Using Information Systems And Intelligent Agents During Natural Occurrences

[1]D. Saravanan .Dr.Dennis Joseph [2] Dr. Anusha Sreeram[3] Dr. Challa Maruthy Subrahmanyam[4] .Dr. Sivakrishna[5] Dr. Kvssn Murty[6] Dr. Manish Kumar[7]

Faculty of Operations & IT ICFAI Business School (IBS), Hyderabad, The ICFAI Foundation for Higher Education (IFHE), (Deemed to be university u/s 3 of the UGC Act 1956), Hyderabad-India
[3]

Abstract: *Natural occurrences are often unpredictable, especially in a country like India, which has a large population, low literacy levels, and inadequate infrastructure. These factors can significantly amplify the impact of natural disasters. When such events occur, all living beings are affected. Although some disturbances can be predicted to a certain extent, the consequences remain severe due to the reasons mentioned above. To address this issue, this paper focuses on how mitigation efforts can be supported through the use of information systems. India is rapidly advancing in technology, and with the help of such systems, we aim to minimize the impact of natural disasters. However, building such systems is not as straightforward as developing other types of information processes. The proposed framework is designed to help people manage the effects of disasters and reduce their impact.*

Key terms: *Natural occurrences, Information systems, Development of IS, Predictable IS, and Data transfer, Interrelating IS.*

1. INTRODUCTION:

Natural occurrences can happen at any time and often have serious effects on all living things. In many cases, these events can even result in the loss of life. To mitigate and reduce the impact of such occurrences in our daily lives, an effective mechanism is required. Such a mechanism should be capable of predicting and providing alerts well in advance so that the damage can be minimized. These natural events are not uniform; they vary depending on geographical location, lifestyle, and environmental conditions. One of the main challenges in addressing these events is that there is no single universal technique that can be applied. The response must be localized and based on factors such as human settlement patterns and environmental characteristics, requiring the development of appropriate methodologies. Information systems play a crucial role in reducing the effects of natural disasters. They help by providing alerts, broadcasting announcements, raising awareness through forecasts, and using predictive analytics based on historical data. Natural occurrences can happen in various forms—such as heavy rainfall, heatwaves, strong winds, or human negligence—all of which can have a massive impact on living beings. The development of effective information systems can help reduce these impacts through various techniques and methods. While natural events are inherently unpredictable, systems can alert people based on the intensity and potential impact, thereby reducing both damage and vulnerability. These systems also help record the intensity of past events, environmental changes, biological shifts, causes, and the ways people have been affected. Quick alerts and insights enable faster and more informed responses.

For example, data from natural disaster risk assessments in India show that:

Floods account for 52% of occurrences, causing 63% of material loss and 32% of human disturbance. Hurricanes contribute to 30% of disasters, resulting in 19% of material loss and 32% of human loss. Landslides cause 10% of disasters, with 2% of human loss. Earthquakes, though rare (less than 5%), still account for 10% of material damage and 33% of human fatalities. This data illustrates that while India may be less prone to frequent natural events, the associated losses in life and property are significantly high. The disaster management cycle includes response, recovery, mitigation, and preparedness. Information systems are especially effective during the response, preparation, and recovery phases. With the help of technology, people can be informed about the nature of the disaster, how to safeguard themselves, where to access relief, and how to prepare before the event strikes. Technology also plays a key role in building awareness and providing early warnings.

Modern technologies—such as internet-based tools, scientific data gathering, topographical analysis, and predictive modeling—enable accurate forecasting. Researchers collect reliable data through tools like satellite imagery and IoT-based sensors, allowing early warning systems to function effectively. These systems provide real-time updates, comparative data sets, and visual aids that help researchers and emergency responders prepare appropriate prevention mechanisms. Mobile devices also play a critical role by providing timely alerts and updates. Information is shared widely and rapidly, helping people respond quickly. This research focuses on how technology can reduce response time during disasters and improve the overall management of emergency operations. During disasters, people often panic, making it difficult to gather and distribute accurate information. Technology helps identify where relief is needed and what kind of support is required.

Proper training and preparation are essential. People must be trained in how to use technology effectively—where, how, and when to use it—and how to relay critical information. Today, with the help of advanced technologies, both natural and man-made disasters can be predicted more accurately, and their impact significantly reduced. Innovations such as topographical monitoring, mobile devices, and artificial intelligence aid in not only recovery but also early warnings and real-time assessments. Drones, sensors, and surveillance equipment can enter areas inaccessible to humans, analyze conditions, and suggest alternatives quickly. Topographical evidence systems continuously monitor high-risk zones. When changes are detected, automatic alarms are triggered, helping reduce material and human loss. These technologies support not just alerts but also detailed preparedness plans for both pre- and post-disaster efforts.

2. EXISTING SYSTEM:
The present system focuses mainly on recovery operations and typically responds only after an event has occurred. Without the use of modern technology, actions are reactive rather than proactive. As a result, users receive little to no information during or before the event. It is only after the incident that they realize the system is designed to assist in recovery. This delayed response is one of the major drawbacks of the existing system.

2.1 Below are some key limitations of the current system:
1. All operations are executed manually.
2. The system activates only after the event has occurred.
3. There is no clear or reliable data on the impact of the event.
4. No historical datasets or information on root causes are maintained.
5. There is no preparedness mechanism in place.
6. Information exchange systems are completely lacking.
7. The system is overly complex, with poor coordination among team members.

2.2 Present systems and its advantage:
Information systems are essential tools in mitigating the effects of natural disasters. They contribute significantly by issuing early warnings, disseminating critical information through announcements, increasing public awareness via forecasts, and applying predictive analytics based on historical trends. Natural disasters—such as heavy rainfall, extreme heat, strong winds, and incidents caused by human error—can severely affect both people and the environment. By implementing advanced information systems, it becomes possible to proactively manage these risks and reduce their overall impact through timely interventions and informed decision-making.

2.2.1 Advantage of propose system:
1. Information is immediately communicated to all relevant members.
2. The flow of information follows a clear and structured hierarchy.
3. The system provides early warnings before an event occurs.
4. The system captures data related to the event, including its occurrence, impact, and causes—helping researchers develop effective solutions.
5. Strong and reliable evidence is systematically generated.
6. A variety of tools support different functions within the system.

7. Users and the broader community receive clear updates about the event, helping reduce panic and enabling calm, informed responses.

3. PROPOSED TECHNIQUE:

Predicting natural disasters is inherently challenging for humans, but with the right mitigation and recovery strategies, their impact can be significantly reduced. In the past, natural events occurred frequently, and communities lacked awareness and education about how to respond. As a result, they were often caught unprepared and suffered greatly. Even when warnings were issued, the manual communication methods delayed the flow of information, preventing timely action. Today, modern information systems play a crucial role in disaster management. These systems not only send alerts but also provide early warnings, safety instructions, and historical records of past events. This enables communities to better understand risks, prepare in advance, and respond more effectively when disasters occur. Information systems also help identify which areas require immediate assistance, ensuring a more efficient response and resource allocation. The proposed system, as shown in the figure, uses advanced technologies to collect, store, and analyze data. Tools such as internet-based applications, satellite imagery, topographical analysis, and predictive models make forecasting more accurate and reliable. Researchers utilize data from IoT sensors and other scientific tools to build early warning systems that deliver real-time updates and visual information, helping emergency teams plan and act quickly. Proper training is essential for individuals and communities to understand how to use these technologies—when to access them, how to interpret alerts, and how to communicate vital information. With the help of innovations like mobile devices, drones, AI, and automated surveillance systems, both natural and man-made disasters can be anticipated and managed more effectively. These tools allow access to hazardous areas, analyze current conditions, and suggest rapid solutions—ultimately reducing damage and saving lives.
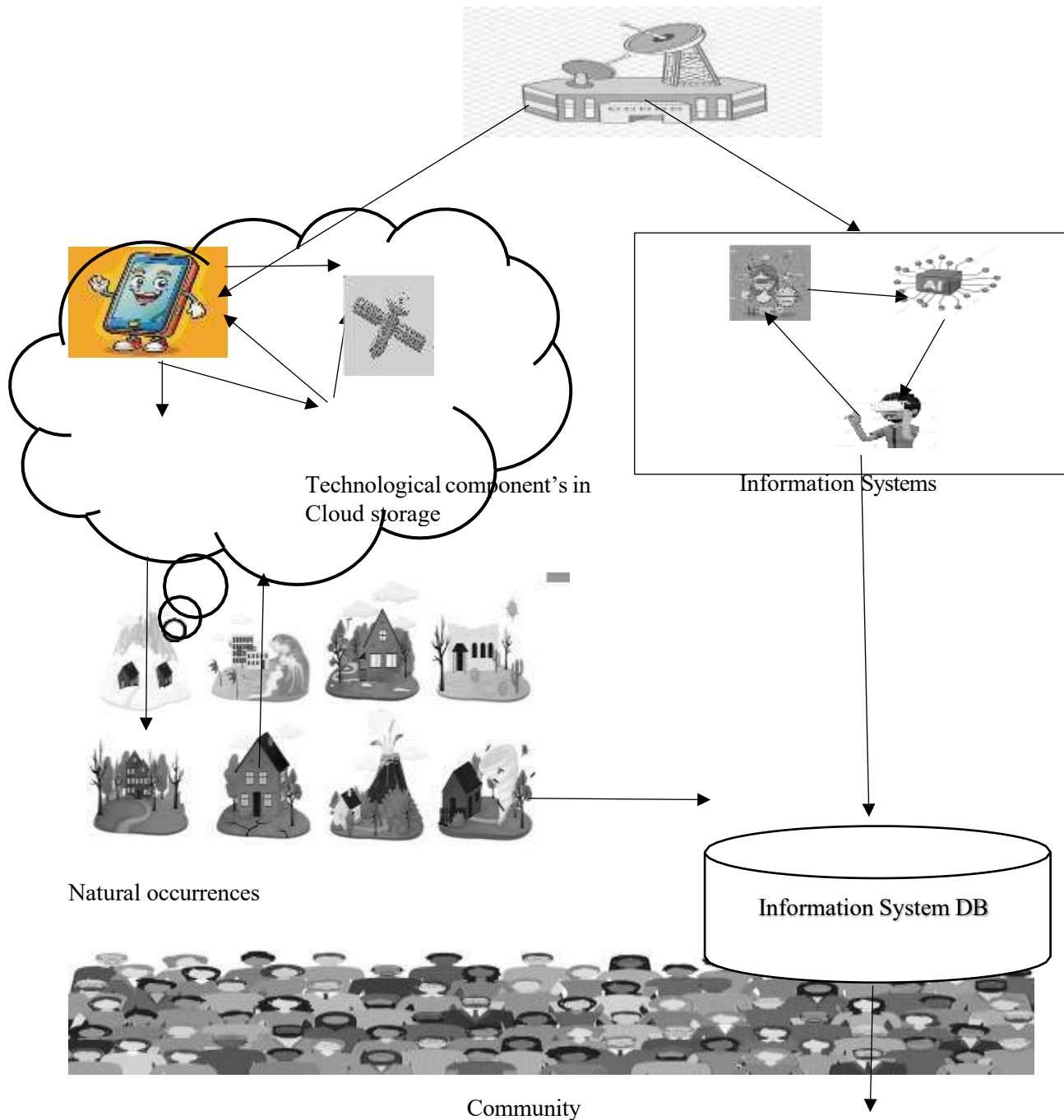
Fig 1 proposed Architecture

4. TECHNOLOGIES BEHIND THE MITIGATION:

Advancements in modern technology—such as internet-based platforms, scientific data collection, topographical mapping, and predictive analytics—have significantly improved the accuracy of natural disaster forecasting. Tools like satellite imagery and IoT-enabled sensors allow researchers to gather dependable data, enabling early warning systems to function with greater precision. These systems offer real-time alerts, comparative data analyses, and visual insights that aid both researchers and emergency responders in planning effective mitigation strategies. Mobile devices also play a crucial role by delivering timely notifications and updates, ensuring that information reaches affected communities quickly. This widespread and rapid communication helps reduce panic and

enables faster, more organized responses. This research explores how technology can be leveraged to shorten disaster response times and enhance the coordination and effectiveness of emergency management operations.

ROLE OF MOVABLE DEVICES:

Today, mobile phones play a vital role in information systems due to their portability and ease of use. Among various information system tools, mobile devices have gained widespread popularity as they are compact, user-friendly, and accessible. Globally, people use mobile phones for a variety of purposes, including communication, messaging, location tracking, weather alerts, education, training, healthcare, and more. These devices are often seen as practical alternatives to computers, as many operations that were once limited to desktops or laptops can now be performed efficiently using smartphones. In the context of natural disasters, mobile phones serve as essential tools within information systems, particularly in warning and mitigation functions. Their portability allows users to receive alerts and updates faster than through other systems. Beyond communication, mobile phones help identify affected locations, enabling users to share live locations and relay the type of support or intervention required. As a result, mobile phones are now used across almost every domain for a wide range of critical and everyday applications.

ROLE OF INFORMATION SYSTEM STORAGE:

Many natural disaster mitigation efforts have failed primarily because people lack access to historical information about such events. Often, communities do not have basic knowledge about the nature of disasters—what the events are, their causes, their potential impacts on society, how to respond effectively, and when they are likely to occur. Natural disturbances manifest in various forms such as heavy rainfall, extreme heat, droughts, and more. The intensity and frequency of these events vary depending on geography and population density. Hence, understanding the historical patterns of such occurrences is crucial for raising community awareness and improving preparedness. One of the most effective technologies to address this issue is the implementation of an information system storage solution. This system can benefit not only researchers and emergency planners but also ordinary citizens, by providing accessible and comprehensive data about past events. Building such a system is not a simple task—it requires accurate historical data and, most importantly, the creation of a centralized repository to support mitigation strategies.

The development of this central repository should ideally be initiated by the government, as it must include diverse data: event types, locations, intensities, root causes, and other relevant details. This information can help communities make informed decisions and respond more effectively during future events. An information storage system enables data collection, storage, and retrieval, ensuring that communities can access vital information when needed. To maintain the system's reliability, the database must be regularly updated. Irrelevant or outdated data should be removed, and new data—regarding recent events, their severity, and underlying causes—should be added consistently. Keeping the data current ensures the accuracy and usefulness of the system for end users. Moreover, it is critical that this data be well-integrated across various geographical regions to form a truly consolidated and comprehensive central repository. Only then can such a system effectively support wide-ranging mitigation efforts.

ROLE OF KNOWLEDGE ENGINEERING:

Knowledge engineering plays a crucial role in managing natural disturbances by enhancing awareness, guiding timely reactions, and supporting community recovery in day-to-day life. Modern information systems, empowered by knowledge engineering, help communities make quick, informed decisions—often without the need for human intervention. These systems are trained using historical and current data, enabling them to detect abnormal events or effects and promptly issue alerts to the affected communities. Decisions generated by the system are based on a combination of past occurrences and real-time data, ensuring relevance and accuracy. With access to well-trained datasets, the system can recognize patterns, assess the severity of the situation, and guide appropriate responses. The data is sourced from various repositories such as databases, official bulletins, field observations, and other reliable inputs. Beyond just issuing warnings, these intelligent systems also recommend mitigation strategies based on prior knowledge. This added capability is a key strength—it not only

alerts the community about impending dangers but also provides actionable steps to minimize damage and enhance safety. In this way, knowledge engineering significantly strengthens the disaster preparedness and response framework.

ROLE OF HYPER SPACE AND SOCIAL MEDIA PLATFORMS:

Information systems play a crucial role in minimizing the impact of natural disasters. These systems help by delivering timely alerts, broadcasting emergency announcements, creating awareness through forecasts, and utilizing predictive analytics based on historical data. Natural disasters—such as heavy rainfall, heatwaves, strong winds, and those caused by human negligence—can significantly affect both people and the environment. The development of reliable information systems enables better preparedness and response, helping to reduce the overall damage. While natural events may not be entirely predictable, modern systems can issue early warnings based on real-time data and risk assessments. This reduces both vulnerability and potential losses. However, to ensure effectiveness, people must be trained on how to use these technologies—understanding when, where, and how to act, as well as how to share vital information within their communities. Advanced technologies now allow for more accurate forecasting and faster response to both natural and man-made disasters. Tools such as mobile devices, artificial intelligence, topographical mapping, and predictive modeling support both prevention and recovery efforts. In addition, drones, sensors, and surveillance equipment can reach inaccessible areas, assess conditions, and suggest appropriate actions in real time, greatly enhancing the overall efficiency of disaster management.

ROLE OF TOPOGRAPHICAL MATERIAL STRUCTURES:

The structure of the TMS significantly differs from traditional information systems discussed earlier. This system is designed specifically to manage natural disturbances through three critical phases: cautioning, reaction, and repossession. These three components are essential in both the pre-disaster and post-disaster stages of effective disaster management. During a disaster event, an information system must be able to address two key questions for the affected community: What should be done? and How can recovery be achieved? If individuals can receive accurate answers to these questions promptly, they are more likely to respond effectively and recover quickly from the disaster's impact. TMS facilitates this process by capturing real-time data via satellite and transmitting it directly into the system. This enables timely and accurate warnings, guides users on immediate actions, and supports recovery operations. For instance, the system can provide precise routes to safety or suggest alternative paths, which is critical when normal infrastructure is compromised. This ensures that both humans and other living beings can be protected more efficiently than with older systems.

One of the major challenges during disasters is the confusion and panic that often disrupts both public response and rescue operations. TMS mitigates this by ensuring rapid communication between affected communities and rescue teams. Its satellite-based data collection provides highly reliable, real-time information, allowing for earlier and more accurate warnings. By enabling proactive rather than reactive responses, TMS helps to prevent many disasters from escalating and supports faster recovery even when an event has already occurred. Its predictive capabilities and coordinated communication make it far more effective than traditional systems in managing both immediate responses and long-term mitigation.

CONCLUSION :

Information systems play a critical role in managing natural disasters by supporting three essential phases: cautioning, reacting, and recovering. These phases are vital in both pre-disaster preparedness and post-disaster recovery. The effectiveness of such systems lies in how well the community understands and uses them to respond to emergency situations. The core objective of using technology in disaster management is to provide timely, accurate, and actionable information. Information systems help people understand what actions to take during a disaster and how to reduce its impact. They provide early warnings, issue public alerts, raise awareness through forecasts, and analyze historical and real-time data to predict potential threats. By enabling quicker decision-making and coordinated responses, information systems significantly reduce damage and improve the community's ability to recover swiftly and effectively.

REFERENCES:

1. Argyroudis, S. A., Mitoulis, S. A., Chatzi, E., Baker, J. W., Brilakis, I., Gkoumas, K., ... & Linkov, I. (2022). Digital technologies can enhance climate resilience of critical infrastructure. Climate Risk Management, 35, 100387.
2. Beardsley, M., Albó, L., Aragón, P., & Hernández-Leo, D. (2021). Emergency education effects on teacher abilities and motivation to use digital technologies. British Journal of Educational Technology, 52(4), 1455-1477.
3. Crompton, H., Burke, D., Jordan, K., & Wilson, S. W. (2021). Learning with technology during emergencies: A systematic review of K-12 education. British journal of educational technology, 52(4), 1554-1575.
4. https://www.atlas-mag.net/en/article/natural-disasters-risk-in-india.
5. https://www.istockphoto.com/videos/group-of-cartoon-people
6. https://www.shutterstock.com/search/natural-disaster-cartoon.
7. Hussien, H. M., Yasin, S. M., Udzir, N. I., Ninggal, M. I. H., & Salman, S. (2021). Blockchain technology in the healthcare industry: Trends and opportunities. Journal of Industrial Information Integration, 22, 100217.
8. Kusumastuti, R. D., Arviansyah, A., Nurmala, N., & Wibowo, S. S. (2021). Knowledge management and natural disaster preparedness: A systematic literature review and a case study of East Lombok, Indonesia. International journal of disaster risk reduction, 58, 102223.
9. Muhammed T, S., & Mathew, S. K. (2022). The disaster of misinformation: a review of research in social media. International journal of data science and analytics, 13(4), 271-285.
10. Munawar, H. S., Mojtahedi, M., Hammad, A. W., Kouzani, A., & Mahmud, M. P. (2022). Disruptive technologies as a solution for disaster risk management: A review. Science of the total environment, 806, 151351.
11. Murayama, Yuko, Hans Jochen Scholl, and Dimiter Velev. "Information technology in disaster risk reduction." Information Systems Frontiers 23 (2021): 1077-1081.
12. Sharma, K., Anand, D., Sabharwal, M., Tiwari, P. K., Cheikhrouhou, O., & Frikha, T. (2021). A disaster management framework using Internet of Things-based interconnected devices. Mathematical Problems in Engineering, 2021(1), 9916440.
13. Yabe, T., Jones, N. K., Rao, P. S. C., Gonzalez, M. C., & Ukkusuri, S. V. (2022). Mobile phone location data for disasters: A review from natural hazards and epidemics. Computers, Environment and Urban Systems, 94, 101777.