



An AI-Based Intelligent System for Early Urban Health Risk Assessment

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Abstract: Rapid urbanization and changing environmental conditions can affect public health in many ways. Factors such as temperature, humidity, rainfall, and air quality may increase the risk of different diseases. This research proposes an AI-Based Community Health Risk Assessment System to predict possible health risks in a community. The proposed system collects real-time and historical environmental data and uses Machine Learning to analyze the data and predict health risks. Based on the prediction, the system can provide early warnings and help authorities take preventive actions. The system also includes health risk hotspot detection feature to identify high risk areas in city based on environmental conditions and predicted health risk. In addition, the system collects combined symptoms reports from citizens and collects them with environmental data and health risk prediction. Using this information, the system generates AI based community health advisories to provide useful health warnings and guidance. Overall, the system combines health risk prediction, early warning, hotspot detection, and health advisories in a single platform. It can help health authorities identify high-risk areas, take preventive measures, and make better data-based decisions to improve community health and safety.

Keywords: Artificial Intelligence, Machine Learning, Community Health, Health Risk Prediction, Environmental Data, Hotspot Detection, Early Warning System, Citizen Symptom Reports, Smart City, Public Health.

I. INTRODUCTION

The environment and weather have a major effect on the health of people living in cities. Factors such as increasing temperature, poor air quality, humidity, rainfall, and sudden weather changes can negatively affect human health. Nowadays, many cities are facing problems such as extreme heat, increasing air pollution, and irregular rainfall. These environmental changes can increase the risk of health problems such as heat stress, dehydration, asthma, allergies, and seasonal infections. The increasing population has led to the increase in the spread of diseases. Along with this, growing number of vehicles, factories, and buildings led to environmental and air pollution.

This eventually reduced the air quality and contribute global warming which can have adverse effect on human health. In facts and the older people are more vulnerable to these conditions and may face problem in respiration and other adverse health effects. The spread of diseases can also put additional stress on hospitals and healthcare staff. The healthcare system depends on historical health data to understand and manage health-related risks. However, during the health crises, action is often taken after many people are diagnosed with disease. We have a large amount of environmental data available from multiple sources only limited amount of data is being used the prediction of future health risk. This can result in delays in taking preventive actions. Without and early warning system, health authorities



may face difficulty in identifying the potential health risk and may not be able to take timely preventive measures. Artificial Intelligence have created many opportunities in the field of healthcare.

Machine learning techniques can help to identify patterns in environmental and health related data and can use these patterns to predict potential health risks. For example, high temperature, high humidity, and poor air quality can be analysed together to identify an increased risk of certain health problems. If health risks are predicted at an early stage, health authorities can provide timely warnings to citizens, prepare hospitals, and take preventive actions. However, many existing health risk prediction systems have some limitations. They may not support real-time monitoring, easy use in different cities, identification of high-risk areas, or providing useful health advice to the community. Since environmental conditions are different in every city, there is a need for a health risk system that considers local environmental conditions. It is not enough to only predict the health risk; it is also important to identify which areas have a higher risk and provide clear information to people living in those areas. To solve these problems, this project proposes an AI-Based Community Health Risk Assessment System. The proposed system combines real-time environmental data, Machine Learning-based health risk prediction, hotspot detection, and aggregated symptom reports from citizens. On the basis of the environmental conditions, the system predicts community level health risk and provides early information related to health risk which can support preventive public health actions.

The system includes a City wise Hotspot Detection feature that analyzes health risk in different areas and also help us to identify locations with high risk levels. This can help health authorities understand the area which requires attention and action to be taken immediately. In addition, the proposed system uses aggregated citizens symptom reports. The system combine environmental data, predicted health risk and symptom information reported by citizens. By analyzing this information, the system generates AI-Bases Community Health Advisories. These advisories can inform citizens about possible health risk in their area and help them take suitable preventive measures. The proposed system is designed to be flexible, scalable, and suitable for use in different urban areas. By combining environmental monitoring, Machine Learning-based health risk prediction, hotspot detection, and AI-based health advice, the system can help health authorities make better data-based decisions. This helps to find high-risk areas, taken action early, and use health resources in a better way. The main objective of the project is to monitor health risks in cities. The system helps to identify health risks early and detects area having high risks. The health related advice is also provided using AI. The system helps cities to prepare for health emergencies and reducing the health problems caused by environment. It helps in creating a safer and healthier place for people.

II. RELATED WORK

The proposed system is based on research in four main areas : (i) urban health data integration, (ii) environmental and climate-based health-risk assessment, (iii) AI and IOT based health monitoring, and (iv) scalability and practical implementation.

A. Urban Health Data Integration

Kakchapati et al.(2026) developed a system combining urban records, census data, and healthcare service information to identify areas with insufficient healthcare facilities[1]. Dashboard and live map features supported decision making. However, the study faced problems with data quality and integration of data from multiple sources.

B. Environmental and Climate Based Risk Assessment

Wang(2024) developed a fuzzy inference System using air, water, soil, and noise data to assess health risk and provide early warning[2]. However, it required high computational resources and did not consider long term health effects or individuals health differences. Marola(2023) studied climate related health risks and showed that climate change and rapid urbanization can increase disease and heat related risks[3].

C. AI and Real-Time Health Monitoring

Gong(2023) developed an IOT and cloud based healthcare system using deep learning for real time health monitoring[4]. The system achieved 95.13% accuracy but required high computational power and faced issues related to sensor quality, security, and scalability. Sapienza(2022) reviewed the use of AI in urban public and found applications in pollution, climate, housing and transportation monitoring[5]. However, evidence of actual improvement in public health remains limited.

D. Research Gap

Existing studies have limitations in data integration, real time prediction, computational requirements, scalability, and practical implementation. Few systems combine community-level health risk prediction, hotspot detection, early warnings, and AI based health advisories using citizens symptom data.



Therefore, this research proposes an AI-based Community Health risk Assessment System that combines environmental data, Machine Learning based application, hotspot detection and aggregated citizen system reports to provide early health risk information and health advisories.

TABLE I
MAPPING OF LITERATURE TO THE PROPOSED SYSTEM

Reference	Focus	Contribution to Proposed System
[1]	Urban health data and healthcare accessibility	Supports integration of urban, census and healthcare data for identifying high risk areas
[2]	Environmental health risk assessment using Fuzzy Interface System	Provides a basis for assessing health risks from environmental factors
[3]	Climate change and urban health risks	Supports early identification of climate related health risks and vulnerable areas
[4]	IOT, cloud computing, and deep learning for health monitoring	Supports the use of real time data and AI- based health risk prediction
[5]	Data integration, prediction, scalability and implementation challenges	Highlights the research gap and motivates an integrated community health risk assessment system.
[1-5]	Data integration, prediction, scalability and implementation challenges	Identifies the research gap and motivates an integrated community health risk assessment system.

III. PROBLEM STATEMENT

Problem Statement: “To provide an intelligent, AI-driven system capable of analysing environmental factors to predict urban public health risk in advance.”

IV. PROPOSED SYSTEM AND METHODOLOGY

The proposed system follows the Agile Software Development Life Cycle (SDLC) methodology. Agile methodology is selected because new data sources, prediction techniques, hotspot detection features, or health advisory modules may need to be added during the development of the project. Agile allows different modules of the system to be developed, tested, and improved step by step. Therefore, the proposed system can be more flexible, scalable, and adaptable.

A. Planning

The main aim of the proposed system is to predict community level public health risks based on environmental conditions and provide timely information to health authorities. The system collects real-time environmental information such as temperature, humidity, rainfall, and air quality. Based on this information, the Machine Learning model predicts possible health risks and provides a Low, Moderate, or High risk level. The system collects real-time environmental information such as temperature, humidity, rainfall and air quality. Based on this information the ML model predicts possible health risk and provides Low, Moderate, or High risk levels. The system also analyzes risk level in different urban areas to identify high health risk hotspot. In addition, aggregated symptom report collected from citizens are combined with environmental data and predicted health risk based on this information, AI system generate community health advisories for citizens and health authorities. This can help them take preventive action before a serious health problem occurs.

B. Analysis

The following main functions of the proposed system are analyzed:

1. Environmental Data Collection– Collecting real time environmental information such as humidity, temperature, rainfall and air quality.
2. Community Health Risk Prediction-Using ML model to predict possible health risk based on environmental conditions.
3. Early Health Risk Information– Providing timely health risk information to citizens and health authorities based on predicted risk.
4. Health Risk Hotspot Detection– Analysing risk level in different areas to identify high risk urban regions.



5. AI-Driven health Advisory–Analysing environmental conditions, predicted health risk ,and aggregated citizen symptom reports to generate useful health advice for the community.

C. Design

The proposed system is an AI based system for monitoring community health risks. It collects environmental data such as air quality, humidity, rainfall along with symptom reports from citizens .The collected data is cleaned and processed to remove errors and missing information. Then AI/ML are used to analyse the data and predict possible health risk as a Low, Moderate and High .The system also identifies high risk urban areas or health risk hotspot to help health authorities focus on areas that needed more attention. Environmental conditions, predicted health risk, and aggregated citizen symptom reports are used to generate AI-driven community health advisories with information about health risks, precautions and preventive measures. Important results such as risk level ,hotspot location, environmental conditions and health advisories are displayed on user friendly dashboard using charts, graphs and maps.

D. Implementation

The proposed system is developed step by step using the agile methodology collects environmental data such as temperature, humidity, rainfall, air quality through APIs, along with citizen reports. The data is cleaned and processed, and a Machine Learning model predicts community health risks as Low, Moderate, or High. The system also identifies high-risk areas or health-risk hotspots. Environmental data. Predicted risks, citizens symptoms are used to generate AI-based health advisories .The results are shown on a user friendly dashboard using charts, graphs and maps. Finally the system is tested and deployed on a web server. In the future ,more cities ,data sources, and advanced AI/ML models can be added to improve the system.

V. SYSTEM DESIGN

Our system consists of five major components: data collection, data processing , machine learning , risk assessment and data storage. The data collection component receives the environmental data such as temperature , humidity , rainfall and AQI, along with citizen symptom reports. The data processing component performs feature engineering and prepares the input for the ML Model. The machine learning component uses two random forest models , where one predicts health risk category and other predicts the possible disease. The risk assessment component calculates the disease risk, hotspot score and community risk using the ml results and environmental conditions. Finally, the storage component maintains users, predictions , weather data , symptom result and risk assessment in MySQL. These components work together to generate health alerts, community advisories, and city wise risk information.

VI. ARCHITECTURE

The AI-Based Intelligent System for Early Urban Health Risk Assessment is designed to monitor environmental conditions and identify potential health risks in urban communities. The system collects real-time data from environmental APIs, citizen symptom reports, temperature, humidity, rainfall, and air quality sources. The Data Ingestion Service gathers this information and stores it in the raw data storage. The Data Processing Engine performs data cleaning, normalization, and feature extraction to prepare the data for analysis. The processed data is stored in the Feature Store and used by the Machine Learning Training Pipeline to train models for predicting health risks.

The Advanced AI Core analyses environmental and health-related data to identify disease patterns and detect high-risk areas or hotspots. It also uses AI and Natural Language Processing (NLP) to generate health advisories, preventive measures, and early warnings. The Main Backend Service manages user requests, risk predictions, and advisory information, while the API Gateway enables communication between the client application and backend services. The Visualization Service presents the results through graphs, charts, indicators, heatmaps, and geographical hotspot maps. Finally, the dashboard provides real-time alerts and community-specific health recommendations to citizens and authorities. This system supports early identification of potential disease outbreaks and helps authorities take timely preventive actions to improve public health and reduce health risks in urban areas.

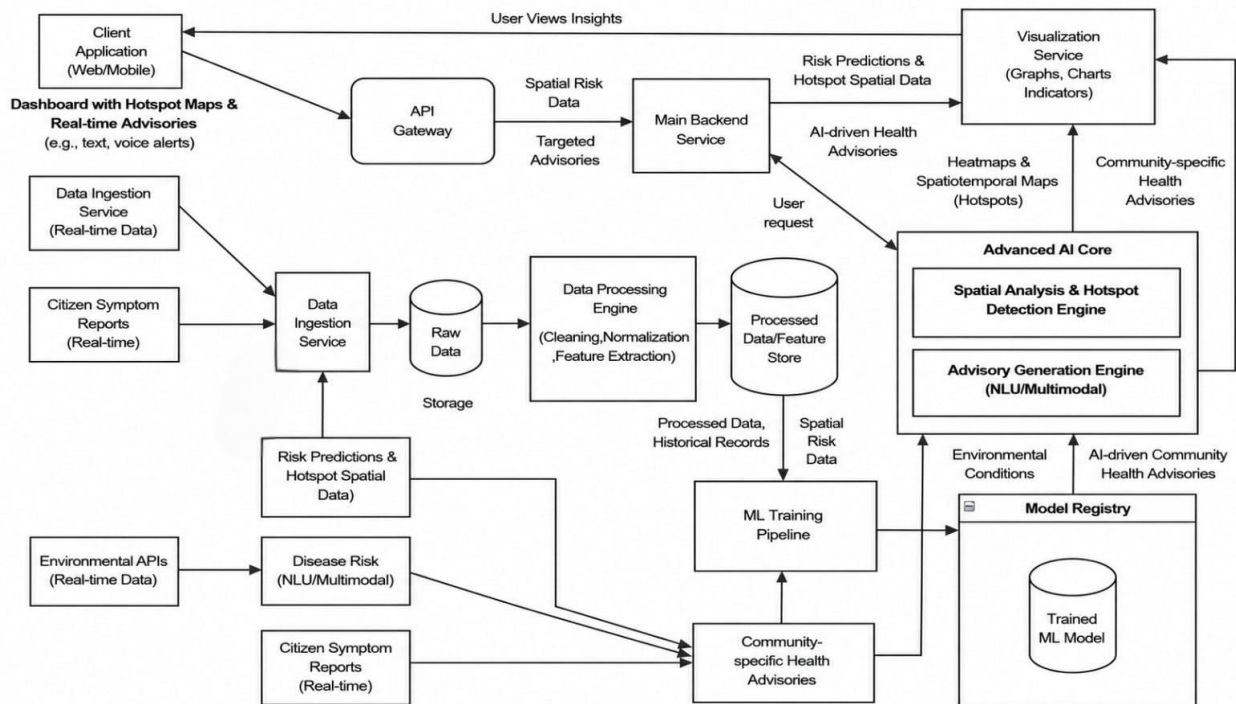


Fig. 1 System Architecture

VII. RESULTS

A. User Dashborad

Fig. 2 The image shows the main dashboard of the system. It displays important information such as high risk low risk areas average AQI and temperature. Charts are used to show air quality and risk distribution in different cities. It gives a quick and clear overview of the health risk data.

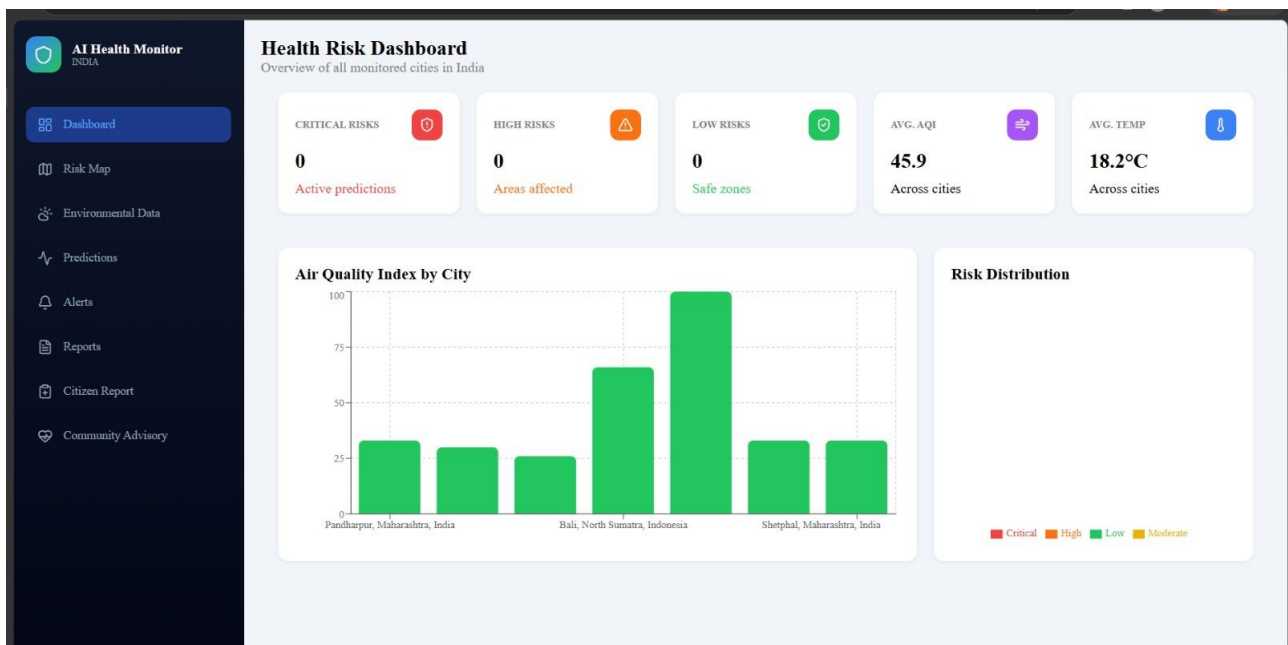


Fig. 2 User Dashboard



B. Risk Map

Fig. 3 This image shows an interactive map with different cities marked on it. Each marker represents the healthcare risk level of that location. Users can click on the markers to get more details. It helps users easily understand risks based on location.

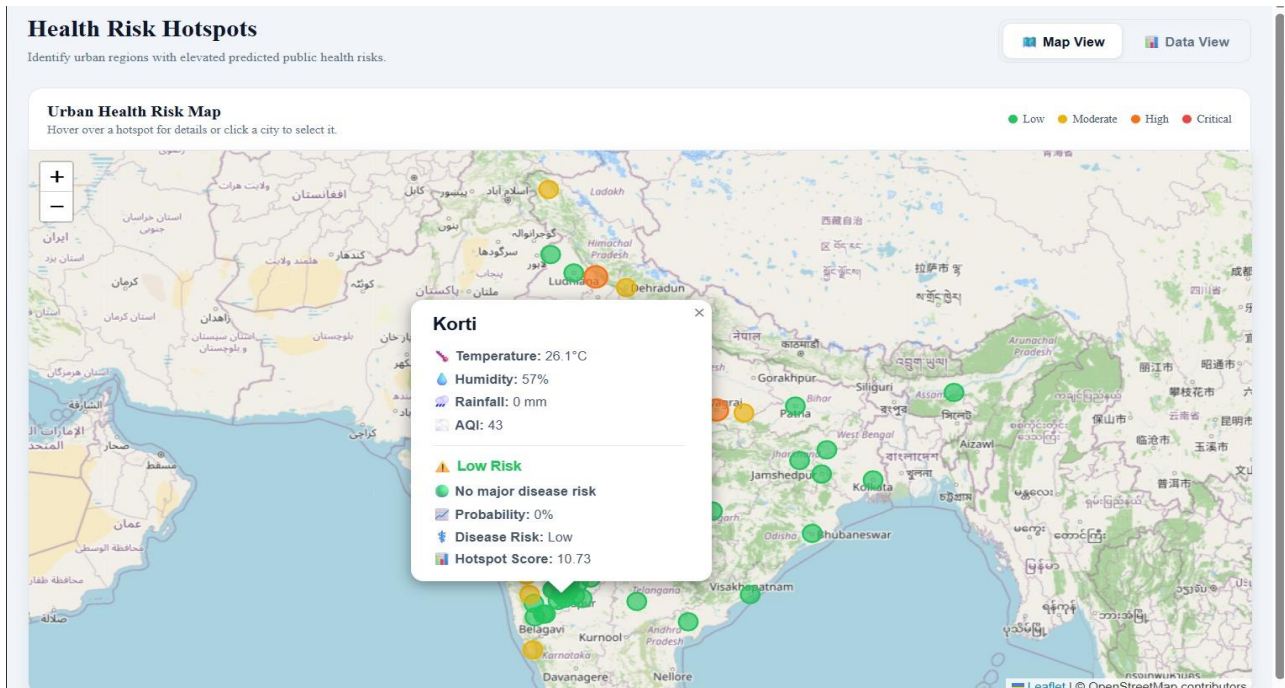


Fig. 3 Risk map

C. Environmental Data

Fig. 4 The image shows detailed environmental data for a specific city. It includes temperatures, humidity, AQI, wind speed, UV level and rain. The data is shown clearly along with a visual chart. There is also a message indicating that the data has been updated. It helps users understand the current environmental condition of the city.

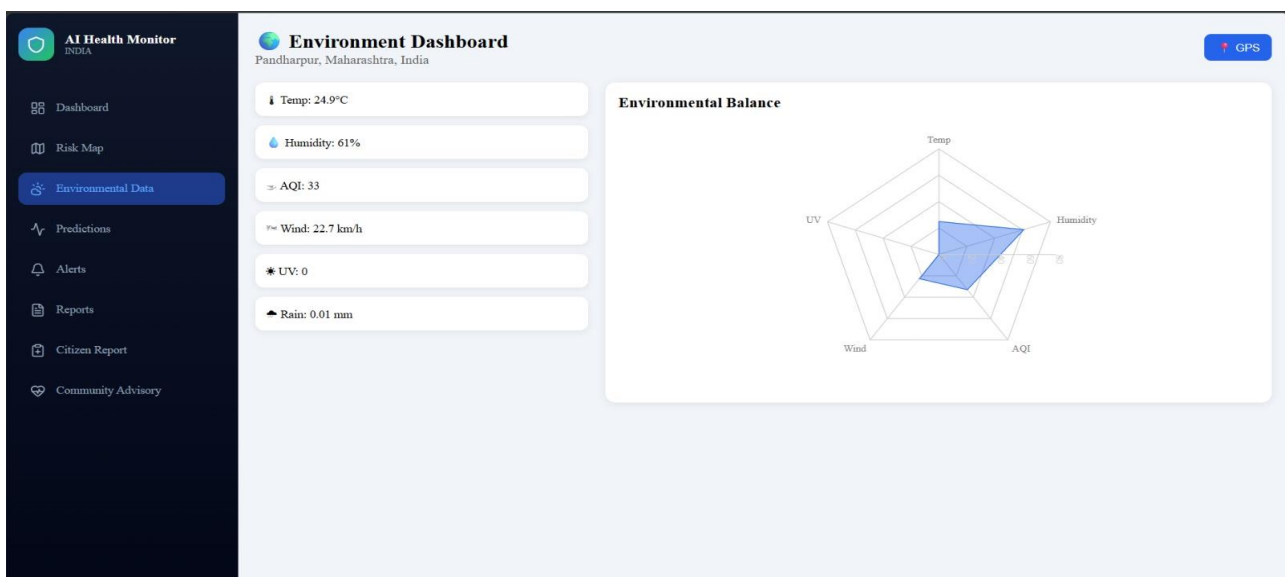


Fig. 4 Environmental Data

D. AI Prediction

Fig. 5 The image shows the Prediction section of an AI Health dashboard. Here, a user can enter a location or use their current location to get health risk predictions. The system displays cards for different cities, showing possible issues like



dehydration or heatstroke. Each card includes the place name, cause (like high temperature), risk level, and probability percentage. There is also a delete button to remove any prediction. Overall, it helps users understand future health risks based on weather conditions.

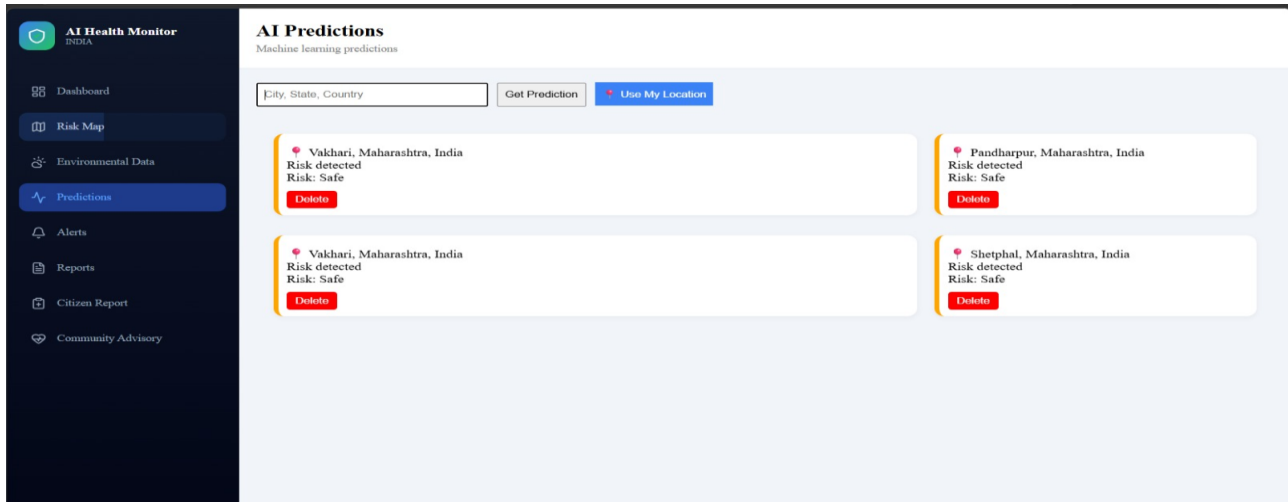


Fig. 5 AI Prediction

E. Health Alerts

Fig. 6 The image shows the health alerts which gives real time updates for different locations. It displays current temperature, humidity, and air quality index AQI for each place. Based on this data it highlights possible health issues like dehydration or hypothermia. Each alert also shows the risk level, such as medium or high. This section is useful for quickly checking current conditions and staying safe.

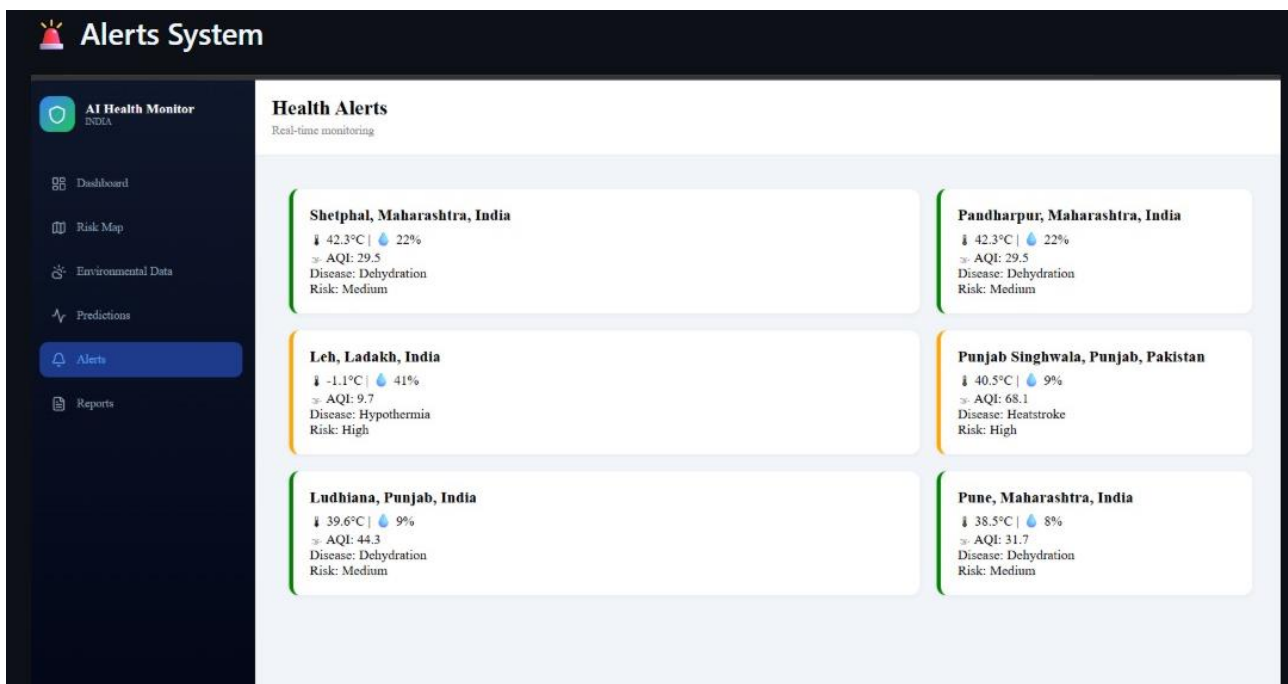


Fig. 6 Health Alerts

F. Community Advisory

Fig. 7 The image shows the community health dashboard of the AI health Monitor. It allows users to enter an area and generate a community assessment. The dashboard displays current environmental conditions, community symptoms, and environmental health predictions. It also provides an overall community risk, which is shown as moderate in the image.



Overall, the dashboard summarizes the community environmental conditions, symptoms, predicted health effects, and health risk.

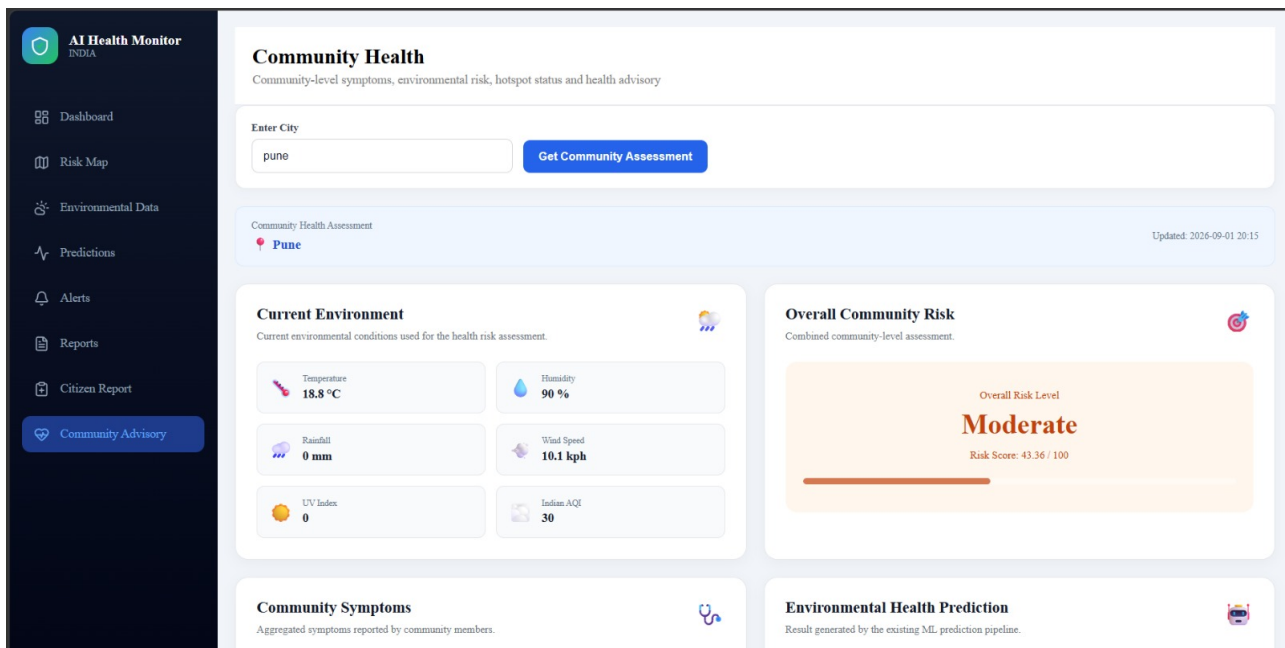


Fig. 7 Community Advisory

G. Admin Dashboard

Fig. 8 The image shows the main dashboard of the AI Health Monitor system. It gives a simple live overview of environmental conditions across different cities. At the top, it displays key information like total cities monitored, average AQI, and average temperature. In the center, a bar chart shows the Air Quality Index of different cities. On the right side, a donut chart shows risk distribution such as low, moderate, high and critical. Overall, this page helps quickly understand pollution levels and health risk status in one place.



Fig. 8 Admin Dashboard

H. Prediction Record Page



Fig. 9 The image shows a table of all disease prediction records stored in the system. It contains important details like date, city, temperature, humidity, and AQI values. Each record also shows the predicted diseases category such as Heat related or cold related conditions. The risk level is clearly marked using labels like low, medium and high along with prediction probability. This page helps in tracking and Analysing all past predictions in an organized way.

Date	City	Temp	Humidity	AQI	Category	Risk	Probability
31 Aug	Vakhari, Maharashtra, India	25.7°C	58%	49	Vector-borne	Medium	43.86%
19 Aug	Pandharpur, Maharashtra, India	29°C	45%	68	Normal / No Disease Risk	Low	-
13 Aug	Vakhari, Maharashtra, India	28°C	59%	55	Vector-borne	Medium	42.11%
12 Aug	Shetphal, Maharashtra, India	27.5°C	59%	60	Vector-borne	Medium	42.98%
12 Aug	Pandharpur, Maharashtra, India	27°C	62%	15	Vector-borne	Medium	45.61%
07 May	Shetphal, Maharashtra, India	38.3°C	31%	52.7	Heat-related	Medium	61.32%
27 Apr	Vakhari, Maharashtra, India	42.2°C	22%	44.3	Heat-related	Medium	51.79%

Fig. 9 Prediction Record Page

I. Summary Dashboard

Fig. 10 The image shows a simple summary of all prediction data in the system. It shows the total number of predictions made so far and highlights the most common disease category. Below that, a distribution chart shows how cases are divided into heat-related, cold-related, and normal categories. This helps users quickly understand overall patterns and trends. It gives a clear and short view of system performance.



Fig. 10 Summary Dashboard

J. Prediction Report

Fig. 11 The image is used for downloading the full prediction report of the system. It contains a simple card with a short description of the report. A button is provided to download report in CSV format. The report includes all weather and



disease prediction data. This feature is useful for saving, sharing, or Analysing data offline. It makes data access very easy for users.

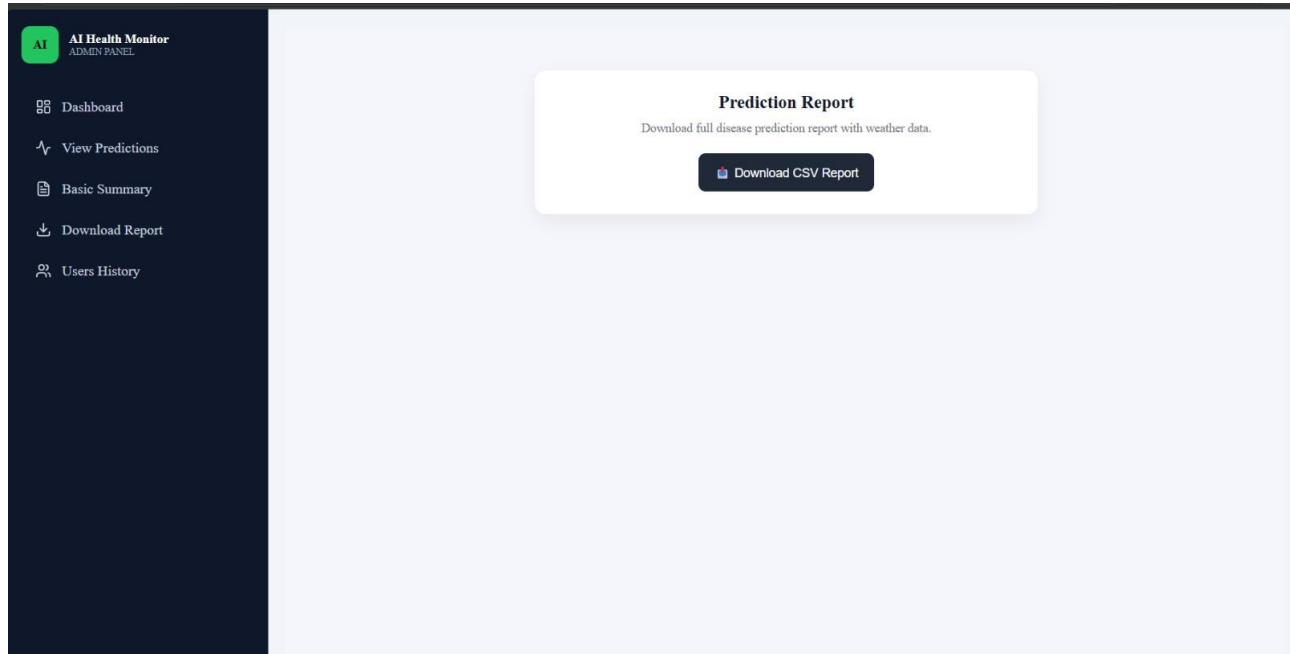


Fig. 11 Prediction Report

I. User Activity Log

Fig. 12 The image shows all user activities recorded in the system. It logs actions like login and prediction requests. Each row contains details such as user name, email, city, and action type. It also shows prediction results or status information for each activity. The time of each action is recorded for tracking purposes. This helps in monitoring how users are interacting with the system.

User Activity Logs							
#	User	Email	City	Action	Predict City	Details	Time
1	Admin	Admin	-	LOGIN	Admin	Admin logged in	01 Sep 2026 15:37
2	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 15:35
3	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 15:02
4	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 14:54
5	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 08:23
6	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 05:28
7	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	01 Sep 2026 03:52
8	Admin	Admin	-	LOGIN	Admin	Admin logged in	31 Aug 2026 04:31
9	rms	rms@gmail.com	Pune	LOGIN	Pune	rms@gmail.com logged in	31 Aug 2026 04:26
10	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	31 Aug 2026 04:24
11	Sujata	sujatalokare@gmail.com	Pandharpur	PREDICT	Vakhari, Maharashtra, India	Malaria (Medium)	31 Aug 2026 04:14
12	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	31 Aug 2026 03:43
13	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	30 Aug 2026 16:26
14	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	30 Aug 2026 08:25
15	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	24 Aug 2026 09:22
16	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	23 Aug 2026 13:52
17	Sujata	sujatalokare@gmail.com	Pandharpur	LOGIN	Pandharpur	sujatalokare@gmail.com lo...	23 Aug 2026 13:48

Fig. 11 User Activity Log



VIII. FEASIBILITY ANALYSIS AND DISCUSSION

A. Technical Feasibility

The system is technically possible using simple and commonly used technologies. React.js is used for frontend, Flask for the backend, and Python with scikit-learn, NumPy, and Pandas for Machine Learning. MySQL is used for storing environmental and prediction data.

B. Economic Feasibility

The system is cost effective because it uses open source technologies such as React.js, Flask, Python, and MySQL. It does not require expensive hardware and can be hosted on cloud platforms when required.

C. Operational Feasibility

The system provides simple dashboards to display environmental data, risk levels, hotspot locations, predictions, and alerts. It can be easily used by health authorities and public users for monitoring health risks.

D. Expected Outcomes

The system is expected to provide early health risk information, identify high risk areas, and generate health advisories. By combining environmental data, Machine Learning predictions, hotspot detection, and citizen symptoms reports, it can support early preventive action.

IX. CONCLUSION AND FUTURE SCOPE

The proposed system effectively handles real time environmental data collection, environmental condition analysis, and community-level health risk prediction. The system analysis environmental factors such as temperature, humidity, rainfall and air quality to predict possible health risks. The predicted risk is shown as a low, moderate, or high. This helps citizens and health authorities get early information about possible health risks and take preventive actions on time. The System also identifies health risk hotspot by analysing health risk levels in different urban areas. This helps health authorities focus more on areas where the health risk is higher. In addition, the system analyses environmental conditions, predictive health risk, an aggregated symptom reports from citizens to generate AI-driven community health advisories. This advisories can provide citizens with information about possible health risk and suitable preventive measures. This approach makes public health monitoring more active and helps health authorities make timely and databased decision for community health. In the future, more health related data, cities, environmental data sources can be added to the system. More advanced machine learning and AI models can also be used to improve prediction accuracy. Features such as better analysis of citizens symptom reports, realtime alerts, and more intelligent health advisories can also be developed. This can make the system more accurate, scalable, adaptive, and effective and provide better support for public health management in urban communities.

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