Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Real Time Triage Decision Support System for Emergency Medical Dispatch

[1]Kalpana Singh Chauhan, [2]Bhageshwari Singh, [3]Shreyas Anute, [4]Aniket Mishra
[1]*Computer Science and Engineering (Cyber Security) Thakur College of Engineering and Technology Mumbai, India* chauhankalpana2020@gmail.com
[2]*Computer Science and Engineering (Cyber Security) Thakur College of Engineering and Technology Mumbai, India* singhrani172003@gmail.com
[3]*Computer Science and Engineering (Cyber Security) Thakur College of Engineering and Technology Mumbai, India* 010335shreyasanute@gmail.com
[4]*Computer Science and Engineering (Cyber Security) Thakur College of Engineering and Technology Mumbai, India* aniket.mishra@tcetmumbai.in
Corresponding author: Kalpana Singh Chauhan (chauhankalpana2020@gmail.com)

ARTICLE INFO

Received: 30 Dec 2024

Revised: 12 Feb 2025

Accepted: 26 Feb 2025

ABSTRACT

Massive victim counts and resource requirements that far exceed available resources are characteristics of disasters. Several organizations are involved in responding to disasters, including hospitals, dispatch centers, emergency operations centers, regional command, and incident commanders. The cooperation of these several organizations should be facilitated by an efficient emergency response system. An emergency management system's victim triage, resource allocation, and hospital dispatch are crucial components. An emergency response framework comprising all of the previously described elements is created in the current study endeavor.

Concentrating on large casualty victims according to the level of severity of their injuries is known as triage, and it calls for a quick and effective initial reaction. Patients are ranked in order of importance for receiving medical care and treatment based on how seriously damaged they are. With the current paper triage methods, it takes time to consolidate victim triage data. The present dissertation presents a low-cost victim triage system that uses RFID tags instead of paper triage tags to compile all victim data into a database. It will make it possible to use GPS to track the movements of emergency responders.

Keywords: Application Programming Interface (API), Electronic Health Record (EHR), Emergency Medical Services (EMS), Information and Communication Technologies (ICT), Mass Casualty Incident (MCI), Pre- commercial Procurement (PCP).

I. INTRODUCTION

A disaster, whether natural or man-made, is a situation that endangers lives and affects an extensive population. They are unexpected, intense, and uncommon occurrences that make the circumstances for those in charge of them chaotic.

An extensive comprehension of the primary inadequacies and difficulties of the already used methods and resources was made possible by an internal screening and organized data collection, which also established a crucial foundation for the later stimulation of functional and, particularly, non-functional needs. Several important categories were addressed by the collection template, including associated with business, organizational, technological, legal, and regulatory aspects.

It is reasonable to say that an inventive system needs to be created in a way that facilitates the process of planning and making decisions while accounting for every variable that the EMS professionals at the scene of the accident currently encounter. The effective utilization of resources is also necessary to minimize the expense of each operation while maintaining the safety of the casualties at all times. All of the emergency specialists that the project collaboration worked with generally stated that the industry needs to push the boundaries of existing development and enhance

Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

the triage management procedures that are now in place.

Connecting EMS professionals with other EMS ecosystem consumers will allow for consistent and dependable interpersonal interaction with the EMCC, the hospital to which the casualty is being transferred, and fast accessibility to the casualty's medical records. This is a system that will actually have a positive effect on the tasks of emergency teams. The previously mentioned need suggests that direct data transmission between the triage system and the other EMS companies' information systems is required. In order to

provide future upgrades and enhancements, data transfer must be feasible and sustainable while implementing this interoperability.

However, in order to accomplish this, the solution must demonstrate that it is capable of replicating decision-making and interventions. In conclusion, with regards to the health records of victims that is shared and updated amongst the many stakeholders, data security must always be ensured by implementing the required cybersecurity safeguards.

II. LITERATURE REVIEW

The literature review and desk analysis were further developed and influenced with an emphasis on triage management in consideration of the collected insights. Solutions, suppliers/R&D providers, projects, procurers, multipliers, and events are among the evaluated factors.

A. Solutions

A comprehensive market screening has been performed to determine the state of alternatives currently available in the triage management field. Among the most appropriate solutions gathered are solutions that are currently on the market. Several techniques were used in combination to find the answers, including patent searches, keyword searches in several search engines,and literature reviews. The web tool IPlytics was utilized to conduct an efficient global patent search since it offers extensive access to all essential patent databases globally, enables the usage of sophisticated filter queries, and creates lists of associated patents. In the first search, almost 5,800

documents were obtained.

Subsequently the data was manually filtered and screened again, the list of approximately 375 relevant patents for the chosen challenge remained. The patent applications underwent a screening process to determine their general alignment with the relevant topic. It was determined whether they handled a complete triage management system or if they only included key components with necessary features.

Patents older than 10 years were disregarded because the core of the shared difficulty is a modern IT solution.

B. Projects

The end product of the project potentially be directly related to the solution being sought (for example, depending on the technology or methodologies employed). The goal of the Real Time Triage Decision Support System for Emergency Medical Dispatch project is to find an open triage management system that can be integrated with several other systems in the future to enhance EMS operations. Gaining insight into R&D&I projects pertaining to, for example, telemedicine, UMVs, and EMS personnel being aware of circumstances can be important to guarantee that the solution being sought can eventually interact with other impending innovations.

Furthermore, national and worldwide R&D funding schemes were evaluated in order to discover projects. Furthermore, a thorough keyword search was conducted on social media and search engines. For each project following information was collected: project acronym, title, abstract, funding program (if any), and start and end date.

Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Fig. 1 Project List(excerpt)

C. Suppliers & R&D Providers

A list of most probable suppliers was compiled in order to connect with them. This covers all potential IT and health IT suppliers (regardless of whether or not they currently have a solution in place). It additionally includes R&D suppliers, such as businesses engaged in pertinent initiatives inside the industry. Several techniques were used in combination to find these sources, including patent searches, keyword searches in several search engines, and literature reviews.

For each supplier or R&D provider following information was collected: name of solution, type, sector, product categories and country.

Fig. 2. Suppliers & R&D Providers List(excerpt)

D. Multipliers

As a further aspect of the desk research, screenings of "multipliers" were conducted. This covers any association, network, cluster, or other kind of organization that can aid in promoting the project, the Call for Tender, and the open market consultations. These can include health-IT clusters, networks for disaster resilience, multipliers, and competency centers that primarily concentrate on the procurement of innovations of all kinds.

A comprehensive keyword search has been conducted on search engines and social media platforms in order to find multipliers. Additionally, other initiatives have been reviewed for pertinent organizations. For each multiplier following information was collected: name, type, aim, and country.

Fig. 3. Multipliers List(excerpt)

III. METHODOLOGY

The requirements' identification, negotiation, and prioritizing can be viewed as essential components that will have a direct influence on all subsequent project activities, including the development of use cases and process models. As a result, the team chose to employ a variety of data collection techniques to extract information from several sources, enabling all participants to maintain a thorough understanding of all pertinent details and guarantee they could also benefit from one another's perspectives.

In order to improve response planning strategies and scenario building, as well as to facilitate collaborative work among multiple actors, the project will design and develop a system. It will integrate a wide range of support tools that

Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

will be used functionally by multiple stakeholders, including command and control centers, police departments, fire departments, medical emergency services, and civil protection units. With the objective to improve collaboration across autonomous systems (satellite, marine, land, and air-based) from various agencies and to standardize the process for cross-border scenario-building, the system that will be developed will incorporate both new and existing tools.

3. With the participation of end users and local authorities, the project will examine the presently used technologies and techniques and offer ways to improve collaboration between all parties.

4. Emergency Mobile Location, or EML, is a mobile localization methodology which provides an accurate dispatchable location (address) to Emergency Services. Call information provided includes both a room and/or apartment number, as well as floor number.

IV. ARCHITECTURE OVERVIEW

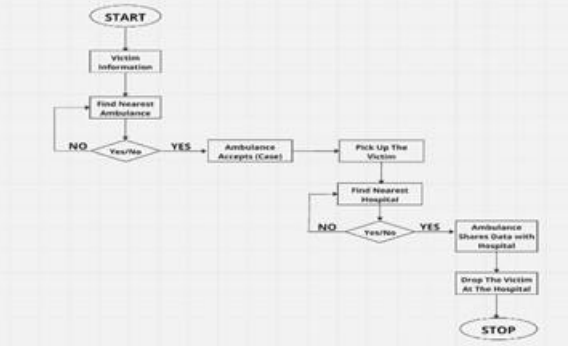

Fig. 4 Block Diagram

1. An extensive consultation strategy will be employed to ensure that all relevant stakeholders, including providers and end users, are consulted at every stage of the development of the capabilities. This will enable early identification of issues related to the conceptualization, design, implementation, integration, and deployment of tools supporting disaster resiliency. The methodology for tracking and analyzing the needs for standardization and certification coordination throughout the project life cycle will be established and enacted.

2. In circumstances involving several victims of natural or man-made disasters, with specific applications when multiple regions or nations are impacted and therefore more interoperability is needed.

A. C2-Sense

Actual data must be dependable, comprehensible, and available in order to be managed effectively in an emergency. This can only be accomplished through interoperability, which makes it feasible for various Command and Control (C2) Systems and Sensor Systems to work together. Regardless, the compatibility of these systems can become extremely complicated if standards and well-defined specifications are not employed. In order to accomplish seamless interoperability by addressing every layer of the communication stack in the security industry, the Project will employ a "Profiling" technique to handle this difficulty. In order to showcase the functionalities of C2 Systems, Sensor Systems, and other emergency/crisis management systems, the primary goal of the project is to create a profile-based Emergency Interoperability Framework through the use of current standards and semantically enhanced Web services.

The following measures will be taken in order to accomplish this:

1. An Emergency Domain Inventory will be developed by reviewing current standards and real-world application cases for sensors, devices, C2 systems, and emergency

management architectures in various security scenarios, an Emergency Domain Inventory will be generated.

2. An integrated Emergency Domain Ontology will be created based on this inventory in order to combine the

Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

knowledge of all stakeholders into a special and adaptable data model.

3. Last but not least, the framework's Emergency Interoperability Profiles will be created making use of the concepts contained in this ontology while also taking into consideration operational and functional needs as well as regional cultural, linguistic, and legal challenges.

B. ROVER

Technology is essential to healthcare systems in the medical field. In addition, portable wireless sensor technology has made its way into the diagnosis, monitoring, and treatment of medical conditions. This technology can enhance patient diagnostic processes by taking vital signs, monitoring body temperature and blood pressure, and giving real-time feedback. Experts from eight nations are working together on the EU- funded ROVER project to create innovative methods and solutions that will help non-invasive on body and in-body wireless technology breakthroughs become commercially viable. It will create a system architecture by utilizing knowledge in computer science, engineering, physics, medicine, and product development. This novel architecture combines encrypted data exchange at all layers with medical participation with non-ionizing diagnostics and monitoring.

C. Next Generation 112

Modern emergency communications are made possible by the NG112 architecture, which makes it possible to collect significantly more data (text, video, location, or additional data), leading to a more effective response. Accessibility for all citizens, especially those with disabilities, is another goal of NG112.

D. Search and Rescue

A prompt and efficient reaction is essential and can prevent or greatly lower the danger of casualties following an earthquake, an industrial chemical leak, or the collapse of a building. For instance, modern equipment and specialized instruments are essential for first responders and rescue teams to improve their accuracy, speed of localization, and decrease in false alarms. The Search and Rescue project will design, implement, and test a highly interoperable open architecture platform for first responders, including cutting-edge frontend equipment systems and backend applications, through a series of huge-scale pilot scenarios. This will enhance first responders' decision- making abilities and provide a dynamic, shared operational picture of the crisis.

E. Engage IMS/CAD

The ENGAGE IMS/CAD suite is a broad call center system for both public and private safety enterprises. This includes call and incident management, computer- aided dispatch, operational resource management, and integration of vital information sources. Implementing mobile dispatch features on smartphones and tablets enhances communication between control centers and field people, allowing for event updates, database access, and rich media messaging.

ENGAGE provides exceptional speed, dependability, and adaptability to complicated communication situations, enabling comprehensive incident control and dispatching for public safety. The system is built on a modular and adaptable software platform, with a dependable distributed Event Driven architecture.

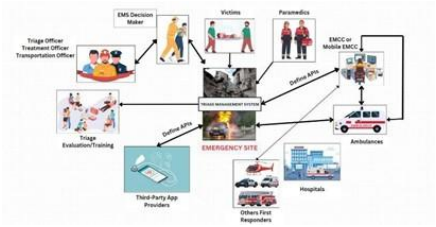

Fig. 5. Main Actors and Systems in a Triage Management Scenario

V. USER CASE SCENARIO

A. Casualty

Imagine an emergency situation in which every second matters. The system responds with a live snapshot of each

Journal of Information Systems Engineering and Management
2025, 10(56s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

casualty. It uploads injuries data and classifies patients into critical, moderate, or minor groups. The effect is that emergency services can spend more time where they're most needed, while all the while the information is updated so that it remains accurate to the state of play as it changes in a crisis.

B. Allocating Resources Wisely

Emergency decision-making frequently feels like a race against time. This system uses sophisticated algorithms to streamline that procedure. It guarantees that resources will arrive in less than 30 seconds, recommends a nearby ambulance, and links it to the hospital that can best treat the injuries. This smart support ensures that relief reaches victims faster and with fewer delays.

C. Collaboration Across Teams

Emergencies pull together not just fire departments, police and hospitals. This system connects them in a seamless manner. It helps to keep everyone on the same page by sharing critical data like victim location and the status of the ambulance in real time. This partnership prevents confusion and facilitates rescue operations.

D. Faster Handover to Hospitals

Transferring a patient from an ambulance to a hospital is a race against the clock. The system automatically sends to the hospital a detailed report, in advance of the patient arriving, outlining the patient's condition and predicted arrival time, and any special needs. This process ensures that the hospital team can spring into action as soon as the patient arrives, minimizing that critical handover time.

E. Reliable Connectivity

With the system's GPS technology, no victim is left waiting for rescue. It tracks the location of ambulances as they move in real time and identifies the precise location of the victim. It also works in rural or difficult terrain and maintains good accuracy, ensuring rescue teams arrive on time.

F. Simple Usability

Emergencies are stressful events, and technology should be used to make responders' jobs simpler rather than more difficult. Simple dashboards and colorful indications are features of the well-designed system. It is easy to operate, even for untrained responders, making it immediately valuable.

G. Language and Availability

Language boundaries are not observed during emergencies. Furthermore, the system enables different languages and even provides voice assistance.

CONCLUSION

When it comes to mass casualty victim triage, the suggested e-triage technique is effective. Additionally, this method gives remote incident commanders an overview of the disaster scenario. The number of casualties, their severity, and triage details are all included in the scene summary. This data facilitates the process of obtaining emergency resources. First responders who are stuck can also be saved with the aid of this technique.

Paper triage tags and these types of technology have similar input throughputs. This hybrid mass casualty victim triage system is the first that utilizes both GPS and passive RFID. When an incident occurs near towering buildings, the GPS system may not be able to track first responders inside, resulting in inaccurate location data. These are a few difficulties of using this method.

Based on their acuity ratings, patients from various emergency sites are sent by the patient dispatch system to 34 hospitals. With the help of this technique, the most urgent casualties are sent to the closest hospitals that have access to medical care. Hospitals can better prepare for incoming patients when they know the estimated time of arrival for each patient. As a result, this model helps incident commanders decide how to distribute patients.

Incorporating patient dispatch, emergency resource allocation, and e-triage technologies results in a comprehensive emergency response system that can make decisions in many different kinds of complex emergency scenarios and can help people in complex and difficult situations more efficiently.

Future research could automate this resource planning tool to recommend places for additional depots and offer advice on resource reorganization based on parameters like minimizing average response time over an area with a minimum threshold restriction on response times also providing alerting systems and providing the exact location of the victim and improving the overall process of triage.

FUNDING
This research received no external funding.

ACKNOWLEDGMENT

We would like to acknowledge Mr. Aniket Mishra, Assistant Professor of Department of Computer Science & Engineering (Cybersecurity), Thakur College of Engineering and Technology for her guidance. We would also like to thank all of the other supporting staff who assisted us by supplying the information that was essential and vital, without which we would not have been able to complete the project effectively.

REFERENCES

[1] https://scholarworks.umass.edu/cgi/viewcontent.cgi?article=1630&context=theses
[2] https://www.iprocuresecurity.eu/knowledge/glossar y
[3] https://rescuewave.de/products-and- services/?lang=en
[4] https://eli-technology.com/what-is-eml
[5] https://www.satways.net/products-sw/engage-ims- cad/
[6] https://www.boe.com/en/Enterprise/SmartFirstAid
[7] https://prometech.eu/commercial/triage-system/
[8] http://verdasee.com/products/
[9] https://triage-plus.com/
[10] https://www.ericsson.com/en/cases/2020/the-5g- connected-ambulance
[11] https://www.ericsson.com/en/cases/2020/the-5g- connected-ambulance
[12] https://triagelogic.com/call-center-software- solution/
[13] file:///C:/Users/singh/Downloads/iProcureSecurity- PCP-D2.1-Requirements-for-Triage-Management-Systems-for-Emergency-Medical-Services.pdf
[14] https://www.researchgate.net/publication/322178409_The_Decision_Support_System_and_Conventional_Method_of_Telephone_Triage_by_Nurses_in_Emergency_Medical_Services_A_Comparative_Investigation
[15] https://bmchealthservres.biomedcentral.com/article s/10.1186/1472-6963-13-111