|Research Article|

Scope of Artificial Intelligence in Enhancement of Emergency Rescue Services: Future Prospects

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Abstract

This research paper aims to determine the scope and use of artificial intelligence (AI) in the development and enhancement of emergency rescue services. The function, use and utilization of Artificial Intelligence is a growing need nowadays. Usage of Artificial Intelligence can revolutionize the emergency rescue service by improving its efficiency, accuracy and especially its response time. AI-driven predictive analytics can do better resource allocation and early identification of disaster-prone areas, by analyzing vast data-sets. Real time information regarding all types of emergencies & disasters, resources including staff & vehicles can be developed & make advanced through algorithms (analysis of statistical data) in AI. Pre-Assessment of emergency hotspots, navigation of hazards, its frequency and intensity can be checked through AI powered drones & robotics. By use of AI protocols, we can develop more quick coordination and communication among rescue workers and other law enforcing agencies on the emergency spot. The AI ongoing evolution and adaptation has the capacity to transform emergency services to leading life-saving interventions and also minimizing the existing & long-term vulnerabilities of different hazards & disasters. It stands as an indispensable element within forthcoming emergency response systems, offering significant potential for reshaping this field. This paper will help the planners & decision makers of emergency rescue service to work with new zeal and enthusiasm, accompanied with advanced technologies.

Keywords: Artificial Intelligence, Emergency Rescue Services, Predictive Analytics.

Introduction:

In today's advance technological era, Artificial Intelligence model is employed in almost all sorts of activities and has greatly impacted the world day to day life. The current research work is an effort to gather data which is related to scope and use of Artificial Intelligence for the

enhancement of emergency rescue service by which world may be make safer and resilient to different kind of emergencies, man-made as well as natural (Soni, 2018). Emergency Rescue Service (Rescue-1122) is providing 24/7 services to the community by responding to all types of emergencies either human induced or nature induced including road traffic accidents, animal related emergencies, fires, floods, earth quakes, land sliding as well as medical emergencies. ERS Rescue-1122 is modern emergency service which is providing medical, fire control, water rescue service, medical emergency service as well as quick response within standard time to disaster phases of mitigation, preparedness and response phase upon a single call just by dialing 1122 helpline number (Khattak, Qureshi & Amin, 2021). All the officials/staff of rescue emergency service are highly trained as per standard SOPs and well-equipped with different advanced tools & equipment's in order to respond in case of any disastrous situations (Khattak & Qureshi, 2020). Though gaps still existing which can be filled by adopting and make use of advanced technologies, in order to further advance & develop the service (Mehrotra et al, 2013). These new technologies like Artificial Intelligence, machine learning etc. has acquired attention of the researchers in different fields in order to get its benefits but AI has great potential to significantly enhance emergency rescue services by improving its response time, resource allocation levitation, and aiding timely decision-making processes (Soni, 2018). Here are some of the vital areas where Artificial Intelligence can play active role for enhancement of emergency rescue service and make this service more & more valuable:

Predictive Analytics

Predictive Analytics is a process of using different kind of data to predict future results & conclusions which plays crucial role in enhancing emergency rescue services, where artificial intelligence & machine learning and different kind of data analysis are done to create statistical models in order to find patterns which might predict & anticipate future behavior in shape of incidents control, optimize resource allocation, and improve response times (Soni, 2018). This system can support emergency service by proactively allocate resources and also to prepare for potential incidents. Predictive analytics can help ERS in incidence forecast, by knowing its occurrence, intensity, frequency etc by analyzing the historical incident data, weather patterns, demographic information, and other most relevant significant factors. It also helps to identify well on time high-risk areas which are exposed to specific hazards such as natural disasters, human induced disasters like accidents or criminal activities (Cao, 2023). Predictive analytics can benefit

emergency rescue service by doing resource allocation, find out population density, condition of traffic, settlements conditions etc. Predictive analytics enables emergency service by forecasting demand based on historical call data, events, and seasonality which ensures optimal staffing and resource allocation during peak expected emergency periods and significant events. Real-time data, traffic position and geo-location information helps in optimizing response routes and reducing delays and improving the results (Wang et al, 2016). By predicting future incidents, their locations & occurrence, frequency, intensity & severity, emergency services may in the position to strategically deploy their personnel, vehicles, and equipment's to minimize response times and maximize effectiveness & usefulness by making key points in such sensitive areas where vehicles and staff are stationed, in order to do immediate response (Nagendra, Narayanamurthy & Moser, 2020). By analyzing equipment's & vehicles data, maintenance needs can be anticipated in advance, ensuring essential resources like ambulances and other vehicles & equipment's are ready when required (Pérez-González, et al, 2019). Integrated data sources highlight high-risk areas, vulnerable populations, and elements of risk etc. enabling proactive preventive measures. Monitoring performance metrics enables timely identification of operational in-efficiencies, leading to enhanced emergency response capabilities (Shah et al, 2019).

Emergency Call Analysis

It holds apparent and potential position in enhancing emergency rescue services. It can provide valuable identifications of probable emergency incidents, refining response times, and improving resource allocation (Pathic et al, 2022). Emergency Call Analysis utilizes statistical models, advanced algorithms and natural language processing to categorize calls based on urgency, symptoms, and caller details, enabling prioritized responses. It integrates location data for precise resource dispatch well on time, identifies emerging tendencies, and allocates other resources strategically for hotspot, high vulnerable areas (Emami, P., & Javanmardi, 2023). Real-time monitoring aids in spotting un-noticed incidents for swift action. The analysis improves call center operations, trainings, and enhances service quality by improved response times (Cutter, 2012). Leveraging historical data, emergency services make data-driven decisions for optimal resource allocation, trainings, and policy enhancements (Blum et al, 2014).

Intelligent Dispatching

Intelligent dispatching systems plays significant role in the enhancement of emergency rescue services, by employing advanced algorithms, different statistical models and real-time data analysis in order to optimize emergency resource allocation (Amorim, Ferreira & Couto, 2018). Many factors like proximity, resource capabilities, and incident severity are being considered by this system in order to swiftly setup & deploy the right resources (Ding, et al, 2023). These systems monitor incoming emergency calls, identify patterns, and use geo-spatial data analysis for effective response planning, especially in the congested & crowded areas. Integration of various data sources assists in informed decision-making processes, while intelligent algorithms hihhlight and prioritize critical incidents, which results in improving patient outcomes (Clarke, A., & Miles, 2012). Seamless communication and performance monitoring foster collaboration among the team members which leads to more effective emergency responses and continuous operational developments (Alazawi et al, 2014; Niedzielski et al, 2021).

Response Time Optimization

Optimization of response time is one of a critical aspect in order to enhance emergency rescue service, by focusing on reducing the time which emergency responders takes in order to arrive well on time at incident location and save lives especially of the severely injured human beings which need response on immediate basis (Ai, Lu & Zhang, 2015). By applying response time optimization approaches, emergency rescue services can enhance their capability to reach the incidents rapidly and in an effective manner (Caunhye, Nie & Pokharel, 2012). Such strategies improve patient outcomes in the shape of property damage minimization and increases in overall effectiveness & success of emergency response operations. All the emergency related facilities if strategically positioned based on incident data and historical response times; it may reduce the travel distances and improves efficacy & effectiveness (Li et al, 2011). Geo-spatial mapping improves routes to incident places, factoring in real-time traffic data. Intelligent dispatch systems has great role in enhancing resource allocation and route/ navigation related decisions, by ensuring timely responses (Pfau & Blanford, 2018). Proactive planning, recurring & regular pattern analysis, and communication updating also helps in minimizing the response times. In the same way by establishing partnerships with other response agencies which are also working on rescue emergencies ensures continuous collaboration and faster emergency interventions (Carroll et al, 2007).

Robotics and Drones

Drones and robotics technology is catching power to be operated in different areas like media coverage and recordings etc. (Tilak, 2020). This technology has remarkable potential for improving emergency rescue services. Drones and robots play essential roles in disaster response phases where disasters hit the communities or high vulnerable areas (Alex & Vijaychandra, 2016). Drones search enormous areas in a smooth way, by providing real-time visuals, images & graphics; conveyance needed supplies well on time, vital in time-sensitive situations (Chowdhury et al, 2017; Park, Ahn & Hwang, 2019). On the other hand, robots assemble data in hazardous situations, evaluate structural stability, and help in plan rescue efforts, minimizing human risks. They also establish temporary communication networks, vital when traditional channels fail (SeungSub, et al, 2017). Medical professionals use robots for telemedicine, aiding immediate medical attention (Mesquita, Zamarioli & de Carvalho, 2016). These technologies, through simulations, enhance emergency responder training for effective disaster strategies (Siegwart et al, 2015). Robotics have also very vital role in controlling fire emergencies especially fire emergencies in confined or in such areas where there is no way to reach physically and make timely responses (Bogue, 2021).

Data-driven Decision Support Systems

The adoption of data-driven technologies brought significant advancements in emergency response phases, by providing valuable understandings and effective decision-making strategies & policy making approaches. (Gaynor et al, 2005). These innovations comprise of various aspects. Real-time data regarding probable incidents are collected from diverse sources such as through sensors and by social media, offering emergency responders a wide-ranging understanding of current incidents and its consequences (Resch, Schmidt & Blaschke, 2017). Resource optimization algorithms accurately & precisely scrutinize the incident patterns, response times, and resource utilization to propose ideal deployment strategies, thus enhancing overall efficiency. Routing and navigation assistance systems are invaluable by providing actual traffic data, allowing immediate and safe navigation of emergency vehicles like ambulances, fire trucks etc. (Vazirizade et al, 2021). Risk assessment tools are used to analyze the data in order to determine vulnerable & high-risk areas, vulnerable populations etc. by providing valuable guidance for response planning comprising of traffic data, safe passage of emergency vehicles like ambulances, fire trucks etc. (Ostrom & Wilhelmsen, 2019). Performance evaluation in data-driven decision

support system is possible through data analysis which is beneficial for uninterrupted improvement efforts, confirming the continuing optimization of emergency response operations (Pettet et al, 2022).

Conclusion:

It is concluded from the above mentioned literature, numerous writings and research work that integration & incorporation of artificial intelligence may have considerable prospects in order to enhance effectiveness, accuracy and response time in case of emergency rescue services. Utilizing predictive analytics, instant data updates and artificial intelligence driven devices (drones & robotics), have great potential to transform emergency responses, resulting in to save precious human lives, properties from damages, degradation of environment, deceasing vulnerabilities and to increase the capacities in order to cope with & withstand to different kind of disasters & emergencies, by upgrading the emergency rescue services. Accepting & embracing artificial intelligence technology will lead to efficient, well-organized and adaptable emergency rescue service in order to make the people, organizations & communities more safe and resilient.

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