

DEVELOPMENT OF A MOBILE APPLICATION SUPPORTED BY MODERN GEOGRAPHIC INFORMATION SYSTEMS FOR PROTECTION AND RESCUE FROM NATURAL DISASTERS AND DISASTERS

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Nowadays it is the concern of both the government and the citizens to take care of the people against the increasing crises around the world. There are so many natural disasters such as: incidents of forest fires, earthquakes, floods, eruptions, tsunamis, etc. despite all these types of natural and man-made disasters from a social perspective, in their potentiality, they lead to regions ending up with serious and irreversible damages that in certain cases end with the permanent displacement of the population. In addition, the extent and severity of such incidents can significantly affect the way populations and wildlife survive. For that reason and the fact that the Geographic Information System is recognized as a useful risk mitigation system during crisis management, we are developing the idea of promoting a new model to have a practical and applicable method of adopting a mobile application based on modern GIS supported by GPS technology within crisis management to save as many lives as possible.

This scientific paper aims to come up with a model that will not allow us to guess how many people are affected by a certain natural disaster. Every smartphone will have an application in the event of a natural disaster and will collect information that will report the last location and the change in the vital function of the person in trouble. This will help the protection and rescue departments to respond as quickly as they can and save as many lives as they can and also reduce the percentage of people who could not call for help. This paper highlights the design challenges and necessary technical innovations towards the goal of making GIS at a much more useful level.

The application will be based on the principle "every person with a mobile phone is a sensor" and feel safe at any given moment. It will collect all the necessary information from personal and collective safety that will help emergency and rescue teams.

In addition to such cases of application, it will also be used in everyday activities to help in various situations where there is a need for interventions. With this application, we enter the area of prevention and have some control over the area of intervention and remediation. For safe rescue in the field we will use the mobile application 4Safe&Save.

Keywords: *GIS, mobile application, protection, rescue and disasters.*

INTRODUCTION

A critical component of any successful rescue operation is time. Knowing the precise location of landmarks, streets, buildings, emergency service resources, and disaster relief sites reduces that time -- and saves lives. This information is critical to disaster relief teams and public safety personnel in order to protect life and reduce property loss. The Global Positioning System (GPS) serves as a facilitating technology in addressing these needs. Incorporation of GPS in mobile phones places an emergency location capability in the hands of everyday users. Today's widespread placement of GPS location systems in passenger cars provides another leap in developing a comprehensive safety net. Today, many ground and maritime vehicles are equipped with autonomous crash sensors and GPS. This information, when coupled with automatic communication systems, enables a call for help even when occupants are unable to do so. GPS has become an integral part of modern emergency response systems -- whether helping stranded motorists find assistance or guiding emergency vehicles. When disaster strikes, apps save lives. We've experienced the social impact disaster management apps can have first hand through our work with The Red Cross. Here are the top nine features that we believe can make mobile apps help during a crisis.

Development of a mobile application "4Safe&Save" supported by modern geographic information systems for protection and rescue from natural disasters and disasters is that's where disaster management technology can come to the rescue, not only responding to emergencies and disasters when they happen but preparing communities, by educating them on the best ways to prepare for the inevitable.

One of the most effective ways we've seen this done is with a mobile app. supported by GIS. Geographic Information Technology in Natural Disaster Education Provide position information for mapping of disaster regions where little or no mapping information is available. Having experienced something of this scale, it feel as though there's a real opportunity to make an impact and help save more lives during times of catastrophe.

By providing positional information about individuals with mobile phones and in vehicles in case of emergency and making sure that app is easy to use and easy to understand FOR EVERYONE, it will make sure the disaster preparedness app can save lives when it matters the most. That's why it's so important that disaster management apps include advice on what to do BEFORE the disaster strikes. It could be a fact file, a quiz, a survival game... as long as people are engaged and learning, it'll save lives.

In all our time working with disaster preparedness and management organisations, we've experienced first hand the impact apps can truly have, and the sheer number of lives they have the potential to save. Natural hazards include earthquakes, cyclones, floods, mud slides, droughts, tsunamis, volcanic eruptions, and fires. For all disasters that follow natural hazards, ICTs play a critical role in facilitating the flow of vital information in a timely manner. Enhance capability for flood prediction and monitoring of seismic precursors and events. Information and Communication Technologies (ICTs) play a significant role in disaster prevention, mitigation response and recovery. Timely, predictable and effective information is much needed by government agencies and other humanitarian actors involved in rescue operations and decision-making processes.

With the popularization and application of mobile smart devices, the number of users of smartphones and tablets has far exceeded the number of desktop computer users. Meanwhile, mobile communication is developing rapidly, and the number of 5G base stations is also increasing. Mobile GIS has become an important client of Web GIS. Survey 123 for ArcGIS is a forms-centered data collection solution for mobile GIS applications. With its simple interface and easy operation, geography teachers can quickly design questionnaires and share them in the form of QR code or URL. At the same time, geography teachers can analyze the collected questionnaire information on the platform.

GIS AND THEIR APPLICATION IN NATURAL DISASTERS AND DISASTERS

The GIS Technology is combined with Global Positioning System (GPS), which will help to receive/update the help from disaster rescue teams. That's where disaster management technology can come to the rescue, not only responding to emergencies and disasters when they happen but preparing communities, by educating them on the best ways to prepare for the inevitable. One of the most effective ways we've seen this done is with a mobile app. GIS technology has been vital for emergency preparedness through planning & execution and has saved many lives in many disasters. It has improved certain extended limits like environmental understanding, strategic decision making, monitoring of climate change impact, and ascertaining future risks. It is mathematics functional algorithms to analyze the geo-spatial data and display the output in a visual format.

GIS is useful for hazard zone mapping and during emergency conditions mitigation of people can easily possible using these maps. GIS and Remote Sensing are much beneficial in mitigation strategies and preparedness plans.

Real-time geographic data can improve the allocation of resources for response. GIS technologies are much useful in the modeling of disaster risks and human adaptations to hazards. It also provides a decision support system in disaster management.

All disasters are spatial in nature. GIS techniques act as a decision support tool. Decision-making can possible by the analysis of different GIS layers. Currently, socio-economic and geo-spatial data is useful for the management and planning of disasters as well as tackling disastrous conditions. Various departments and agencies are stakeholders using GIS in the disaster management process. GIS, RS and GPS is useful in disaster management applications and for decision making. The evolution of computer technology and the availability of hardware is helpful for the rapid expansion of GIS in both disaster research and practice.

GIS is the most complete information system for modeling, analyzing spatial data, and displaying community vulnerability. When we identify hazard locations with critical infrastructure. Processed GIS Models can be useful for the determination of event impact and necessary mitigation requirements. Preparedness is important when a disastrous event occurs. An analysis of risk and hazards is beneficial in an emergency management program.

In the event of a disaster or post-disaster emergency, GIS technology uses a combination of GPS and 5G technology to enhance assistance. In the event of a disaster, people need emergency assistance after the disaster, geospatial data can be used to determine the answers to user questions regarding emergencies like health center operations, temporary potential shelter locations, and so on.

The central / state government or relief team address/respond to all those in need of help during the time of the fight against a disaster with of help of GIS Technology. Making sure your app is easy to use and easy to understand FOR EVERYONE, it will make sure the disaster preparedness app can save lives when it matters the most. The real-time location tracking platform or web/mobile GIS-based applications are enabled to interact with the maps which contain the details of the earthquake location & its intensity, health facility, nearby base camp information, and damage assessment. The GIS-based application also acts as a collective platform for data gathering around the incident of infrastructure damage or fire and information dissemination to relief teams involved in providing aid to those affected by the disasters.

DEVELOPMENT OF A MOBILE APPLICATION “4Safe&Save” BASED ON GIS FOR PROTECTION AND RESCUE FROM NATURAL DISASTERS AND DISASTERS

The development of mobile applications has made it possible for people to access information and services anywhere they are. Applications that help people in the event of a natural disaster or disaster can be very helpful. A modern geographic information system (GIS) can be used to create maps, which will show areas affected by a particular type of disaster, as well as where resources are needed most.

This application will allow users to find shelters, food banks, and other necessary resources quickly and easily. The application will also allow responders to locate victims quickly during a crisis situation. The development of a mobile application “4Safe&Save” that is based on GIS is a research and development project. The project will involve the study of the problem, the formulation of the need, the design of the system, the development of the system, and the testing of the system. The application will be designed to be used by civilians, civil defense and response teams to locate and rescue victims from disasters. The system will be able to integrate with other systems to provide the user with a comprehensive picture of the disaster and the area surrounding it. Implementation of the system will involve the training of personnel who will be responsible for using the system. The personnel will also be required to maintain and update the system.

Geographic Information Systems (GIS) provide accurate mapping tools necessary for effective decision making following a disaster. Modern Geographic Information System technology allows users access maps using GPS devices embedded within smartphones, tablets and laptops. Geographic Information Services offer several applications including emergency services where realtime location of the affected area is critical enabling timely response and recovery, mitigation strategy support, resource allocation/assistance decisions based on current data, public warnings, tracking volunteer activity/instructions.

GPS systems provide essential tools for emergency response teams including first responders, police officers, search and rescue personnel, public utility workers as well as transportation service providers to locate victims faster, identify potential hazards sooner, reduce property damage due to hazardous conditions and enhance evacuation efforts. We need to learn about different cultures before we go overseas to see what life there is like so that when we return home our interactions are based upon mutual understanding rather than stereotyping and ethnocentrism. When rescue teams reach areas affected by floods, earthquake or hurricanes, they need to determine their exact positions within five meters accuracy in order to coordinate their search operations effectively.

Having weighed up all arguments, we come to the conclusion that the use of smartphones and other portable electronic equipment can be beneficial for people working closely with dangerous situations, when applied correctly. Having experienced something of this scale, I feel as though there’s a real opportunity to make an impact and help save more lives during times of catastrophe. When disaster strikes, apps save lives. We've experienced the social impact disaster management apps can have first hand through our work with The Red Cross.

STRUCTURE OF THE SYSTEM AND MOBILE APPLICATION “4Safe&Save”

Field data is very important in GIS applications and Mobile GIS provides crucial information. Field teams capture information and sent it back to the user. So ground information useful for recognizing actual event conditions. Then new data can be sent to operation teams in the field (where the disaster occurs), so they have the information possible for protecting lives and providing safety to people. Whether it’s a response or recovery phase, Mobile GIS provides the right

information. Google People Finder is another innovative piece of technology which can help with disaster relief efforts. It was developed in 2010 in response to the Haiti earthquake. It is an open source web application, which is available in over 40 languages. The application allows users to post and search for the status of people affected by a disaster. During the 2015 Nepal earthquake, well over 7,500 records on the people finder were searched.

For that purpose it should be made a complex system of software for managing crisis situations and disasters. The system it will be able to help in all aspects of crisis management.

The system must comply with the objectives, functions and powers of the territorial bodies of executive authorities and departments of the countries, in the field of prevention, combating and elimination of criminal crises, terrorism, natural and manmade, anti-terrorist and anti-criminal protection, safety and security. Creating a system should be comprehensive interdepartmental aimed at improving information technology and information and communication infrastructure of public administration in general [4].

To create a comprehensive system is to ensure the safety of protection by reducing the probability of threats of natural, man-made, criminal, terrorist and other situations due to:

- Effective monitoring of the current situation and providing information for the authorities.
- Providing information about the current state of security facilities, protection services and operational headquarters.
- Providing analysis and management of the threats, natural, man-made, criminal, terrorist and other character crisis.

With an integrated system must be provided:

- Development of technical regulations (conditions) to equip the objects of protection (and their components) technical means of security and control, as well as the functioning of the monitoring tools and equipment (systems).
- The ability to monitor the status of security protection objects (their elements), as well as the movement of persons and transport facilities for protection.
- Automation of the process of collecting and transmitting information to the monitoring objects of protection (their elements).
- The possibility of collecting and transmitting information from existing and emerging security products to protect and control objects.
- The possibility of collecting and transmitting information to the services of territorial bodies.
- The possibility of sharing information between services (including situational centers) with the task of ensuring human safety both on a bilateral and multilateral basis.

Must be implemented automated control mechanisms, information analysis monitoring, forecasting situations. Integrated system it will be based on geographically distributed principle and consisting of a single point of management, transport network, as well as places of gathering, processing and analysis of information.

International conference on the occasion of international civil protection day
CHANGES, CHALLENGES AND RESILIENCE OF CIVIL PROTECTION DURING COVID 19
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The whole system it will consists of four phases.

- Phase one: Software that helps in locating, guiding and directing the people;
- Phase two: Flying drones that search and detect disasters and people;
- Phase three: Specialized machines for helping people;
- Phase four: Human resources or specialized people working on field.

1 st phase: Is to use a GIS software that will detect the crisis/disaster and to classify it. (What sort of disaster (crisis) and the proportions of it).

Then it will be created an appropriate application for all types of smart phones, for all types of operating systems (Android, IOS, Microsoft). The application it will have access to the location of the smart phone, calls, messages, emails and the phone contacts. This will allow locating phones in crisis areas and access to vital content on the phone (name of the user, numbers of the closest or most used phone calls), for those phones that are turned on (operational)[3].

The application will consist of three main functions / tools:

- Prevention or procedures and actions what to do before the disaster,
- Instructions what to be done during the crisis and
- Instructions after the crisis, how to take un appropriate measures and procedures

1. The first function of the application will inform the users about the possible natural disaster, what to do and how to do it. Directions on how to protect, provide or avoid possible situation (flood, fire, tsunamis, NHB pollution ect). It will inform the consumers where to head, with the appropriate address, phone numbers and how to reach the place with a particular map.

2. The second function it will be based on the morale and stability during the disaster. How the users to remain calm and not to panic, but to think realistically and rationally. Of course, the application will have all the previous functions, where how and what to do.

3. The third tool will consist of basic survival manuals with pictures. And measures where people to go and how to reach the most basic needs.

For all non-smart phones and cell phones that don't have GPS, this will also be possible. It can still be tracked. This is because a cell phone is basically an advanced two-way radio in which communication are made via cell towers. These cell towers are within a network of cell towers which its main function is send and receive the radio signals emitting from your phone. And cell phone is basically transmitting radio signal to the nearest cell tower. The closer your phone to a cell tower, the stronger the signal that is emitted. So, by measuring the signal strength and also through triangulation method with other

cell tower; that is by measuring how strong or weak signal emitted by your phone, your phone location can be pinpointed almost accurately. Innovation is that mobile application “4Safe&Save” is remembering last position of every person, no matter of his condition. We will know exactly how many people are effected directly in every disaster situation by showing their last coordinates on map that will help us in search and rescue operations.

2nd phase: The second phase will be consisting of a series of little flying drones which it will be equipped with a various sensors and cameras (video live stream, thermal scanning, structural laser scanning, Wi-Fi hotspots servers, signal scanner and receiver). Sensors for identifying the crisis and sensors for tracking and founding people. All flying drones will be communicating with one HQ that will control the drones.



Figure 1: Parrot beob drone

3rd phase: will be for those who cannot reach the emergency centers and basic needs. On them will be sent help from ground and air with adequate machines (robots and drones) in the form of food, water, first aid and medicine. The machines will choose where to go alone and where to deliver the packages by implementing AI and machine learning softvers.

4th phase: will consist of specialized teams for different kind of disasters and teams dedicated for managing crisis situations. Every team will be equipped with equipment and tools for dealing with every situation on field and in every HQ. This phase will have an option of including the Army of the country that has a crisis or every available people.

POTENTIAL BENEFITS OF USING A MOBILE APPLICATION “4Safe&Save” FOR DISASTER MANAGEMENT

People will be relying on our app to get themselves to safety, that’s why keeping their life-line alive is by far the most important thing to do. Assist with hazard mapping to identify key infrastructure at risk - the risk can then be addressed through mitigation or built in redundancy. Can also be used for later damage assessment post-disaster, the merit of using

multiple types of crowdsourcing data is that it covers all age groups of citizens and overcomes technical limitations, such as poor mobile network connectivity.

After the disaster, in the recovery phase, it is possible to provide connectivity with the solution as Cell on Wheels (COW) (Riccardi, 2016). The lack of network operation during a disaster can be overcome by developing of our mobile application that collects urban data to reduce hazards and enable communication during the disaster without using a network in the moment, but with WiFi drones we can make buffer zones for net communications.

The goal of IoT devices used during catastrophe management is to not only minimize the harm caused by the disasters but also ensure prompt and effective assistance to the victim and quick recovery from that disaster effectively. All these objectives are fulfilled by using effective IoT devices for the effective rescue operations post from the disaster.

There are various forms of catastrophe damage information needed for successful preparation and urgent relief for these disasters. The IoT technologies that are already quite advanced can minimize the harm caused by the catastrophe situation. Having the ability to track disasters in real-time means that you can know when and where the disaster is going to hit and how to respond on it.

For example, you can get help and information on how to provide emergency medical aid for an injured person. In emergency situations you just need to connect to the application, find your problem and follow the instructions provided by the experts, and the most important thing is that this application knows your last location and have all your data information. “The application is quite important for population especially for those people who live in rural and remote areas to understand what disasters are likely to impact their living area, how to cope with disasters like earthquakes or floods, and how to manage the situation until professional emergency help comes.”

Such an application would be useless if nobody used it. Telecommunications are critical at all stages of disaster management: mitigation, preparedness, response and relief, recovery and rehabilitation. There is a lot of literature on the topic of crowdsourcing support for disaster management. From the wealth of information found in previous studies, a few recent review studies have highlighted that look back at the importance of the practice due to the constant evolution of technologies.

Challenges that must be overcome for the development of a mobile application “4Safe&Save” for disaster management are the criticality and complexity of disaster operations requires robust and validated ML and DL solutions. Disaster operations affect human life; therefore, the developed models should also be explainable to be understood by domain experts and decision makers. Moreover, research should focus on improving the quality of the data and developing novel data capture techniques as well as using crowdsourcing to improve the performance of ML/DL-based methods for disaster management operations.

Bottlenecks in DL that need to be addressed in future studies, in order to enhance the robustness of DL-based methods for effective disaster management, include the limited amount of available labeled training data and the human labeling of the

datasets. DL overcomes the manual feature engineering process by automatically learning complex structures, yet with the expense of requiring very large amount of labeled data manually annotated in order to automatically learn the features. Moreover, social media data contain high levels of noise, therefore, more methods should be developed to effectively differentiate signal from noise in the above data.

Furthermore, focus on all phases and areas of disaster management is needed, as already identified in previous reviews. Long-term disaster recovery includes sustainable development efforts ultimately leading to community resilience building. The resilience of key infrastructure influences the effectiveness and progress of disaster recovery efforts.

Vulnerability assessment of an urban electricity and transportation infrastructure was studied in the context of resilience, using a hybrid graphical causal method. Additionally, the accurate damage and loss assessment is necessary for efficient management of financial aid allocation during the recovery phase. Novel methods based on CNNs and satellite imagery data can enhance the performance of damage assessment of residential buildings.

Furthermore, the integration of multiple remote sensing data can improve the overall performance. If information and communication technology (ICT) infrastructure is damaged during a disaster, it can be difficult to carry out relief operations. This disruption can cause serious problems in communications and the identification process of the areas where immediate relief operations are needed. It is proposed and applied a methodology to identify those areas where relief operations are needed based on priority using big data analytics techniques. They used the census, geospatial and satellite images data and deployed this system using the cloud platform of AWS (Amazon Web Services).

The complexity of the disasters and the criticality and complexity of disaster operations require robust decision making, enhanced by information technology and in particular AI.

CONCLUSION

This integrated system should allow:

- Ensure compatibility of existing and emerging information and technical systems to improve the efficiency of management in the field of safety of life of the population.
- Increase the effectiveness of control objects with mass stay of people and critical facilities.
- Increase the effectiveness of measures to eliminate the consequences of natural and man-made disasters.
- To reduce the loss of life in emergencies, fires, earthquakes by locating people in every situation and every moment.

Every day, we are confronted with disasters of varying degrees. Those that have adequately developed, maintained, and exercised their contingency plans will survive. Yet many people continue to take the uninhibited operations of their lives for granted. They remain complacent, assuming that the power will always be available, the telephone system will not fail,

there will be no fire or earthquake--everything will always be normal. However, it is only as good as the foundation upon which it was built. The foundation is, of course, the concept.

This research application is the means by which a particular mission, program, or policy directive is translated into a fundamental organizational and operational methodology. Once the system is developed and is sanctioned by both management and the operating elements, construction of the contingency plan may commence. A fundamental premise of successful contingency planning is that plans are developed by those who must carry them out in the event of an actual disaster. Disaster planning is truly a vital part of the overall business plan. With every year rising disasters the people are more and more threatened. We are hoping that with this software will help them all. The software is expected to decree the casualties all around the world, in the crisis areas, and organize the management in these situations. The low cost of the software is a big advantage in the development of the system.

*All this information is part of Military academy research application, and all of them are forbidden for unauthorized use and coping without permission of the authors and institution.

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