

# Disease Trend Analysis and Health Alert System

Prof. Mohini Thakre<sup>1</sup> Shubham Deokate<sup>2</sup> Prathmesh Ardak<sup>3</sup> Lisha Patle<sup>4</sup> Sejal Kumbhare<sup>5</sup>

<sup>1,2,3,4,5</sup>Department of Information Technology  
<sup>1,2,3,4,5</sup>GHRCEM, Nagpur, India

**Abstract** — In today's world, diseases spread quickly and epidemics are becoming more likely, so good disease surveillance and quick action are necessary to keep people healthy. Traditional monitoring systems frequently encounter issues such as reporting delays, manual data entry, inconsistent records, and restricted predictive functionalities. These problems make it hard for people and governments to make informed decisions in time to stop outbreaks. To solve this problem, our project suggests making a centralized web-based platform called Disease Trend Analysis and Health Alert System. The recommended platform improves disease surveillance, guarantees quicker decision-making, and lessens the impact of epidemics by bridging the gap between unprocessed healthcare data and actionable insights. The ultimate goal of this project is to provide authorities and citizens with a scalable and dependable health monitoring tool that enhances public health outcomes and healthcare management.

**Keywords:** Disease Surveillance, Health Monitoring System, Epidemic Prediction, Web-Based Platform, Public Health Analytics, Health Alert System

## I. INTRODUCTION

Rapid urbanization, shifting lifestyles, and international mobility have all contributed to the rise and spread of infectious and non-communicable diseases in today's world. Effective use of healthcare resources and avoidance of massive outbreaks depend heavily on the timely identification and tracking of disease trends. Traditional disease surveillance techniques frequently face obstacles like data collection delays, restricted regional coverage, and the absence of real-time insights. Technology-driven solutions are becoming more and more crucial in public health management to address these issues.

In order to collect, analyze, and report patient disease data from hospitals and other healthcare facilities throughout a city or region, this study focuses on creating a centralized web-based application. Weekly or yearly, the system tries to spot patterns and trends in disease events, pointing out which diseases are on the rise and which are on decreasing. These data-driven insights will help global organizations like the World Health Organization (WHO), healthcare providers, and public health departments make well-informed decisions and carry out early actions.

In order to predict possible outbreaks, monitor the spread of diseases, and quickly alert the public and authorities, the suggested system makes use of modern technologies like data analytics, machine learning, and real-time reporting. The platform raises awareness and encourages citizens to take protective action as soon as possible through engaging dashboards, notifications, and health alerts.

Improving disease surveillance, enhancing decision-making, and encouraging advance healthcare planning are the ultimate objectives of this project. The system helps to lessen the effects of epidemics and enhance general public health

outcomes by providing authorities and citizens with accurate, up-to-date information.

The system regularly gathers patient disease data, either weekly or annually, from hospitals, labs, and healthcare facilities throughout a city or region. It highlights which diseases are on the rise and which are on decreasing over time by using this data to find patterns and trends in disease occurrences. The platform can track the spread of infectious and seasonal diseases, forecast possible outbreaks, and send early alerts to the public and healthcare authorities by utilizing cutting-edge technologies like data analytics, machine learning, and real-time reporting.

The system's interactive dashboards and notification modules, which clearly and easily display disease trends, are a major feature. By staying informed about high-risk diseases in their city, citizens can take timely preventive action. These insights can be used by health authorities to organize successful awareness campaigns, distribute medical resources, and plan treatments ahead of time. Additionally, the system facilitates multi-city comparisons, which enables government organizations to pinpoint hotspots, monitor regional variations in disease trends, and formulate data-driven policy choices.

## II. LITERATURE REVIEW

A Smart Public Health Monitoring System that tracks and assesses health conditions using real-time data analysis was proposed by Sharma and Gupta (2022) [1]. In order to lessen the impact of diseases through preventive measures, their study emphasizes the significance of ongoing monitoring and prompt identification of health risks.

The importance of data analytics and the Internet of Things in disease surveillance systems was highlighted by Patel and Reddy (2023) [2]. Their research shows how sensor-based analytics and data collection can help early warning systems and enhance public health management decision-making.

A high-resolution spatiotemporal record of weekly disease cases throughout India can be found in the EpiClim dataset (2024) [3]. This dataset is a useful tool for trend analysis and epidemic forecasting because it allows researchers to examine the relationship between environmental factors like climate variations and the spread of disease.

Apart from studies centered on health, research in other fields also demonstrates the potential of IoT integration and data-driven forecasting [4]. To illustrate how predictive analytics can maximize resource planning in sectors other than healthcare, Asy'ari et al. (2023) used the k-nearest neighbor algorithm to forecast hotel room rates.

Similarly, Manicka Prabha et al. (2024) investigated IoT-enabled smart mirrors for home connectivity, fusing smart home integration with internet browsing [5]. Such IoT applications show the adaptability of connected technologies

and their potential to improve user experiences in a variety of fields, even though they are not directly related to healthcare.

These studies collectively show that the advancement of disease surveillance, public health monitoring, and related fields is greatly aided by the integration of real-time data, IoT, and predictive analytics. Opportunities to apply cross-domain innovations to healthcare data analysis are also highlighted in the reviewed literature.

### III. PROPOSED SYSTEM

By providing a centralized, intelligent, and flexible platform for disease monitoring and control, the proposed Disease Trend Analysis and Health Alert System aims to address the failings of the current manual and scattered surveillance methods. In order to help citizens and healthcare authorities take right away measures to avoid problems, the system focuses on gathering, storing, and using health-related data.

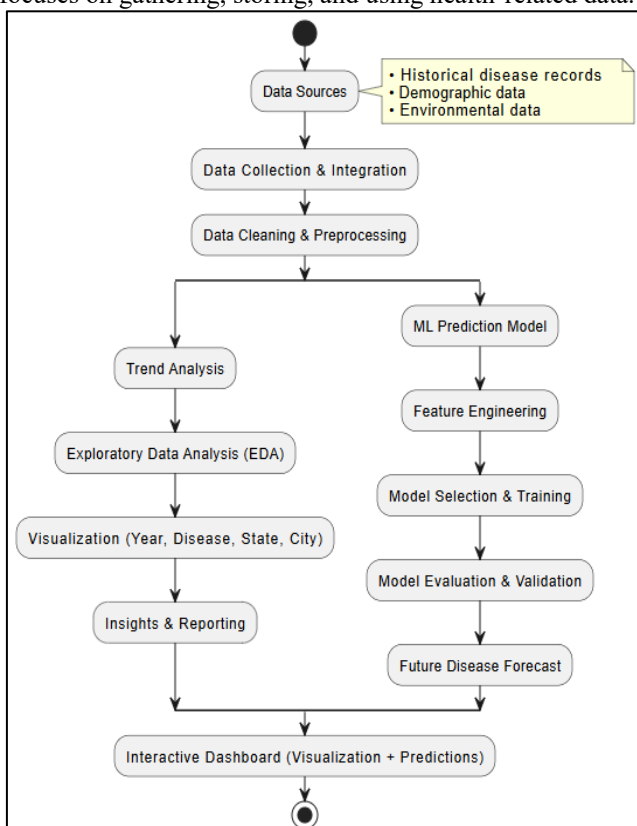


Fig. 1: Flow Chart

Collecting organized patient data from hospitals, labs, and other healthcare facilities throughout a city or region is the system's primary function. This platform guarantees regular data submission (weekly, monthly, or annually), which makes the surveillance process more systematic and dependable than traditional reporting methods, which are frequently unreliable and delayed. A centralized database houses all of the data that has been submitted, making it simple to access, integrate, and compare data from different hospitals and geographical areas.

To find trends, variations, and patterns in the occurrence of diseases, the data is processed using machine learning algorithms and data analytics after it has been gathered. The system can help authorities predict possible

outbreaks by highlighting which diseases are on the rise and which are on decreasing in particular geographic areas. In order to predict future risks, predictive modeling and time-based forecasting techniques are applied to historical data, allowing for proactive rather than reactive decision-making.

A web-based interface and dashboards that offer interactive disease trend visualizations are features of the proposed system. Health officials can download analytical data, compare disease patterns across regions, and access reports by city or hospital. The platform provides citizens with mobile notifications and easy-to-use dashboards that inform them of the increasing number of diseases in their community and recommend preventive actions. This dual focus guarantees that timely and accurate information is available to the public and policy makers alike.

The system's alert function, which automatically sends out notifications when disease cases rise above certain limits, is a crucial component. For instance, the system will quickly alert hospitals, citizens, and relevant health authorities if there is a sudden rise in cases of seasonal diseases like dengue or malaria. In helping in setting priorities for actions like resource distribution, vaccination drives, or awareness campaigns, these alerts are divided into three risk categories: low, moderate, and high.

Because of its scalable and extendable design, the system can be expanded from a single city to several cities or even to the entire country. To improve cooperative disease control initiatives, it can also be integrated with external health databases and international health monitoring agencies like WHO.

By combining data collection, alert mechanisms, visualization, and predictive analytics into a single platform, the recommended system enhances monitoring of diseases while also giving healthcare authorities useful information and empowering citizens to protect themselves by raising awareness. In the end, it seeks to improve healthcare planning, minimize the effects of epidemics, and build healthier communities.

### IV. DATABASE STRUCTURE

The dataset, which includes outbreak records from several states and districts, acts as the foundation for the database structure of the Disease Trend Analysis and Health Alert System. Successfully organizing disease data, connecting it to time-related and geographic characteristics, and supporting analysis for trend identification and alert generation are the objectives of the database design.

Attributes including the week of the outbreak, state, district, disease, number of cases, deaths, date, latitude, longitude, precipitation, Leaf Area Index (LAI), and temperature are all included in the core dataset. The following table formats are suggested as a structured and scalable method of storing this data:

1) *Location Table:*

- Features: State/UT, District, Latitude, Longitude, Location\_ID (Primary Key).
- Goal: Allows for region-wise analysis and visualization by storing the outbreak area's geographic details.

- 2) *Disease Table o Features:*
  - Disease Name, Category (infectious/non-infectious), Symptom Level, and Disease\_ID (Primary Key).
  - Goal: Standardizes disease data and enables grouping for analysis.
- 3) *Outbreak\_Record Table:*
  - Features: Week\_of\_Outbreak, Day, Month, Year, Cases, Deaths, Record\_ID (Primary Key), Disease\_ID (FK), Location\_ID (FK).
  - Function: Acts as the primary table that connects temporal, location, and disease data. The actual outbreak records are kept there.
- 4) *Environmental Factors Table:*
  - Properties: Temperature, LAI, Precipitation, Record\_ID (FK), and Env\_ID (Primary Key).
  - Goal: Keeps track of environmental and climatic factors related to every outbreak record. These characteristics help in determining the connection between environmental factors and diseases.
- 5) *Trend Analysis Table:*
  - Attributes: Trend\_ID (Primary Key), Disease\_ID (FK), Location\_ID (FK), Time\_Period, Total\_Cases, Percentage\_Change.
  - Purpose: Stores aggregated disease statistics (weekly, monthly, yearly) for visualizations and reports.
- 6) *Alert Table o Features:*
  - Minimum Value, Date, Risk\_Level (Low/Medium/High), Disease\_ID (FK), Location\_ID (FK), and Alert\_ID (Primary Key).
  - Goal: supports early warning by maintaining system-generated alerts when disease cases exceed specified limits.

#### A. Key Features of the Database

- Normalization: To prevent duplication and ensure scalability, data is arranged into distinct entities (Disease, Location, Outbreak, Environment).
- Integration: To facilitate predictive modeling, outbreak records are connected to environmental variables (temperature, precipitation, and crop index).
- Scalability: The structure allows for future growth because it includes data from multiple cities and states.
- Security: To protect privacy, only summary outbreak data is kept; sensitive patient-level information is not.

This database design guarantees that outbreak data can be efficiently queried, stored in a structured format, and analyzed for trend detection, visualization, and real-time health alerts.

### V. RESULT ANALYSIS

Meaningful knowledge about disease occurrences, their seasonal variations, and the impact of environmental factors were obtained through the implementation of the Disease Trend Analysis and Health Alert System. A number of criteria, including disease frequency, mortality rates, district-specific variations, and seasonal trends, were used to analyze the results.

The dataset, which included 8,985 records from various states and districts, was processed by the system. The information included environmental factors like temperature,

precipitation, and Leaf Area Index (LAI), as well as characteristics like disease type, number of cases, deaths, and week of outbreak. Following the dataset's preprocessing and cleaning, the following outcomes were produced:

#### A. Trends in Disease Frequency

- According to the analysis, the most frequent outbreaks were ongoing illnesses like Acute Diarrheal Disease, Dengue, and Malaria.
- Seasonal peaks were visible in time-series visualizations, especially during the monsoon months, demonstrating the direct correlation between temperature and rainfall.

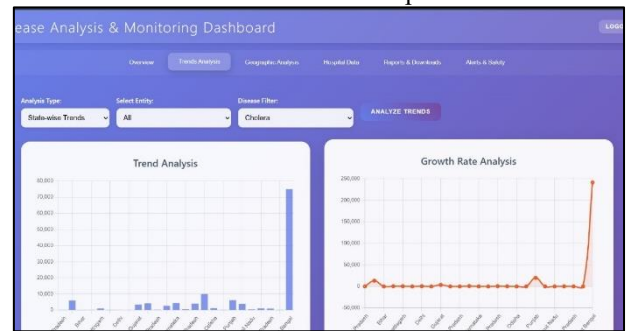


Fig. 2: Trend Analysis

#### B. State-Wise and District Comparison

- Geographic mapping revealed major hotspots where frequent outbreaks were found in states like Kerala, Gujarat, and Maharashtra.
- Authorities were able to concentrate preventive efforts in areas with consistently high case numbers by using district-wise comparisons to identify these areas.



Fig. 3: City Comparison

#### C. The Effect of Environmental Elements

- Higher temperatures and precipitation were found to be significantly associated with vector-borne illnesses such as dengue and malaria, according to correlation analysis.
- The significance of ecological factors was confirmed by the higher incidence of mosquito-related diseases in areas with high LAI (dense vegetation).

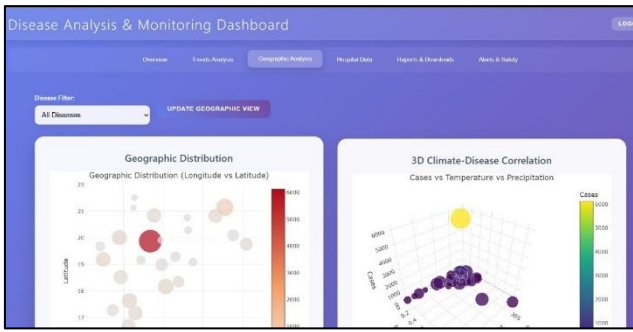


Fig. 4: Geographic Analysis

#### D. Analysis of Mortality

- Although common disease cases were common, isolated areas with inadequate healthcare infrastructure had higher death rates.
- The mortality tracking feature of the system offers a foundation of evidence for more effective resource allocation.

#### E. Trend Prediction and Warnings

- Using historical data and predictive modeling, the system suggested possible disease increases for the coming weeks.
- When cases went above certain limits, which were divided into low, medium, and high-risk categories, automated alerts and notifications were produced.

#### F. Visualization Results

- The results were displayed as heatmaps, charts, and graphs on interactive dashboards.
- While citizens received simplified alerts and proactive instructions, health officials could view the current state of diseases.

## VI. CONCLUSION

By providing a centralized, data-driven, and scalable solution, the recommended Disease Trend Analysis and Health Alert System effectively overcomes the drawbacks of current disease surveillance techniques. The system offers important insights into the emergence and decline of diseases across cities and districts by gathering structured health data from hospitals and combining it with environmental factors like temperature, precipitation, and vegetation index.

To predict possible outbreaks, the system uses predictive modeling in addition to historical and current data analysis. It provides health authorities with precise information for organizing preventive measures, allocating resources, and launching awareness campaigns through interactive dashboards, reports, and automated alerts. In addition, timely alerts assist citizens in reducing exposure to high-risk diseases and taking the appropriate precautions.

The analysis of the results showed that illnesses like dengue, malaria, and acute diarrheal disease exhibit distinct seasonal patterns that are impacted by the climate. The system's ability to link outbreak data with environmental factors enhances prediction accuracy and supports proactive decision-making. Furthermore, comparisons at the district and state levels enable stakeholders to pinpoint hotspots and rank areas of danger.

To sum up, the project helps to improve early detection, increase disease surveillance, and lessen the overall effects of epidemics. It offers a strong foundation for the digital transformation of healthcare by bridging the gap between raw health data and useful insights. In addition, the system's scalability guarantees that it can eventually be adapted to several cities, states, or even the national level, supporting long-term public health management and international epidemic readiness.

## REFERENCES

- [1] Sharma, V., & Gupta, R. (2022). "Smart Public Health Monitoring System using Real-Time Data Analysis." *IEEE Access*, Vol. 10.
- [2] Patel, H., & Reddy, M. (2023). "Disease Surveillance Systems using Data Analytics and IoT." *IEEE International Conference on Health Informatics*.
- [3] EpiClim: India Epidemic-Climate Dataset (2024) – A high-resolution spatiotemporal dataset of weekly disease cases across India.
- [4] Asy'ari, V., Anshori, M. Y., Herlambang, T., Farid, I. W., Karya, D. F., & Adinugroho, M. (2023). Forecasting average room rate using k-nearest neighbor at Hotel S. *2023 International Conference on Advanced Mechatronics, Intelligent Manufacture and Industrial Automation (ICAMIMIA)*, *IEEE*. doi: 10.1109/ICAMIMIA60881.2023.10427942
- [5] Manicka Prabha, M., Rajkumar, G. V., Jegadeesan, S., Jothi, J. N., Jayavathi, S. D., & Krishnan, R. S. (2024). Revolutionizing home connectivity with IoT-enabled smart mirrors for internet browsing and smart home integration. *2024 5th International Conference on Mobile Computing and Sustainable Informatics (ICMCSI)*, *IEEE*. doi: 10.1109/ICMCSI61536.2024.00107