



# Application of GIS in **Disaster Management**

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#### INTRODUCTION

Disaster management encompasses activities before, during, and after disasters to effectively handle and support at-risk individuals or communities. Government agencies at different levels are responsible for reducing vulnerability and ensuring efficient emergency management and recovery. The complexity of disaster management has increased due to the rise in large-scale emergencies and new threats, necessitating enhanced planning, prevention, and mitigation efforts. Emergency managers play a vital role in coordinating various departments.

GIS (Geographic Information System) provides valuable tools for risk assessment, emergency planning, real-time mapping, resource management, damage assessment, and facilitating communication and collaboration among stakeholders, thus supporting disaster management comprehensively. Disaster management is having two parts which are Pre-Disaster and Post-Disaster events.

Pre-Disaster Stage	
Mitigation	Preparation Process Activities
Post Disaster Stage	
Response	Recovery





Some of the major innovative solutions of IGiS Technology in Disaster Management cycle are as follows:

Forecast climate conditions and climate anomalies

Identify the critical vulnerabilities & damages zones through Sensors

SAR based flood mapping

Find best route that provide the fastest response

Damage assessment through EO

**Real-time Location Tracking for rescue** 

**Map and Report Generation** 



### Forecast climate conditions and climate anomalies

Remote Sensing technology is a powerful tool used to monitor and collect detailed information about the Earth's topography and meteorological/climate data. The integration of IGiS MetGIS module enhances its capabilities by enabling users to easily predict climate conditions and anomalies. This advanced forecasting ability is instrumental in preparing for climatological disasters, aiding in emergency preparedness, and ultimately saving lives, as evidenced by its successful use during past cyclones. Moreover, this technology has expanded the boundaries of environmental understanding, strategic decision making, monitoring the impacts of climate change, and assessing future risks. It employs mathematical algorithms to analyse geo-spatial data and presents the results in a visual format.



# Identify the critical vulnerabilities & damages zones through Sensors

#### Satellite imagery based vulnerability analysis

cybersecurity, and environmental monitoring, sensors play a crucial role in identifying vulnerabilities and damage zones. For disaster management, IGiS utilizes powerful tools like weighted overlay and AHP (Analytic Hierarchy Process) to assess vulnerabilities and damage zones. In addition to the mentioned tools, IGiS offers a range of other tools including heat map generation, hydrology analysis, and density analysis. These tools are instrumental in facilitating effective mapping and decision-making for potential zones. By customizing sensor systems to suit specific applications, there is a considerable enhancement in monitoring and response capabilities.





#### • Real time sensor based vulnerability assessment

IGiS leverages real time sensors i.e. IoT sensors to detect vulnerabilities and damage zones by integrating various sensors that gather data from different perspectives. This collected data undergoes analysis to identify structural weaknesses, unstable terrain, and areas prone to natural disasters. During a disaster, real-time sensor data is utilized to evaluate damage and prioritize relief efforts. The IGiS web portal incorporates IoT sensor data from multiple sources and presents it with distinct symbols for departmental users, enabling clear identification of high-risk zones. Moreover, an automatic buffer is generated around the sensor, highlighting the high-risk data and facilitating the filtering of villages, fire stations, police stations, and other entities falling within this buffer zone.





# SAR based flood mapping

In disaster scenario, water plays a definitive role as it affects a large part of the world through a cycle of floods. For mapping and mitigation of the areas pertaining to flood, SAR imageries have proved to be very critical as they have the capability of working in presence of clouds. IGIS has a dedicated functionality to make use of the SAR dataset for flood mapping using pre and post event images. This in lieu provides important insight to authorities to mitigate the effects.





#### Find best route that provide the fastest response

The IGIS Network analysis tool plays a crucial role in identifying optimal locations and routes for rapid emergency response, such as hospitals and fire stations. Real-time location tracking platforms and web/mobile GIS-based applications enable users to interact with maps containing vital information like risk locations, intensity, health facilities, nearby base camps, and damage assessments. Using the IGIS analytics tool, a buffer is generated around the integrated sensor, highlighting high-risk data and automatically determining the nearest villages and shelters. It also provides the shortest route to reach those villages, ensuring efficient response and support during emergencies.



#### Damage assessment through EO

Post any disaster it is pivotal to know what the damage is. This helps the rescue operations in mitigating the after effects of the event. Earth observation technology helps in this assessment through various functionalities and one of them being Change detection. IGiS is one of the very few software's in the market with a dedicated Change detection module with an array of tools from pixel based basic change detection to statistics based advanced change detection which provides users prompt insights into the change happened due to any calamities.









# **Real-time Location Tracking for rescue**

IGiS leverages various data sources such as GPS devices, drones, and satellite imagery to track the real-time location of rescue teams, responders, and affected individuals. This integration enables effective resource deployment and coordination. By overlaying the real-time location data on geographic maps, IGiS enhances situational awareness by providing visual representations of rescue team locations, infrastructure, hazards, and affected individuals. With its GIS capabilities, IGiS enhances efficiency, saves lives, and reduces the impact of disasters by improving situational awareness, optimizing resource allocation, facilitating route planning, enabling coordination, and supporting informed decision-making.





## **Map and Report Generation**

By utilizing GIS maps, valuable information about past disasters is obtained, which in turn enables more effective disaster management. In the case of IGiS, the inclusion of IoT sensors allows users to visualize and track real-time data such as humidity, moisture, and temperature. This data is presented in the form of a line chart, facilitating clear identification of changes over time. This feature proves particularly advantageous for departmental users who require constant monitoring of climatic conditions. The analysis of historical data aids in the identification of vulnerable areas and the formulation of robust strategies for mitigating future risks. The creation of risk zone maps using IGiS helps authorities prioritize their efforts and allocate resources efficiently for improved preparedness, early warning systems, and the development of infrastructure. Through this proactive approach, vulnerability is reduced, resulting in minimized impacts from future disasters and the effective safeguarding of communities.



#### CONCLUSION

The utilization of IGIS offers a range of benefits, including enhanced communication and decision-making through visualizations and maps. It has the capability to identify patterns and issue early warnings, contributing to proactive measures. By integrating with other systems, IGIS further improves situational awareness and response capabilities. Ultimately, IGIS plays a pivotal role in enhancing the safety and resilience of an area.

#### ABOUT

### **Scanpoint Geomatics Limited**

Scanpoint Geomatics Ltd. is the leader in the Indian Geomatics Industry. We pioneer the nation's geospatial domain through IGiS. An indigenous technology that brings GIS, Image Processing, and Photogrammetry together on the same platform under the Make in India Initiative. We are proud of our partnership with the Indian Space Research Organisation (ISRO). With an innovative approach and over two decades of rigorous research and development, the duo developed the IGiS platform. Backed by ISRO's domain expertise, we aim to push forth innovation and uplift the global geospatial domain.



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