



Bharat Vigil: India's Institutional Weather Risk Intelligence & Evacuation Assistant

Vishakha Kumbhar^{#1}, Prof. Vidya Ugare²

¹International institute of management science, Pimpri-Chinchwad, 411033, India

²International institute of management science, Pimpri-Chinchwad, 411033, India

ABSTRACT :

Our platform combines satellite data, weather intelligence, and models into a unified dashboard that can be easily used by institute, hospitals, and universities, etc. By examining institutions through various PIN codes them with live rainfall intensity, cyclone paths, etc. Bharat Vigil tries to explain some of the critical space data into understandable and actionable alerts. To fill this critical gap of understanding complex space data, we have proposed Bharat Vigil: India's Institutional Weather Risk Intelligence & Evacuation Assistant, a system designed to safeguard our lives through live disaster monitoring and evacuation support.

By combining these satellite tracking, real-time risk situations, and dashboards the system represents and provides a scalable model for our national disaster support. With continued focused development into government and educational frameworks, Bharat Vigil can become a support system in India's mission to reduce disaster possibilities.

With focusing on the needs of educational environments this project ensures that institute is protected with data-backed insights. Our platform not only visualizes multiple weather reports but also provides some safety recommendations and alerts. Our platform also gives downloadable reports facility. Our project Bharat Vigil is not just a dashboard or portal it is an important solution that institutions need to be disaster-ready.

In India all the Institutions must require some targeted and sharp tools that transform such raw forecasts into evacuation and give fast safety guidance. Here we have introduced Bharat Vigil, a decision support system which integrates the weather data and satellite intelligence to provide insightful recommendations. It also provides features such as city or PIN-based search. Our system explains how satellite intelligence can be generally used for real-time institutional safety.

Keywords: Satellite Data, Disaster Risk Intelligence, Weather Analysis, Climate Resilience, Safety, Weather Forecasting

I. Introduction

Our idea is rooted with goals that every educational institution must be equipped. By taking timely quick action in the situations of cyclones, heat, flood waves etc. With the rapidly increasing frequency of natural disasters, this traditional method of response often falls short and fails in monitoring alerts..

We all know that our India has mostly invested in remote sensing and forecasting system through the Bharat Forecasting System (BFS) which helps to deliver approx 6km high-resolution forecasts, and help to provide satellite driven alerts, these platforms offer raw or technical data. Institutional users such as schools, college, and hospital often lack the capacity to interpret this information in real time.

Our project Bharat Vigil addresses this gap by offering a web-based intelligence and evacuation assistant tailored to institutions. It combines data sources, provides dynamic maps, simulates cyclone paths, and generates institution-level evacuation guidance. In doing so, Bharat Vigil transforms raw data into actionable intelligence that enhances the disaster preparedness and response.

II. Literature Review

These recent research in weather disaster highlights significant progress in the satellite tracking, forecasting, remote sensing, and analysis. These works expand improvements in monitoring and predictive accuracy, but they remain largely technology-oriented. This gives greater sight to more understandings of geographical conditions. Many national agencies have shown the value of near real-time geospatial intelligence. Many programs such as Sentinel Asia and the International Charter on Space and Major Disasters have explained the utility of satellite imagery for rapid emergency response [1].

Many Geospatial dashboards have also been observed as essential tools for situational awareness and alerts. These platforms require technical expertise and are less suited for local areas, colleges, school or small institutions that demand actionable interfaces.[2] Similarly American NASA public api

tries provide large-scale disaster monitoring capabilities at a global level while, India's platform delivers cyclone, floods and weather overlays to support research. This systems primarily focus on data dissemination, rather than institution-level decision-making. [3]

In the India, early warning mechanisms have gained value through the Indian Meteorological Department. These agencies issue weather alerts and cyclone warnings at a national scale . Prior evaluations indicate that these systems frequently lack localized evacuation guidance, specific safety protocols, and leads to limiting their effectiveness [4].

Emerging research has now explored the role of artificial intelligence, assistance and machine learning in enhancing fast disaster response. These techniques such as data cleaning, data anomaly detection and risk of classification have been applied to forecast cyclon, flood zones. While these approaches tries to improve predictive accuracy and most studies remain experimental and fail to combine these AI insights into our practical institutional actions, leaving such gap between research outcomes and field implementation.[5]

Some of the other works have highlighted the importance of disaster intelligence. Studies tries to explain that the effectiveness of early warning systems depends not only on technological experience but also on accessibility, cultural, and communication strategies . Without disaster alerts, visual portals, dashboards disaster information often fails to translate into timely community action.[6]

Here, observation is that there is urgent need for solutions such as BHARAT VIGIL, which integrate advanced satellite data with advance interface design. It is seen that tracking and prediction frameworks have matured. Still they remains a little notable research gap in bridging satellite intelligence and with institutional risk management and planning. Our this project tries its best to seeks to fill these gap by integrating some live satellite data, disaster patterns, disaster data, voice alerts, and customized safety recommendations.[7]

Literature Review Table

Author(s), Year	Title / Focus	Methodology	Key Findings	Our Study
Sharma & Kulkarni (2021)	AI-Driven Flood Forecasting Using IoT Sensors	Integrated sensors with deep neural networks for real-time flood prediction.	Reduced false alarms and enabled timely warnings.	Supports Bharat Vigil's AI-based flood alerts.
Li & Chen (2022)	Satellite-Based Cyclone Path Prediction	Applied learning models on multi-satellite imagery datasets.	Produced more cyclone path forecasts	Enhances Bharat Vigil's cyclone detection and impact visualization features.
Patel et al. (2023)	Geospatial Dashboards for Response	Built a GIS-enabled dashboard combining satellite data, disaster reports, and social media feeds.	Improved situational awareness for emergency response teams.	Inspires Bharat Vigil's real-time safety dashboard for institutions.
Nair & Deshmukh (2020)	Remote Sensing for Risk Mapping	Used imagery with vegetation indices and time series analysis.	Detected high-risk zones with improved accuracy.	Guides Bharat Vigil's integration of vegetation.
Zhou et al. (2022)	Deep Learning for Small Object Detection in Satellite Images	Models with attention mechanisms for tiny target tracking.	Achieved higher detection accuracy	Strengthens Bharat Vigil's satellite tracker for identifying hazards.
Rao & Singh (2021)	Institutional Preparedness in Disaster Reduction	Survey based study of college evacuation strategies in India.	Highlighted lack of intelligence and training gaps.	Bharat Vigil's focus on institutional level assistance.
Kumar et al. (2022)	Cyclone-Prone Regions	India's existing meteorological and alert systems.	Delays in local accurate forecasts.	Validates Bharat Vigil's multilingual voice alert and messaging tools.
Alam & Javed (2023)	Role of AI in Satellite data Classification	Trained and Transformer based models for land cover mapping.	Improved classification with minimal manual input.	This Helps Bharat Vigil expand into risk zone mapping.
Fernandez et al. (2021)	Disaster Frameworks and Gaps	Policy review of Framework implementation.	challenges in translating national policy into local action.	localized safety intelligence.
Das & Mehta (2023)	Air Quality Monitoring with IoT and Cloud	Deployed the IoT sensors and dashboards to track urban air quality.	Provided alerts from poor air conditions.	Offers scope to Bharat Vigil to add environmental risk intelligence.
Singh & Banerjee (2024)	Disaster Data for Mapping	images, and social media inputs during floods.	Enhanced mapping with faster ground validation.	data for more responsive dashboards.
Global Earth Observation Group (2024)	Trends in Disaster Intelligence	analyzing satellite constellations and geospatial platforms for disaster use.	need for unified dashboards combining multiple datasets.	Aligns directly with Bharat Vigil's vision as a unified space data safety system.

III. Implementation

Our project Bharat Vigil employs a dark themed interface for professionalism. Also a navbar organizes the navigation across all modules and a search bar enables local queries. The Institutional Assistant page dynamically provides more detailed information and safety alerts.

The flow: Input → Data Fetching → Processing data → Simulation → User Output/results.

- i. City-based or pin based weather search results.
- ii. Cyclone path reports over the Leaflet.js map.
- iii. SatTrack with multiple layered visualizations of risk zones.

IV. Challenges and Opportunities

This project Bharat Vigil faces challenges such as data accuracy and the need for real-time scalability to handle very large volumes of institutions. Implementation and institutional adoption also remain critical. Some times its very difficult to fetch real time accurate data. Still somewhere technology is not sufficient or advanced to examine it till the core.

Each challenge also presents a corresponding opportunity. Data accuracy can be enhanced through different integration into our system, while scalability can be achieved via cloud-based micro services. Alerts should be proper and clear to understand so that action can be taken properly.

Training the users on how to interpret and understand alerts and take timely fast action is equally important otherwise the system may not achieve its full purpose. Constant updates every after minutes, government collaboration, and long-term maintenance are required to keep the platform effective and efficient. It should consume a lot of time to generate report of give response.

Challenges

- Monitoring Disaster: In natural disasters or phenomena every second counts. The system should not only display data but also help users make quick actions and confident decisions without confusion.
- Balancing Simplicity with Depth: Bharat Vigil needs to remain easy and understandable for non-technical users also, while still offering advanced features and achieving this balance is not that easy.
- Local Customization: India's huge geography and languages mean alerts must be understandable and fulfill needs, languages, which adds little extra complexity.
- Trust and Credibility: Institutions sometimes may hesitate to completely rely on an automated system for evacuation unless they are sure. Building long duration trust is a challenge.
- Continuous Maintenance: While building such huge system it is important to keep it updated with new data sources, information, technologies, and government policies which requires ongoing effort and resources.

Opportunities

- Life Saving : Our system can directly help to save lives by giving institutions timely evacuation guidance and alerts during floods, cyclones, or any other disasters.
- National Level : With the help of government support Bharat Vigil can become a nationwide platform
- Future Space Tech: Our this platform can grow slowly by linking with ISRO satellites and apis , Artificial Intelligence based weather models, etc making it more smarter and more advanced over time.

V. Conclusion & Future Work

The platform integrate a modular architecture featuring map overlays, voice alerts in multiple languages, and predictive models for cyclone analysis. These components boost situational awareness and make the system usable by a variety of stakeholders. With its institutional evacuation and response module, *Bharat Vigil* delivers data-driven guidance, facilitating coordinated action and faster decision-making in emergencies.

Technically, the project builds an extensible and scalable foundation that can integrate further environmental and spatial data systems. Automated reporting, satellite imagery layers, and AI-based risk assessment all enhance the solution's robustness and adaptability. Performance evaluations confirm its potential to function as a working prototype for real-time monitoring and disaster mitigation across diverse sectors.

In summary, *Bharat Vigil* represents a convergence of satellite intelligence, advanced visualization, and computational analytics geared towards resilient disaster management. The research underscores the importance of domestic digital infrastructure in advancing India's weather-intelligence capabilities. Future enhancements will target improved prediction accuracy through machine learning techniques and adoption of sensors to amplify early warning and institutional resilience.

Future work includes: Now to improve scalability and accessibility Bharat Vigil can introduce offline-first capabilities with SMS, radio alerts, flash messages for areas without internet, and voice based assistants to guide people in their local language. In future collaboration with ISRO's satellite constellations and also global climate monitoring networks can enhance performance. In the future, our system may even integrate advance disaster simulations for institutional training and automated drone coordination for rapid rescue. Also we will try to provide drone help on disaster areas. These

many advancements will make Bharat Vigil not just a dashboard but also a next generation command interface for disaster management at both national and global levels. By aligning advanced space-tech data with institutional needs, Bharat Vigil represents a scalable step toward resilient, technology-driven disaster management in India.

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