A Novel Machine Learning Categorial Algorithm with Remote Detecting and GIS Based Decision Support System to Identify Disaster

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Abstract— In order for disaster management to make good decisions, it needs new tools like the geographic information system (GIS). This study looks at how disaster management groups use GIS tools and whether or not they have a GIS-based decision support system. It also looks into whether or not organizations can work with other organizations and what the problems are during times of crisis or disaster.Disaster prevention is an important part of the agenda for sustainable development. It is also an issue that affects the social, economic, environmental, and humanitarian sectors. There is a need to study and look into these important parts. Even though Open GIS technology standards have been developed by several agencies in recent years, which allow for the use of geographic information services and the interoperability, integration, and sharing of data between different emergency management agencies, it is still very important for decision makers to find the right services and ways to see geospatial information. The goal of this paper is to do a literature review on how different authors have used geospatial technology to deal with both natural and man-made disasters and to find new ways to move forward in this important area.

Index Terms— GIS, Remote Sensing, Disaster, Emergency Management.

I. INTRODUCTION

A disaster is a serious change in the way a community or society works that causes widespread damage to people, property, the economy, or the environment that goes beyond what the community or society can handle with its own resources. Disasters disrupt society because they kill people, make new victims, and destroy infrastructure and homes. Disasters can also hurt the environment because they destroy natural resources. Since society, the economy, and the environment are the three most important parts of sustainable development, it follows that disasters have a negative effect on sustainable development, which is why disasters need to be managed properly. When a disaster happens, money and budgets that were supposed to be used for development are moved to deal with the disaster and get life back to normal. It is thought that 70–80% of information can be tied to a geographic location. This means that the nature and characteristics of geographic information (GI), as well as how it is used, are very important for effectively managing crises. Because of this, spatial data and related technologies have been shown to be essential for making good decisions together in disaster management. But current studies show that, even though spatial data can help with disaster management, it is hard to collect, access, share, and use the spatial data that is needed for disaster management. During the disaster response phase, when things are changing quickly and time is of the essence, these problems get worse.

Disasters may be natural or manmade. Natural disasters like earthquakes, floods, tsunamis, and so on will happen and can't be stopped. Still, their effects on people's health and property can be lessened if the right preventative measures based on geospatial technology are planned and put into place in a timely, coordinated way during each phase of an operation, such as relief, rehabilitation, and reconstruction. Earthquakes are caused by the movement of tectonic plates, which are like the panels on a football and make up the surface of the earth. Along fault lines, where two plates meet, a lot of stress builds up. When the rock between the plates breaks, the ground shakes suddenly and violently. The epicenter is the place where the shaking happens and where the earthquake is strongest.

Disaster management consists of four stages: mitigation, readiness, response, and recovery. The reaction phase of a disaster entails a variety of actions, including the execution of plans, the installation of command centres and shelters, and the supply of all necessary emergency services. Critical actions must be scheduled and sequenced at this point. Appropriate personnel must be appointed promptly to avoid the accumulation of undesirable consequences. While the recovery phase (which includes cleaning, infrastructure repair and replacement, and continuous provision) is likely to be delayed, the need for efficiency and effectiveness is just as critical. Thus, the critical nature of preparation and the specifics of disasters. However, once the disaster has occurred, site managers must design sophisticated actions in a short period of time without consulting their top supervisors. Remote sensing can be utilised in a variety of ways in public administration and planning, including monitoringurban development and land use. After wars, industrial disasters are probably the most devastating things that people can cause. Chemical, mechanical, civil, electrical, or other process

failures in an industrial plant, caused by accident or carelessness, can lead to these disasters. They can cause a lot of damage inside and/or outside the plant. India's nuclear facilities follow rules that are recognized around the world to keep people and the environment safe. Aside from this, a terrorist attack in any of India's major cities could cause a nuclear disaster. To avoid these kinds of disasters, you need a good decision support system.

Figure 1: Disaster Management Phases

Government spatial planning and administration can benefit greatly from the use of GIS-based data. As a result, the database stores the data's spatial coordinates. In addition,The database of the system can be used to store spatial data that has been evaluated by GIS software. For example, hotspot analysis can be used on crime data to find places where there are a lot of crimes. This is important for preventing crime and for law enforcement operations. The complexity of challenges affecting sustainable development necessitates intelligent decision-making, which is becoming increasingly difficult, particularly in the sphere of environmental protection. New decision support approaches and instruments have been developed as a result of advancements in decision theory and the study of decision support systems. However, designing and developing instruments capable of assisting decision-makers in making complicated decisions is a time-consuming and difficult undertaking.

II. LITERATURE REVIEW

Mehra et al., (2020) Systems designed to aid in disaster prediction must be resilient enough to resist the challenges a disaster management system may encounter. Under the event of a sandstorm or hurricane, the presence of dust particles may degrade a system's system; nonetheless, autonomous driving systems should operate safely in foggy situations. During a disaster, disruptions in communication are also a risk. In additionOther difficult tasks include maximizing the number of people protected during a disaster or pandemic, evacuating people at the right time, identifying vulnerable areas for pandemic spread, reaching the most affected people/areas and providing them with adequate resources, estimating economic loss, and many others.

Anbarasan et al. (2020) describe an approach for detecting flooding based on machine learning. It leverages Hadoop

MapReduce to remove duplicate values. The rules are then formed based on the rainfall sensor, humidity sensor, water flow sensor, and water level sensor. In addition, CNN utilizes the regulations. The suggested neural network organizes data pertaining to flooding into positive and negative categories. To assess and increase the precision of the data they collect, IoT devices might apply machine learning algorithms. In mitigating flooding, IoT-enabled methods encounter a number of hurdles. It involves a complex set of interdependent variables, such as precipitation, pressure, and flow rate. The sensor network must be built using the specified settings. Count and connection of sensors are strongly dependent on river readings. Indeed, previous studies on natural hazards, such as mapping flood susceptibility, have utilized the Random Forest approach efficiently.

Simioni et al (2020) The deterioration of these ecosystems is exacerbated by climate change, which reduces precipitation and raises temperatures. These occurrences, along with anthropogenic perturbations, have created an unsettling scenario for the Mediterranean forest environment. In addition to these reasons, forest fire is a significant hazard to the Mediterranean forest, with over 50,000 fires annually consuming an average of 600,000–800,000 hectares of forest. Therefore, forest fire susceptibility maps remain vital for identifying and predicting potential threats in this setting in order to safeguard the operating qualities of forest ecosystems as well as their invaluable services and benefits for human welfare. In addition, land use planning requires the compilation of a forest fire susceptibility map early on. In addition, such a map can serve as a valuable tool for reducing susceptibility and may aid in ecological risk prevention decision-making.

Moayedi et al (2020) However, few papers have investigated the use of ensemble models for assessing forest fire vulnerability. This study employs five novel hybrid models that integrate statistics and machine learning methodologies. The Frequency Ratio was added into the machine learning algorithms MLP, LR, CART, SVM, and RF for predicting forest fire vulnerability. As the region most affected by the fire on a national scale, the case study centered on Morocco's northern region. We are not aware of any prior research that utilized machine learning algorithms and GIS technologies to predict and monitor forest fire risk. The primary objectives of this study are: I to evaluate the effectiveness of hybrid models for forest fire forecasting in this study region; and (ii) to create spatial susceptibility maps using the presented methodologies to identify high-risk areas requiring emergency action. Thus, the findings of this study are regarded as a valuable guide for the management of Mediterranean forest ecosystems.

III. RESEARCH METHODOLOGY

The entire system operates primarily through two techniques. This indicates that emergency circumstances are handled by a registered IoT module installed in the building and a mobile application. The user can send a request with a single click of a button. Admins have a dashboard for real-time monitoring and can issue notifications to users via IoT module-integrated

alarms. Each request is transmitted via mobile application using an internet connection. The live monitoring system retrieves the user's location information from the database and displays it as a map view.
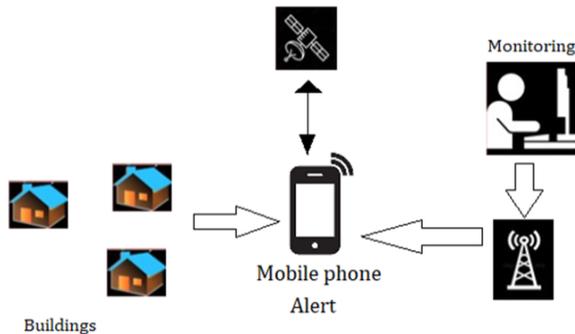

Figure 2: Architecture Framework

A. Methodology Proposed Steps Submit your manuscript for review electronically. The approach consists primarily of registering the IoT module with the mobile application, communicating emergency conditions to the control room, and issuing notifications from the control room.

1) Registration: Before logging in, each user must register for the mobile application. User registration should be completed using their home location. The mobile application retrieves the home's latitude and longitude automatically. User must provide the SIM card number installed into the IoT module during registration.

2) Button click: Using a simple button push, a registered user can notify monitoring centers or the control room of current critical situations. This can be achieved in two ways. Utilizing a mobile Application and Hardware device (IoT module). Clicking a button will update the dashboard (Admin side). They can view the most recent requests/updates associated with the user's location. Decisions regarding requests are made manually.

3) Alarming: Location-based alerts are available to administrators. The administrator is able to select district and local areas within the district that may suffer imminently deteriorating conditions.

This system's whole implementation comprises of a hardware component and a software component. The majority of the software is implemented using Java, PHP, and JSON. The object-oriented capabilities and user-friendly environment provided by Java on Android. By utilizing the naive Bayes method, it is predicted that excessive rainfall may cause flooding in some places. Therefore, the JSON file indicates these potential affected regions. If the statistics indicate an unfavorable state of the disaster system, it indicates that there is no cause for alarm. The system searches for individuals in affected zones before sending them a warning.

By doing so, only the affected individuals and not the entire database receive alerts. It provides a summary of the classification of the alert. Figure illustrates an internal perspective of the application. Users must click "Create

Account" and give the appropriate information in order to insert data into the database. After registering, a person's information is stored in a database. A user can modify or delete their account details by using the Change Account menu. There are two options accessible after choosing Modify Account: modify account and delete account. The user's unique mobile number (primary key) must be provided in order to change their account details. To delete an account, customers must re-enter their mobile number. The system will then search the database for this mobile number and delete the corresponding data. When applications request weather updates, the website evaluates the disaster status and generates a JSON report depending on the current weather conditions.

IV. ANALYSIS & RESULTS

After collecting information from multiple sensor devices located in a particular area of interest. When a proper connection is established with a server device, the detected data will be automatically transferred to the web server. By inputting the IP address of the monitored server, the appropriate web page will be displayed. The website provides data on changes in the earth's coordinates and water level fluctuations in the region where the embedded monitoring system is located. Cloud storage will be used to store the records (Google Spread Sheets). Data stored in the cloud can be used for parameter analysis and continuous monitoring. All data will be saved in the cloud, enabling us to deliver at any time a trend analysis of earthquakes and floods in a particular location.
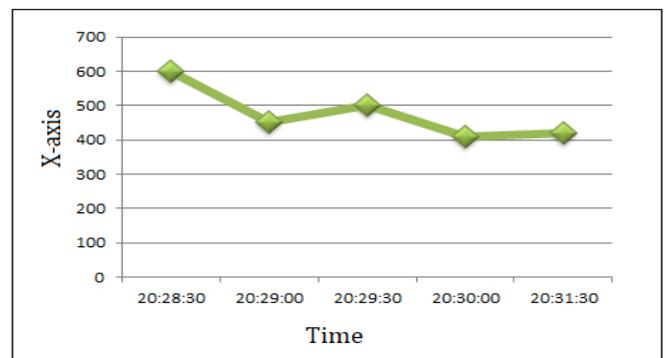

Figure 3: X-axis Variation

Figure 3 depicts the fluctuation of the x-axis at regular time intervals. For each geographic point, a threshold value is determined based on the region's prior history. This depicts the x-axis variation at various points throughout time. The reference number in this case is 500.

Figure 4 depicts the fluctuation of the y-axis at regular time intervals. For each geographic coordinate, a threshold value is determined based on the region's historical data. This depicts the variation of the y axis at various times. The reference number in this case is 500.
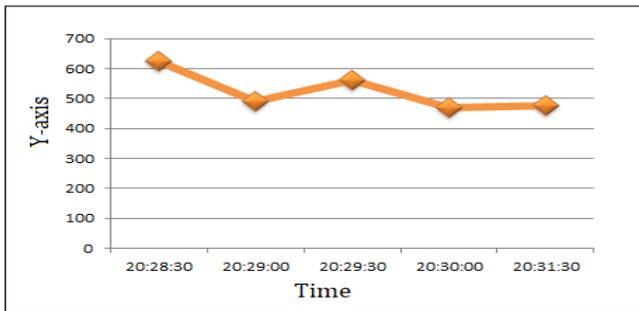
Figure 4: Y-axis Variation

Utilizing distinct foundation maps can be useful. Following the occurrence of the attack, the restriction must be imposed in order to prevent the occurrence of despondency-related mortality as a result of the fall and additionally. On the walking stick, a functional prototype of a 3-axis accelerometer-based fall detection system and many additional modules was successfully fabricated. It is vital to emphasize that the person holding the stick should be well-informed on the stick's functionality, especially the distress/SOS button. Our approach to the creation of the smart walking stick is straightforward and foolproof. All of the modules are interconnected by RIO, and since all of the sensors are small, the stick is easy to transport. Additionally, the RIO is powered by a battery, so there is no need to worry about power usage, as the sensors we've used require very little energy. As a result of interfacing numerous sensor types that are not typically interoperable, we have made our walking stick functional both indoors and outside.

VII. CONCLUSION

According to this study, we may build low-cost wireless sensor network components to detect flooding and deliver alerts to coastal residents of a country.Adoption of innovative processes could reduce the probability ofDestruction of large-scale infrastructure and loss of lives caused by both natural and man-made disasters. The Internet of Things, which enables the seamless integration of heterogeneous devices with distinct capabilities, is a feasible option for disaster management. Using data analytics and artificial intelligence techniques, IoT-enabled disaster management solutions provide early warning of an impending event. Given the magnitude of the effects of any disaster, the IoT-enabled disaster management system can be used to locate the victim and even conduct rescue operations. This study aims to provide a foundational understanding of IoT-based disaster management systems so that past research contributions and future directions for disaster management system research can be comprehended.

REFERENCES

1. A.Mehra, M. Mandal, P. Narang, and V. Chamola, "Reviewnet: A fast and resource optimized network for enabling safe autonomous driving in hazy weather conditions," IEEE Transactions on Intelligent Transportation Systems, pp. 1–11, 2020.
2. M. Anbarasan, B. Muthu, C. Sivaparthipan, R. Sundarasekar, S. Kadry, S. Krishnamoorthy, D. J. S. R.], and A. A. Dasel, "Detection of flood disaster system based on iot, big data and convolutional deep neural network," Computer Communications, vol. 150, pp. 150 – 157, 2020.
3. G. Simioni, G. Marie, H. Davi, N. Martin-St Paul, R. Huc Natural forest dynamics have more influence than climate change on the net ecosystem production of a mixed Mediterranean forest Ecol. Model., 416, p. 108921, 2020.
4. H. Moayedi, M. Mehrabi, D.T. Bui, B. Pradhan, L.K. Foong Fuzzy-metaheuristic ensembles for spatial assessment of forest fire susceptibility, J. Environ. Manage., 260, p. 109867, 2020.
5. Rahmati, O.; Samadi, M.; Shahabi, H.; Azareh, A.; Rafiei-Sardooi, E.; Alilou, H.; Melesse, A.M.; Pradhan, B.; Chapi, K.; Shirzadi, A. Swpt: An automated gis-based tool for prioritization of sub-watersheds based on morphometric and topo-hydrological factors. Geosci. Front., 10, 2167–2175, 2019.
6. Nhu, V.-H.; Rahmati, O.; Falah, F.; Shojaei, S.; Al-Ansari, N.; Shahabi, H.; Shirzadi, A.; Górski, K.; Nguyen, H.; Ahmad, B.B. Mapping of groundwater spring potential in karst aquifer system using novel ensemble bivariate and multivariate models. Water, 12, 985, 2020.
7. Shirzadi, A.; Solaimani, K.; Roshan, M.H.; Kavian, A.; Chapi, K.; Shahabi, H.; Keesstra, S.; Ahmad, B.B.; Bui, D.T. Uncertainties of prediction accuracy in shallow landslide modeling: Sample size and raster resolution. Catena, 178, 172–188, 2019.
8. Abedini, M.; Ghasemian, B.; Shirzadi, A.; Shahabi, H.; Chapi, K.; Pham, B.T.; Ahmad, B.B.; Bui, D.T. A novel hybrid approach of bayesian logistic regression and its ensembles for landslide susceptibility assessment. Geocarto Int., 34, 1427–1457, 2019.
9. Garosi, Y.; Sheklabadi, M.; Conoscenti, C.; Pourghasemi, H.R.; Van Oost, K. Assessing the performance of GIS-based machine learning models with different accuracy measures for determining susceptibility to gully erosion. Sci. Total Environ., 664, 1117–1132, 2019.
10. Bui, D.T.; Shirzadi, A.; Shahabi, H.; Chapi, K.; Omidavr, E.; Pham, B.T.; Asl, D.T.; Khaledian, H.; Pradhan, B.; Panahi, M.; et al. A novel ensemble artificial intelligence approach for gully erosion mapping in a semi-arid watershed (iran). Sensors, 19, 2444, 2019.
11. Huang, F. et al. Landslide susceptibility prediction based on a semi-supervised multiple-layer perceptron model. Landslides 17(12), 2919–2930, 2020.
12. Panahi, M., Gayen, A., Pourghasemi, H. R., Rezaie, F. & Lee, S. Spatial prediction of landslide susceptibility using hybrid support vector regression (SVR) and the adaptive neuro-fuzzy inference system (ANFIS) with various metaheuristic algorithms. Sci. Total Environ. 741, 139937, 2020.
13. Lozano F.J., Suárez-Seoane S., Kelly M., and Luis E., A multi-scale approach for modeling fire occurrence probability using satellite data and classification trees: a case study in a mountainous Mediterranean region. Remote Sens. Environ. 112(3): 708–719, 2008.

14.   Martín Y., Zúñiga-Antón M., and Rodrigues Mimbrero M., Modelling temporal variation of fire-occurrence towards the dynamic prediction of human wildfire ignition danger in northeast Spain. Geo. Nat. Hazards Risk, 10(1): 385–411, 2019.

15.   Jaafari, A.; Najafi, A.; Pourghasemi, H.; Rezaeian, J.; Sattarian, A. Gis-based frequency ratio and index of entropy models for landslide susceptibility assessment in the caspian forest, northern iran. Int. J. Environ. Sci. Technol., 11, 909–926, 2014.