumari
Explanation:
This research focuses on using Twitter as a platform for handling public complaints in railway services. It enables real-time communication between citizens and authorities, improving transparency and responsiveness. The system collects tweets and routes them to relevant departments for action.

3. Sentiment Analysis on Tweets for Trains Using Machine Learning
Authors: Sachin Kumar, Marina I. Nezhurina
Explanation:
This study applies machine learning techniques like Artificial Neural Networks and Random Forest to analyze sentiments in railway-related tweets. It helps in identifying public opinion and categorizing feedback into positive and negative sentiments.

4. Railway Complaint Tweets Identification Using Machine Learning
Authors: Nadeem Akhtar, M. M. Sufyan Beg
Explanation:
This research introduces a graph-based approach combined with machine learning to identify complaint-related tweets. It improves the accuracy of detecting complaint-type messages from large volumes of unstructured data and helps in efficient categorization.

IV. PROBLEM STATEMENT

Urban areas are increasingly struggling to handle public complaints effectively because of growing population and infrastructure needs. Traditional systems depend on manual processes or basic digital platforms that only allow users to register and track complaints. This leads to delays, a lack of transparency, and poor communication between citizens and authorities. These systems respond only after an issue is reported and do not provide real-time insights or data-

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driven analysis. As a result, service delivery suffers and public trust declines. Furthermore, current solutions do not have ways to verify the authenticity of complaints. This makes them open to spam or false reports that waste administrative resources. Authorities lack tools to analyze complaint patterns, identify high-risk areas, or predict future problems, which limits their ability to take preventive actions. Therefore, there is a need for a smart and integrated system that not only manages complaints but also ensures validation, predictive analysis, and real-time monitoring. This would support proactive governance and improve urban management overall.

V. PROPOSED SYSTEM OVERVIEW

The proposed system, CivicSense, is an AI- powered web platform designed to improve public complaint management and support smart urban governance. It allows citizens to report issues such as road damage, garbage, and water supply by providing details like area, category, severity, and media proof. This makes the process more structured, transparent, and accessible. The system also provides a centralized dashboard for administrators to monitor and manage complaints. It includes AI- based features like stress prediction and complaint validation, along with real-time analytics for better decision-making. Additional features such as role-based access, status tracking, and notifications enhance efficiency, making CivicSense a smart and proactive solution for handling urban issues.

VI. SYSTEM ARCHITECTURE

The proposed system, CivicSense, is a web- based platform designed to connect citizens, administrators, and governing authorities through a unified interface for efficient civic issue management. The primary aim of the system is to digitize the complaint process, ensure transparency, and support intelligent decision-making using data analytics and AI techniques. It manages user information, complaint records, and media evidence while providing real-time insights for better governance.

1. Modules

1.1 Citizen Module:

This module allows users to create an account and securely access the system. Citizens can report issues by entering details such as complaint category, ward or location, severity level, and a description. They can also upload supporting images or videos as proof. Once submitted, users can monitor the progress of their complaints and view updates such as pending, ongoing, or resolved status.

1.2 Admin Module

The administrator module provides complete control over complaint handling and system monitoring. Admin users can view all complaints, analyze area-wise distribution, and update complaint statuses based on verification. This module also allows administrators to review uploaded media, prioritize issues, and manage users efficiently, ensuring smooth system operation.

1.3 AI Processing Module

This module focuses on intelligent analysis of complaint data. It evaluates factors such as the number of complaints, severity levels, and response delays to determine stress levels in different areas. Additionally, it can be used to examine uploaded media files to identify invalid or misleading complaints. The output helps classify regions into different stress categories, enabling proactive action.

1.4 Authority Module

This module is intended for higher- level monitoring and decision-making. Authorities can access summarized reports, visualize complaint trends, and observe area-wise performance through dashboards. This supports better planning, resource allocation, and timely intervention in critical areas.

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2. Backend Architecture

The system follows a layered architecture to handle different operations efficiently:

- Frontend (Angular): Provides an interactive user interface for all system users.
- Backend (ASP.NET Core): Manages application logic, authentication, complaint processing, and API services.
- Database (SQL Server): Stores user data, complaint details, status updates, and system records in a structured format.
- AI Layer (Python / Rule-Based Models): Performs data analysis, stress prediction, and validation of complaints.
- Media Handling: Stores and retrieves uploaded images and videos securely for verification purposes.

3. System Workflow

- A user registers and logs into the system.
- The user submits a complaint with relevant details and optional media evidence.
- The complaint is recorded in the database with an initial status.
- The administrator reviews the complaint and updates its status after verification.
- The AI module analyzes complaint data to determine area-wise stress levels.
- The system generates insights and displays them on the dashboard.
- Notifications are sent to users for important updates such as complaint submission and status changes.

4. Notification and Status Handling

- Users receive confirmation messages upon successful registration.
- Notifications are generated when a complaint is submitted.
- Updates are sent when the complaint status changes (e.g., in progress or resolved).
- All status changes are updated in the database and reflected in the user interface in real time.

VII. IMPLEMENTATION DETAILS

The implementation of the proposed CivicSense System is divided into key stages: User Registration and Complaint Submission, Complaint Processing and Management, AI- Based Analysis, and Notifications and Updates.

User Registration and Complaint Submission

Users, including citizens and administrators, access the system through secure login. Citizens can register, log in, and submit complaints by providing details such as complaint type, area, severity, description, and optional media proof. All data is validated and stored securely to ensure accuracy and privacy. Each complaint is recorded with an initial status like Pending and assigned a unique ID for tracking. The data is stored in a centralized database for further processing and analysis.

Complaint Processing and Management

After a complaint is registered, it is available for admin review. The admin can view details, verify media, and update the complaint status. Complaints are categorized and prioritized based on severity and type. The system stores all records and updates them in real time. The dashboard provides filtered views by status, area, or category, helping admins manage complaints efficiently.

AI-Based Analysis

The system includes an intelligent analysis component that processes complaint data to generate meaningful insights. It evaluates factors such as complaint frequency, severity levels, and resolution delays to estimate the stress level of different areas. Based on this analysis, areas are classified into categories such as Low, Medium, or High Stress. Additionally, the system can analyze uploaded media files to identify suspicious or invalid complaints. This helps

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reduce spam and ensures that administrative efforts are focused on genuine issues. The results of this analysis are displayed on the dashboard in the form of charts and reports for better understanding.

Notifications and Updates

The system provides real-time notifications to keep users informed about important events. When a user registers or submits a complaint, a confirmation message is generated. Updates are also sent when the complaint status changes, such as when it moves to In Progress or Resolved. These notifications can be delivered through email or SMS.Users can track the status of their complaints directly through the system interface, while administrators receive alerts for pending complaints that require action. This ensures timely communication and faster resolution of issues.

Data Storage and History

All complaint records, user details, and status updates are stored in the database for future reference. Users can view their past complaints, while administrators can analyze historical data to identify trends and recurring issues. This stored information supports better planning, improved decision-making, and faster handling of similar problems in the future.

SYSTEM ARCHITECTURE

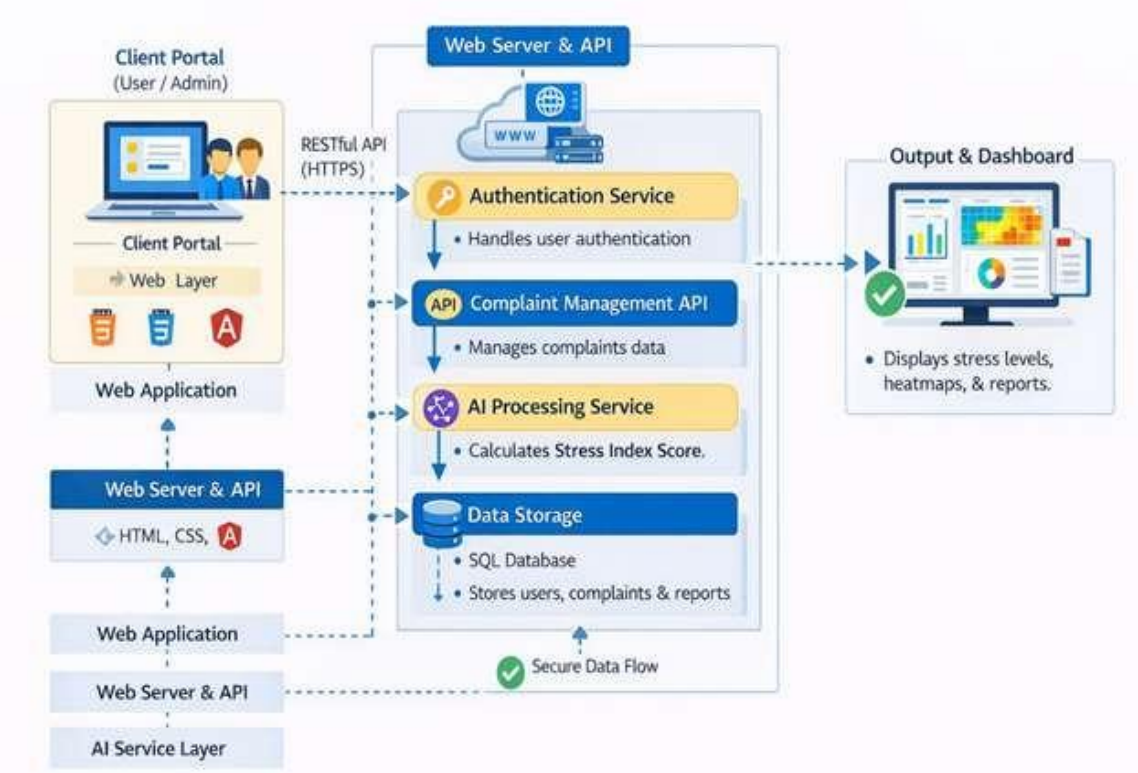

Figure 1: System Architecture

VIII. PROPOSED SYSTEM

System Architecture of the proposed CivicSense system is based on an integrated web platform for complaint handling, verification, analysis, and monitoring.

Our proposed system will function in the following steps:

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Step 1: User Registration
Citizens and administrators register in the system using their required details.

Step 2: Login and Authentication
The system verifies users through secure login and role-based authentication.

Step 3: Complaint Submission Citizens submit complaints by entering complaint type, area or ward, severity, description, and optional image or video proof.

Step 4: Complaint Storage and processing The submitted complaint is stored in the database with an initial status, and it becomes available for admin review.

Step 5: Complaint Verification
The administrator checks complaint details and supporting media to confirm whether the issue is valid and requires action.

Step 6: AI-Based Analysis
The system analyzes complaint data such as frequency, severity, and pending duration to identify area-wise stress levels and complaint trends.

Step 7: Status Update and Monitoring The admin updates the complaint status as Pending, In Progress, or Resolved, while authorities monitor reports through the dashboard.

Step 8: Notification System
Users receive notifications regarding complaint registration, status changes, and resolution updates through email or SMS.

IX. ANALYSIS OF PROPOSED SYSTEM

1. Improved Efficiency and Real-Time Interaction:
CivicSense digitizes complaint handling, enabling real-time registration, tracking, and updates. Notifications reduce delays and improve communication.
2. Intelligent Analysis and Predictive Insights:
The system uses AI to analyze complaint data and identify stress levels and high-risk areas, supporting proactive decision-making.
3. Secure Role-Based Access:
Access is controlled based on user roles, ensuring data security and proper system usage.
4. Enhanced Transparency and System Reliability:
Users can track complaints in real time, while centralized data improves coordination and faster resolution.
5. MODULES
The proposed CivicSense System is divided into five main modules: Citizen, Admin, AI Analysis, Authority, and Notification. Each module is designed to perform specific functions for smooth system operation.
1. Citizen Module
Users can register, log in, and submit complaints with complete details. They can also track the status of their complaints and view past records, ensuring transparency and easy access.

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2. Admin Module

Admins manage all complaints, verify submitted data, and update complaint status. This module helps in prioritizing issues and ensuring timely resolution.

3. AI Analysis Module

This module analyzes complaint data to identify trends, stress levels, and detect invalid or spam complaints. It supports better

decision-making through data insights.

4. Authority Module

Authorities monitor system performance using dashboards and reports. It helps in identifying high-risk areas and planning effective actions.

5. Notification Module

This module sends real-time updates to users about complaint registration, status changes, and resolution through email or SMS, improving communication.

RESULTS

Home Page

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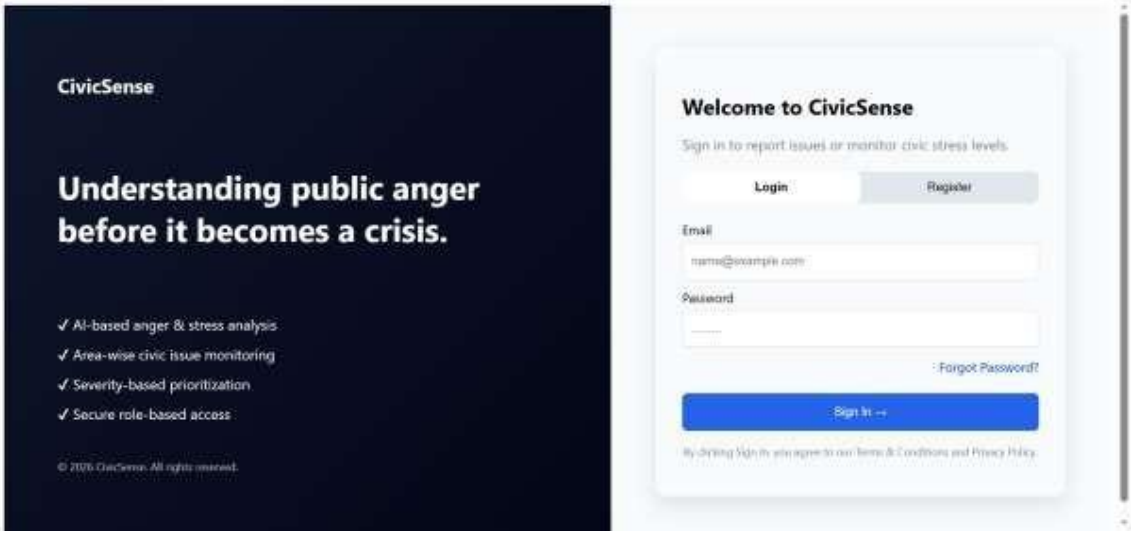

Login Page

User Dashboard

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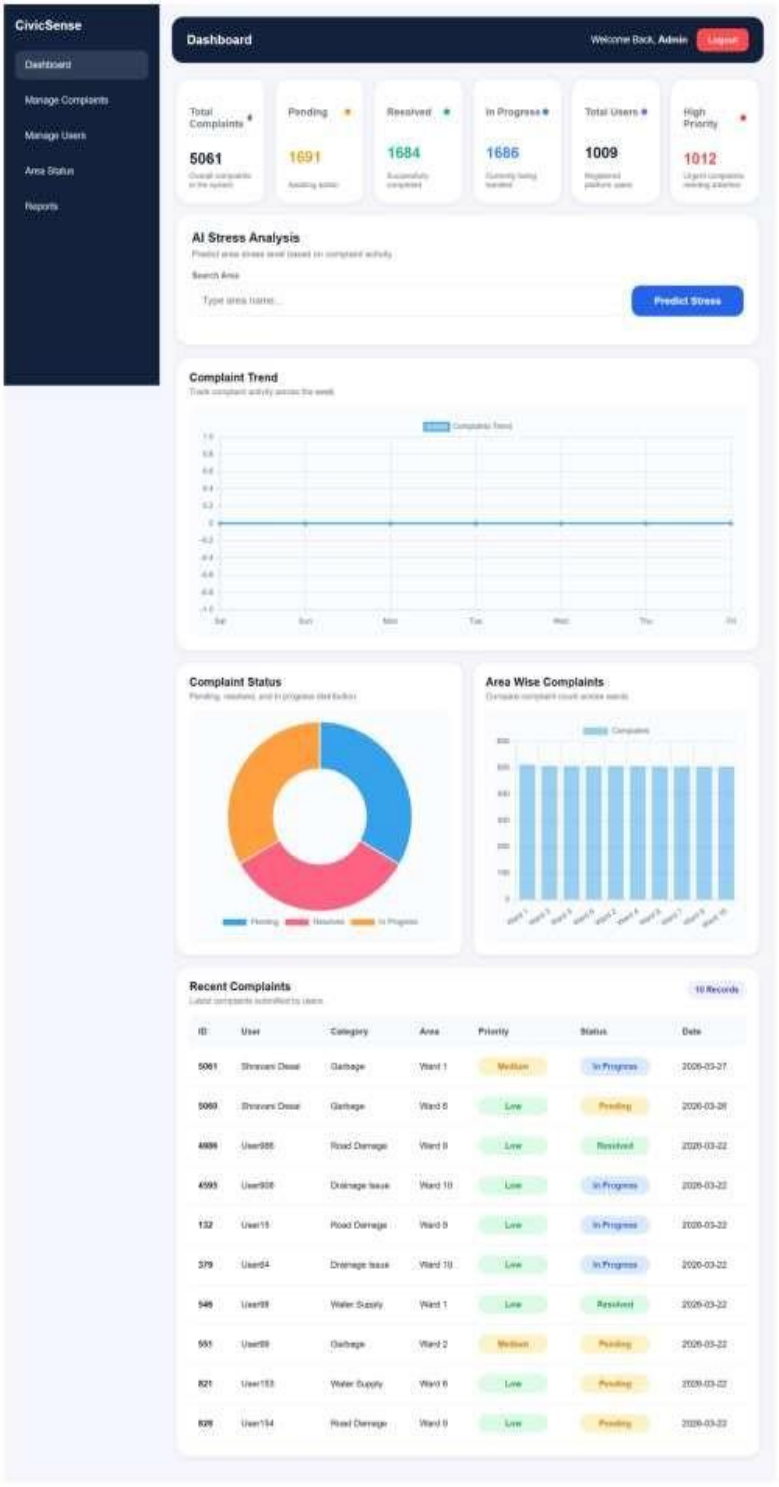

Admin Dashboard

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XI. CONCLUSION

The CivicSense system provides a modern and intelligent solution for managing public complaints in urban areas by combining digital complaint handling with AI-based analysis. It improves transparency, speeds up issue resolution, and helps authorities identify high-risk areas through data-driven insights. With features like real-time tracking, complaint verification, and predictive stress analysis, the system supports proactive governance and better decision-making. Overall, CivicSense offers a scalable and efficient approach to enhance citizen engagement and improve the quality of urban services.

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