

Disaster Scope: Disaster Management and Budget Analytics Dashboard

Dr. M.K. Jayanthi Kannan¹, Anubhavi², Shashank Pandey³, Akshat Bhavsar⁴, Sanyam Bhavsar⁵, Divyani Singh⁶

¹*Professor, School of Computing Science Engineering and Artificial Intelligence, VIT Bhopal University, Bhopal-Indore Highway, Kothrikalan, Sehore, Madhya Pradesh - 466114*

^{2,3,4,5,6}*Student School of Computing Science Engineering and Artificial Intelligence, VIT Bhopal University, Bhopal-Indore Highway, Kothrikalan, Sehore, Madhya Pradesh - 466114*

Abstract—Natural disasters are infrequent in today's world; the number of these events and how they impact the lives of millions continues to grow. As a result, there is an increasing need to use sophisticated data analytics in order to allocate resources efficiently and manage budgets for public safety. The Disaster Management and Budget Analytics Dashboard provides an integrated, data-driven analytical platform for analyzing both historical and real-time data about disasters. The data analysis produced by this platform allows for meaningful insights that can be used to support decision-making regarding the management of disasters. The Dashboard provides the ability to perform trend analysis of disasters, compare disasters by state, track budgets allocated for disaster management, and use interactive visualization to create a user- friendly environment for the users of the system. The use of predictive analytics, risk assessment methods and real-time data monitoring helps to enhance the ability of authorities and organizations to understand disaster patterns and therefore better allocate their resources. The system is built with the capacity to allow for data uploading and reporting, which also enhances the flexibility and usability of the system. The overall purpose of the system is to enable local authorities and organizations to improve their ability to prepare for, respond to, and plan for disasters through the use of a better-supported process for developing effective and informed management strategies related to disasters.

Index Terms—Disaster Management, Data Analytics, Budget Analysis, Predictive Analytics, Risk Assessment, Real-Time Monitoring, Data Visualization, Decision Support System

I. INTRODUCTION

Data-driven tools for disaster management are

increasingly important as the number of natural disasters increases and resources/budgets need to be managed efficiently. Many disasters, such as floods, earthquakes, or cyclones, are affected by a variety of environmental and geographical factors that make it difficult to predict their occurrence, and many traditional methods of analyzing and forecasting disasters do not have the ability to provide real-time analysis or insight into data, therefore causing delays in responding to and wasting resources on disaster response. As a result, the Disaster Management and Budget Analytics dashboard was created to provide integration of real-time data, historical data, and interactive visualizations that allow for trend analysis and comparisons of states and budgets for improved decision-making. The application uses both data analytics and predictive analytics to identify disaster patterns and ensure improved preparedness levels. Furthermore, a combination of real-time monitoring and budget analysis will allow for faster response times and better allocation of resources. Finally, the application will contain visualization and reporting features to provide clarity and assist with strategic planning decisions. In summary, the Disaster Management and Budget Analytics Dashboard will provide greater efficiency when responding to disasters and will help optimize the use of resources while responding. DisasterScope

II. LITERATURE REVIEW OF EXISTING SYSTEMS

Table 1: Literature Review DisasterScope: Disaster Management and Budget Analytics Dashboard

Anubhavi 24MIP10164	Objective used	Technology used	Methodology used	Efficiency	Issues
<p>Title: Preparedness and Response in the Century of Disasters: Overview of Information Systems Research Frontiers</p> <p>Authors: Ahmed Abbasi, Robin Dillon, H. Raghav Rao, Olivia R. Liu Sheng</p> <p>Journal: Information Systems Research (INFORMS Journal)</p> <p>Year: 2024</p> <p>DOI: 10.1287/isre.2024.intro.v35.n2</p> <p>URL: https://pubsonline.informs.org/doi/10.1287/isre.2024.intro.v35.n2</p>	<ol style="list-style-type: none"> To study the role of information systems in disaster preparedness and response. To analyze how real-time data improves emergency decision-making. To identify research gaps and future directions in disaster information systems. To enhance coordination between agencies using technology-driven solutions. 	<ol style="list-style-type: none"> Information Systems for disaster data storage and management Real-Time Data Processing and Monitoring Systems Big Data Analytics for handling large-scale disaster data Cloud Computing for scalable and remote access Communication Networks for rapid information exchange 	<ol style="list-style-type: none"> Literature Review: Study of existing research and technologies in disaster systems Case Study Analysis: Evaluation of past disaster response systems Data Integration: Combining multiple data sources for unified analysis System Evaluation: Identifying strengths, weaknesses, and performance gaps Framework Suggestion: Proposing improved models for real-time disaster response 	<ul style="list-style-type: none"> Enables real-time monitoring and faster information flow Improves coordination among emergency response teams Enhances situational awareness during disasters Supports quick and accurate decision-making Reduces response time and potential damage 	<ul style="list-style-type: none"> Difficulty in integrating heterogeneous data sources Dependence on stable network and infrastructure Data security and privacy concerns High cost of implementation and maintenance Reliability issues during extreme disaster conditions

The research explores the significance of utilizing information systems to enhance disaster preparedness, mitigating impacts of disasters; finding new ways to improve response efforts to the increasing frequency of disasters in the present day. Real-time data collection, processing and communication, through the use of technology, allow authorities to efficiently and effectively respond to disasters. Other aspects of the research examine: The collection of data from multiple sources (e.g., sensors, reports and communications) in order to gather all available data pertaining to a disaster. Real-time processing of

incoming disaster-related data. The sharing of information to enhance coordination between emergency response organizations and efforts. The evaluation of the efficacy of existing disaster-related information systems. The development of frameworks to be utilized for enhancing preparedness and response methods. In terms of overall effectiveness, enhancing situational awareness, enhancing coordination between response agencies, improving the quality and speed of decision-making, as well as ultimately lessening the overall impact from disasters through timely and efficient actions.

Table 2: Literature Review Disaster Management and Budget Analytics

Shashank Pandey 24MIP10188	Objective used	Technology used	Methodology used	Efficiency	Issues
<p>Title: Health Consequences of Disasters: Advancing Disaster Data Science</p> <p>Authors: Jeremy A. Colf, Tony McAleavy</p> <p>Journal: PNAS Nexus (Oxford University Press)</p> <p>Year: 2024</p> <p>DOI: 10.1093/pnasnexus/pgae211</p> <p>URL: https://academic.oup.com/pnasnexus/article/3/6/pgae211/7695603</p>	<ol style="list-style-type: none"> The paper focuses on analyzing the health impacts caused by disasters. It aims to improve disaster response using data science techniques. It studies how disasters affect public health systems and communities. It supports better planning for healthcare resource allocation during disasters.. 	<ol style="list-style-type: none"> Data Science techniques for analyzing health-related disaster data. Big Data Analytics for handling large-scale datasets Statistical Models for evaluating health impacts Data Visualization tools for presenting health trends 	<ol style="list-style-type: none"> Data Collection: Gathering health and disaster-related data from medical records, surveys, and government sources. Data Preprocessing: Cleaning and organizing data for consistency and accuracy. Data Analysis: Applying statistical methods to study health effects of disasters. Impact Assessment: Evaluating short-term and long-term health consequences. Interpretation: Generating insights to improve healthcare response strategies. 	<ul style="list-style-type: none"> Improves understanding of disaster-related health risks. Supports better healthcare planning and emergency response. Helps in efficient allocation of medical resources. Enhances decision-making using data-driven insights. 	<ul style="list-style-type: none"> Limited availability of accurate health data in disaster situations. Difficulty in integrating diverse healthcare datasets. Privacy concerns related to medical data. Complexity in analyzing long-term health impacts.

It is of importance that data science be used to understand how disasters have affected health care. Disasters can disrupt the health care system, and therefore it is necessary to provide efficient data analysis to assist with emergency response and recovery planning. The methodology of the research includes: Collecting and collating data from numerous medical reports, disaster records, and public health records. Integrating data from health-related data and disaster related data for comparative analysis.

Identifying trends related to the types of injuries, diseases and populations affected by disasters. Measuring the impact of a disaster on an individual's health as a result of that disaster. Producing strategic insight to guide policy and management of health care. The overall effect of this method is to improve decision-making for emergency health care, enhance preparedness strategies, and ensure that scarce medical resources are used effectively during disasters.

Table 3: Literature Review Disaster Management and Analysis Budget Analytics

Akshat Bhavsar 24MIP10118	Objective used	Technology used	Methodology used	Efficiency	Issues
<p>Title: Leveraging Machine Learning Algorithms for Improved Disaster Preparedness and Response through Accurate Weather Pattern and Natural Disaster Prediction</p> <p>Authors: Harshit Jain, Riya Dhupper, Ankit Shrivastava, Deepak Kumar, Meenakshi Kumari</p> <p>Journal: Frontiers in Environmental Science</p> <p>Year: 2023</p> <p>DOI: 10.3389/fenvs.2023.1194918</p> <p>URL: https://www.frontiersin.org/articles/10.3389/fenvs.2023.1194918</p>	<ol style="list-style-type: none"> The paper explores how machine learning algorithms (MLAs) can improve disaster preparedness by accurately forecasting weather patterns and predicting natural disasters like floods, hurricanes, and droughts. It reviews MLAs including Neural Networks, Decision Trees, and Random Forests applied to satellite, atmospheric, and historical data for enhanced disaster prediction. 	<ol style="list-style-type: none"> Neural Networks (NN): Pattern recognition from satellite and atmospheric data. Decision Trees (DT): Rule-based prediction using environmental conditions. Random Forests (RF): Ensemble method for high accuracy. Support Vector Machines (SVM): Linear and non-linear classification. CNNs: Image-based disaster monitoring. 	<ol style="list-style-type: none"> Data Sources: Satellite, radar, weather stations, historical records, and social media data. Literature Review: Systematic review of studies. Algorithm Evaluation: Supervised, unsupervised, reinforcement learning. Case Studies: NOAA hurricane forecasting, flood mapping, wildfire risk. 	<ul style="list-style-type: none"> Prediction Accuracy: RF and SVM improve accuracy. Early Warnings: NNs enable real-time alerts. Resource Allocation: Identify high-risk zones Real-Time Insights: Live data enables dynamic response. 	<ul style="list-style-type: none"> Data Quality: Requires large clean datasets. Algorithm Bias: Biased data affects predictions. False Positives: Reduces trust. Skilled Personnel: Requires expertise. Scalability: High computational cost.

The purpose of this study is to utilize machine learning techniques to aid in predicting and preparing for disasters by examining weather patterns and other types of weather-related disasters. The study focuses on how to use sophisticated machine learning models to make better use of historical and present-day environmental data to create models that make predictions on future events (such as floods, hurricanes, and droughts) and provide better forecasts for disaster warning systems while minimizing damages. The study encompasses the steps that will be necessary to implement and evaluate the use of

machine learning techniques for prediction of disasters as follows: Collecting data from various sources (satellites, weather stations, and historical environmental records). Preprocessing the data to remove, normalize, and group together the vast amount of environmental data. Developing machine learning models (Neural Networks, Decision Trees, Random Forests). Creating a predictive system to predict disasters by identifying patterns of similarities or differences in the dataset. Evaluating the models for accuracy by comparing predictions with actual historical data on disasters, using validation techniques

to verify the accuracy of the machine learning model used in making predictions. In terms of being efficient, the proposed methodology improves prediction accuracy becomes an effective means of notifying people of potential disasters, provides better planning for disaster management, and improves the quality of

management decisions through the use of real-time data analysis. Investor Sentiment and Optimized Deep Learning" explores the integration of investor sentiment analysis with deep learning models to enhance stock price prediction accuracy.

Table 4: Literature Review Recent Disaster Management and Budget Analytics

Sanyam Bhavsar 24MIP10124	Objective used	Technology used	Methodology used	Efficiency	Issues
<p>Title: Recent Developments in Machine Learning Predictive Analytics for Disaster Resource Allocation</p> <p>Authors: Sunita Pachar, Deepak Dudeja, Neha Batra, Vinam Tomar, John Philip Bhimavarapu, Avadh Kishor Singh</p> <p>Journal: Proceedings (MDPI)</p> <p>Year: 2023</p> <p>DOI: 10.3390/engproc2023059019</p> <p>URL: https://www.mdpi.com/2673-4591/59/1/19</p>	<ol style="list-style-type: none"> To optimize disaster resource allocation using machine learning techniques. To improve decision-making in distributing resources like food, medical aid, and rescue teams. To enhance efficiency in disaster risk management and reduce resource wastage. To support data-driven planning for better budget utilization. 	<ol style="list-style-type: none"> Machine Learning and Deep Learning algorithms Big Data Analytics for handling large disaster datasets Cloud Computing and IoT for real-time data collection Social Media Analytics for identifying resource needs 	<ol style="list-style-type: none"> Data Collection: Gathering data from sensors, satellite images, and social media platforms Data Preprocessing: Cleaning and organizing large-scale disaster datasets Model Development: Applying ML/DL models for prediction and allocation Demand Forecasting: Predicting resource requirements based on past and real-time data Optimization Models: Allocating resources efficiently to high-risk areas 	<ul style="list-style-type: none"> Improves resource allocation accuracy and efficiency Reduces wastage of resources and budget Enables faster response during disasters Supports real-time decision-making and planning Enhances coordination between agencies 	<ul style="list-style-type: none"> Requires high-quality and real-time data Risk of biased or incomplete data affecting allocation High computational and infrastructure costs Ethical concerns in fair distribution of resources Complexity in integrating multiple data sources

The goal of this research is to explore how machine learning and predictive analytics can be used in order to utilize resources and manage budgets during crises. This research will demonstrate that by using advanced data-driven methods, authorities can distribute significant supplies such as food, medical supplies, and rescue teams to those in need and have minimal waste of resources, but respond to disasters in a timely and effective manner. This research will examine: Collecting data through satellites, sensors, and social media, Pre-processing data so that large amounts of

data will be cleaned and organized, developing a model using machine learning and deep learning techniques, Forecasting demand for resources in order to help determine how much of each type of supply will be needed in the affected areas, Optimizing/allocating resources based on the predictions made about projected demand. This methodology will ultimately help improve efficiency by optimizing resource use, decreasing budget waste, increasing speed of response, and supporting data-driven decision making to enable effective disaster management.

Table 5: Literature Review the Survey of Disaster Management and Budget Analytics

Divyani Singh 24MIP10185	Objective used	Technology used	Methodology used	Efficiency	Issues
<p>Title: A Survey of Disaster Management Datasets</p> <p>Authors: Sohail Abbas, Manar Abu Talib, Qasim Nasir, Omar Belal, Mohammed Emad Al-Haidary, Ibtihal Ahmed</p> <p>Journal: Journal of Applied Statistics (Taylor & Francis)</p> <p>Year: 2025</p> <p>DOI: 10.1080/02664763.2025.XXXXX</p> <p>URL: https://www.tandfonline.com</p>	<ol style="list-style-type: none"> To study and compare disaster-related datasets from multiple heterogeneous sources. To improve integration techniques for structured and unstructured data. To enhance decision-making using comprehensive and unified datasets. To identify research gaps, limitations, and future opportunities in disaster data management. To support efficient disaster prediction, response, and recovery planning. 	<ol style="list-style-type: none"> Data Integration and Data Fusion techniques Big Data Analytics for processing large-scale datasets Cloud Computing for scalable storage and accessibility Database Management Systems (SQL/NoSQL) Data Visualization and Dashboard tools AI/ML techniques for pattern detection and insights 	<p>Data Collection: Aggregating datasets from satellites, government agencies, NGOs, and social media platforms</p> <p>Data Classification: Categorizing data based on disaster types, geography, and time</p> <p>Data Cleaning: Removing noise, duplicates, and inconsistencies</p> <p>Data Integration: Merging heterogeneous data (structured + unstructured) into a unified framework</p> <p>Data Analysis: Identifying trends, correlations, and patterns across datasets</p> <p>Evaluation: Assessing data quality, reliability, completeness, and usability</p>	<ul style="list-style-type: none"> Improves accuracy and reliability through multi-source validation Provides comprehensive insights for better decision-making Enhances disaster prediction and preparedness strategies Enables seamless data sharing across multiple agencies Supports real-time monitoring and analysis 	<ul style="list-style-type: none"> Data inconsistency and lack of standardization across sources Difficulty in integrating heterogeneous data formats Privacy, security, and ethical concerns High computational and storage requirements Data redundancy and duplication problems Limited availability of high-quality real-time datasets

The research provides an extensive overview of disaster-related datasets that have been derived from a wide range of different sources. The research emphasizes how critical it is to integrate these datasets into a cohesive format. By combining satellite imagery, governmental records, sensor networks as well as social media outlets, there can be improved analysis, prediction and response to disasters. The research further points to several challenges including data discrepancies as well as a lack of standardization and suggests methods for improving how the data can be applied. The research provides: Data collection from many diverse and sometimes geographically separated sources. Data classification in terms of type of disaster along with region. Data cleaning and integration into a common system, Data analysis aimed at identifying patterns and trends, Data quality assessment and usability analysis. The proposed methodology will provide more efficient and accurate data, allow for quicker and better decision making, promote increases in preparedness for disasters, and ensure more efficient coordination of several agencies with their corresponding systems who are working on disaster management.

III. PROPOSED SYSTEM DESIGN

The Disaster Management and Budget Analytics Dashboard is a unified, data driven solution to analyze disaster related data and help decision makers act appropriately. The system integrates data sources including historical data, real-time updates, and user uploaded data into a comprehensive view of the trends associated with disasters and their utilization of resources. This system will allow organizations and agencies to track disaster trends, use state-based comparisons on a disaster-by-disaster basis, and measure budget expenditures in an effort to respond to disasters more efficiently. The proposed system is built on a modular design that consists of a data collection layer, a data processing layer, a data analytics layer, and a data visualization layer. The data collection layer captures disaster related data across a range of sources including disaster databases, Application Programming Interfaces (APIs) and user uploaded documents. The data processing layer provides for data cleaning, data normalization, and data transformation in order to make use of the data in an accurate manner. The data analytics layer offers

statistical and predictive methodologies so that agencies can identify disaster trends, understand current and future risks associated with disasters; and develop analytical reports supporting various disaster decisions. The data visualization layer enables users to easily interpret the data processed in the previous layers through various interactive dashboards, graphs, and reports. The proposed system can also analyze the

budget to assist in tracking disaster related expenditures and budget allocations during disaster events. Integration of real-time monitoring with analytical models will enhance disaster preparedness while improving efficiency of disaster response. The disaster management and budget analytics dashboard provide a scalable, user friendly, and efficient way to analyze and manage disaster response and recovery.

IV. ARCHITECTURE DIAGRAM

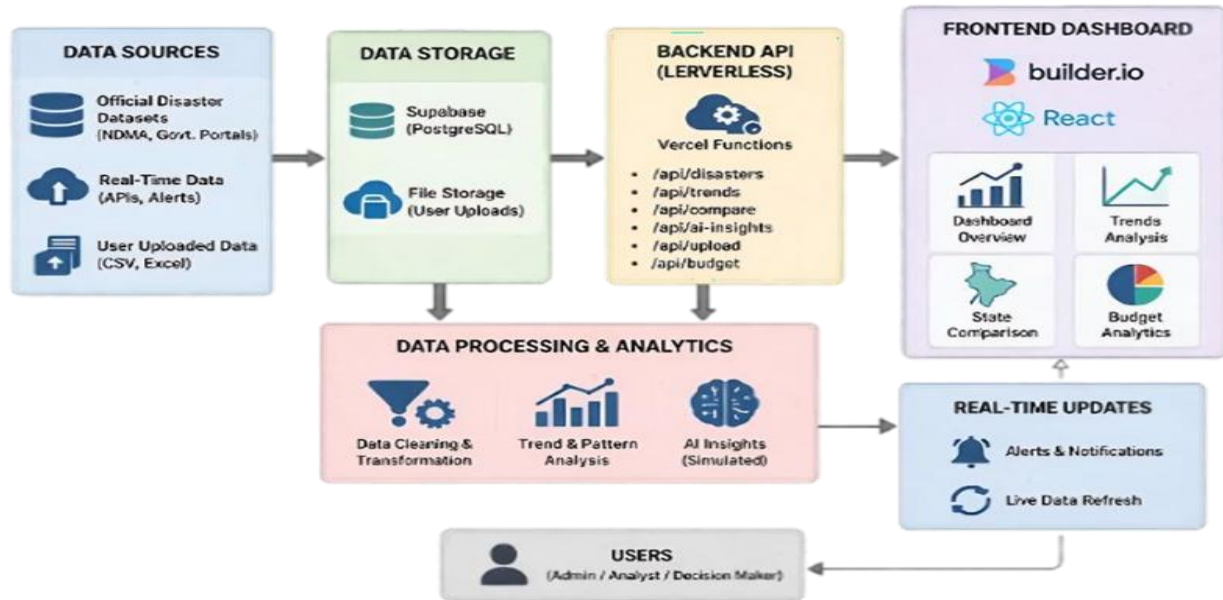


Fig 1: Architecture Diagram

V. METHODOLOGY AND ALGORITHMS USED

To provide insights on disaster data, we must first collect multiple sources of information including government datasets, APIs, and user-uploaded files. The collected data is then pre-processed through cleaning, normalization, and validation in order to ensure consistency and accuracy. Once the data has been pre-processed, we will aggregate the data and analyze it to determine patterns in how disasters occur, based on the parameters of location, type, and time. The aggregated data can then be used to assess the allocation of budgets and the use of resources during disaster events. The analysis results are then visualized on interactive dashboards so users can easily interpret insights from the analysis and make informed decisions based on the analysis.

ALGORITHMS USED

The system utilizes a combination of statistical and analytical algorithms:

a) Data Cleaning Algorithm

1. Removes duplicate and inconsistent records
2. Handles missing values using mean/median substitution
3. Ensures structured and reliable datasets

b) Aggregation Algorithm

1. Groups data based on attributes (state, year, disaster type)
2. Computes totals, averages, and frequency counts
3. Helps in generating summarized insights

c) Trend Analysis Algorithm

1. Uses time-series analysis to identify patterns over

- years
- 2. Detects increasing or decreasing disaster occurrences
- 3. Helps in forecasting possible future trends

d) Budget Analysis Algorithm

- 1. Compares allocated vs utilized budget
- 2. Calculates efficiency ratios and expenditure patterns
- 3. Identifies underutilization or overspending

e) Risk Assessment Algorithm

- 1. Classifies risk levels (Low, Medium, High)
- 2. Based on frequency and severity of disasters
- 3. Supports decision-making and preparedness planning

VI. PROJECT FUNCTIONAL MODULES IMPLEMENTATION

The proposed project includes multiple modules with specific tasks, and each is designed for efficiency and the scalable nature of the Disaster Management and Budget Analytics Dashboard. Data Collection Module, the data collection module collects data from various sources, including government disaster data sets, real-time APIs, and user-uploaded files (CSV, Excel). The purpose of this module is to provide a steady stream of historical and live data that can be processed and analyzed. Data Storage Module All collected data is stored in a structured, reliable database (such as Supabase – PostgreSQL) and in file storage. All collected data is stored securely in the database and includes historical disaster records, user data, and file storage. Data Processing Module, Data processing includes cleaning, validating, and transforming the data. The data processing module cleans the data to remove inconsistencies from the data, fills any missing values, and organizes the data to be structured for analysis and the various analytical methods that could be used. Analytics Module, the analytics module applies various statistical methods to identify: Trends for disasters Compare state by state and time, Budget allocation and budget utilization. The analytical module takes the data from the processing module and adds value to the collected data. Insight Generation Module, the insight generation module takes the analytical data and generates summarized insights and interpretations of the data. The insights from the data show patterns, such as a trend of increasing disasters

and budget use, as well as a trend of bad budget usage.

VII. METHODOLOGY FOR DEVELOPING DISASTER ANALYTICS DASHBOARD

Needs-Assessment : Survey and analyze the Disaster Management Systems (DMS) to determine the needs to develop analytics dashboards. Analyze the current DMS to identify opportunities for improvement and limitations. Analyze the issues of real-time data availability, accuracy, budget tracking, and accessibility for Multimodal CTRs. Requirements Definition: Define critical features such as trend analyses of disasters, comparisons between states, budget analysis, and uploading of data. Prioritize key functionalities such as real-time updates, interactive dashboards, and accurate visualizations of the data. Ensure the system Has sufficient scalability, reliability, and user-friendliness. Platform Design: Create a user-friendly and intuitive dashboard to make it easy to navigate. Use interactive visualizations and charts to display trends and comparisons related to disasters. Use a modular-based architecture to build the system; with front-end interfaces, backend (API), and database. Development: Use state-of-the-art technologies from Builder.io for the front-end and serverless APIs for the back-end. Create and develop data processing and analytical logic for trend detection and budget analyses. Build modules for uploading, storing, and simulating real-time based data. Testing: Perform unit tests, integration tests, and overall testing of the system to assure reliability. Validate the accuracy of the data and the correctness of the analyses provided. Ensure that the user interfaces are responsive and easy to use across all devices. Evaluation: Carry out unit testing, integrated testing and system testing to guarantee reliable functionality. Verify that the data is accurate and that the outputs of the analyses are correct. Evaluate the end user interface for functionality across different devices, including usability and responsiveness. Implementation: The deployment of the system will occur on cloud-based hosting services such as Vercel for the frontend and backends as application programming interfaces (APIs). Seamlessly incorporate with a database service (i.e., Supabase). Design and implement the system to function with optimal performance (real-time updates). Updating &

Servicing: The overall system should be monitored and errors resolved quickly. All datasets should be updated regularly, with improvements to analytical models. Enhance existing features based on user feedback as disaster management requirements change.

VIII. SYSTEM INTERFACE AND OUTPUT SCREENS



Fig 2: Dashboard Overview



Fig 3: Analytics

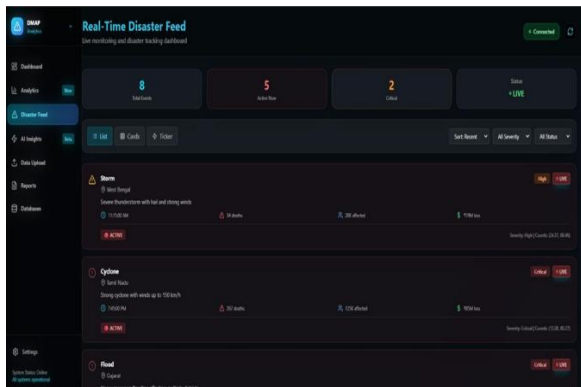


Figure 4: Disaster Feed

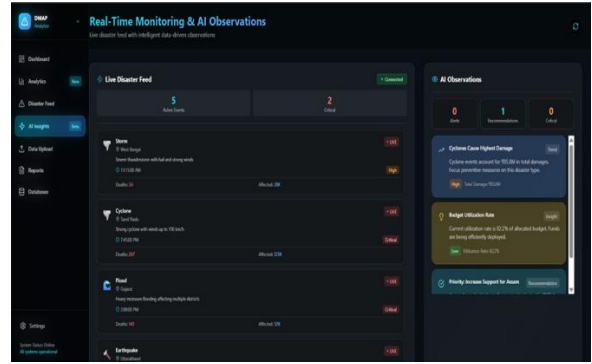


Figure 5: AI Generated Insights

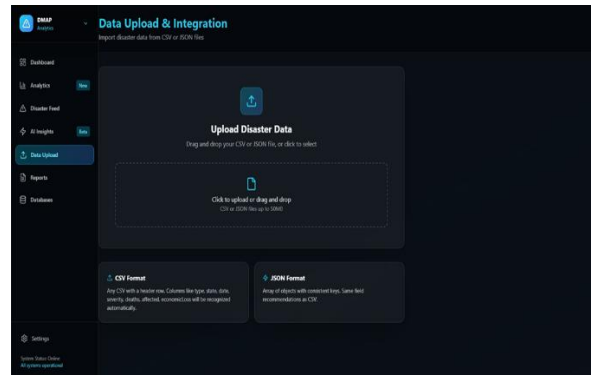


Figure 6: Data Upload

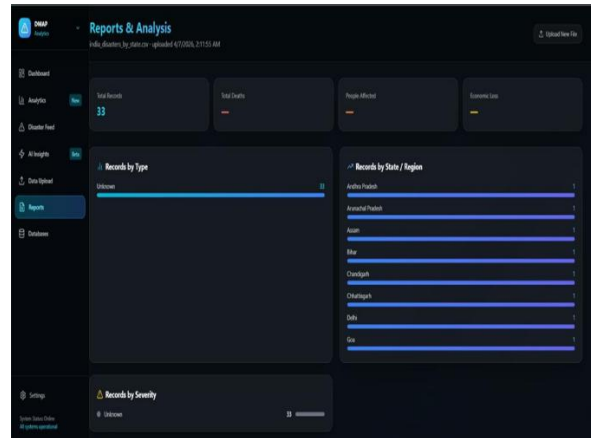


Figure 7: Reports & Exports

IX. RESULT ANALYSIS, CONTRIBUTION AND FINDINGS

This study provides a detailed examination of how information technology plays a vital role in preparing for and responding to disasters. It emphasizes that using real-time systems capable of processing large quantities of data and providing accurate information will improve decision-making, provide situational

awareness, and enhance coordination among first responders. However, there are still some issues regarding the use of such systems; these include poor data quality, reliance on existing infrastructure, and concerns about security. As a result, there is much room for improvement in the area of disaster-management technologies.

X. CONCLUSION

This Disaster Analytics Dashboard is a fast and data-friendly way to look at disaster data and help with the decision-making process. The Dashboard is integrated with multiple data sources, processes a large number of data sources, and provides insight through interactive dashboards that are easy for users to understand. The Disaster Analytics Dashboard has additional functions such as analyzing trends, comparing states, and evaluating budgets. These functions make understanding the patterns and use of resources during disasters easier. The addition of real-time data to the system increases the reliability and usefulness of the system by ensuring that users have up-to-date information for use in the practical application of the system. This project exemplifies the combination of modern web technologies and data analytics to enhance disaster management/disaster planning. The Dashboard is able to grow, is efficient, and supports enhancements into the future, which makes it an asset to the analysis and decision-making process.

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