Enhancing Rescue Operations in Dubai Police's Transport and Rescue Department
through IoT and AI Integration

Budoor Al Salahi and Dr. Rachid Jabbouri

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Abstract

Purpose: This research proposes how all the space, the Internet of Things, and Artificial Intelligence technologies can be better used in the Transport and Rescue Department of the Dubai Police. With the rapid evolution in smart technologies, IoT and AI have much scope to refine rescue operations regarding time management, accuracy, resources, and overall processes. Since the requirements in rescue missions are often complex, including environmental change and the need for urgency, the role of IoT and AI is extremely important in decision-making and successful operation. This study investigates how to employ these technologies within Dubai Police's existing rescue framework, which has gaps such as slow response or response delay and inefficient resource distribution. It aims to explore the potential benefits and challenges that the use of these technologies entails while drawing lessons from global best practices on emergency response more generally.

Methodology: Using qualitative and quantitative research methods, including interviews, surveys, observation, global case studies, and reviews of existing literature, the research will make recommendations on how these technologies can be effectively used to enhance the success of rescue missions. By fully embracing the concept of Dubai being a smart city, this research will not only upgrade the local emergency response systems, but it will also create a model for the other regions that want to convert to advanced technologies in rescue operations. At the heart of the research is a goal to reach more efficient, faster, and safer rescue operations that, in turn, ensure public safety in Dubai.

Findings: Research results show that the Dubai Police have already started using a variety of technology to ensure smart operations (e.g., SAS analytics and VR training), but IoT and AI integration are hampered by infrastructure, technology training gaps, and interagency coordination issues. Rescuers recognize that AI and IoT can be utilized to help in enhancing situational awareness and speeding the response, however, they also flag issues about cybersecurity and the system's compatibility.

Unique Contribution to Theory, Practice and Policy: The implication of the research is two-fold. First, it gives specific, practical recommendations on what to do to enhance Dubai's emergency response system. Second, it presents a scalable model for cities that are trying to equip themselves with smart, technology-driven rescue systems.

Keywords: *IoT, AI, Rescue Operation, Dubai Police, SAR*

JEL Classification Codes: *H56, O33, L86, H83*

INTRODUCTION

The ongoing trend of rapid advancement of technology has specifically signified the combination of smart technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) transforming industries globally. In rescue operations, where one second makes the difference as to whether one lives or dies, there are incredible possibilities to reengineer how rescue operations are conducted. Different types of operations consist of urban search and rescue (USAR), maritime rescue, mountain rescue, and disaster response. For example, USAR teams are the ones that know how to operate in the wreckage sites, while maritime rescue units are those that deal with the ocean emergencies. The primary objective of a rescue operation is to save human beings who are trapped because of natural disasters such as earthquakes, floods, and hurricanes, or man-made incidents like industrial accidents, transportation mishaps, and acts of terrorism (Sebastian, 2025). A typical rescue situation usually involves environments that are dangerous as well as the locations aren't safe (Grieco et al., 2014). Dubai, as a worldwide innovator and city planner, is in the best position to lead these developments. The research focuses on how lives can be saved using IoT and AI systems in the Department of Transport and Rescue of the Dubai Police, which should improve productivity, speed, accuracy, and response of the operations. By engaging with cutting-edge solutions and real-life problems, this research not only matches the Dubai vision of a smart city but also sets a positive example of the worldwide use of technology to rescue.

Problem Statement

Even though Dubai Police's rescue operations have been excellent, the constant development of cities with different requirements alongside the necessity for quick and effective rescues gives rise to new difficulties. The traditional methods of rescue are often not enough to handle the changes and numerous characteristics of current emergencies. For instance, rescue operations in Hatta during the flood were difficult to carry out because of the harsh weather and the necessity of special equipment, which brought out the drawbacks of using traditional methods in rapidly changing cities (Desk, 2024). Some challenges in operation are incorrect explanation or unclear location that the callers typically fail to present, which might cause the incidents of response team's arrival to be delayed. In addition, traffic jams alongside the public's late reaction in giving way to the emergency vehicles, which could even be a bigger problem, although partly caused by the confusion or ignorance of drivers (Ali, 2023). Such challenges point to the crucial requirement for innovative solutions, such as IoT and AI, to achieve the intended efficiency, elevate the quality of decision-making, and achieve flawless performance in lifesaving operations.

Research Aim

- To explore how using IoT and AI technologies can improve the effectiveness and efficiency of activities related to search and rescue in the Transport and Rescue Department in Dubai Police. In particular, the study is interested in the implementation of these technologies, the obstacles they may encounter, and how they can be effectively used in emergencies.

Research Objectives

- To examine both the existing and future challenges in Dubai Police rescue operations.
- To measure the benefits and drawbacks of bringing in IoT and AI technologies on rescue missions.

- To uncover the best ways to proceed and some of the most popular cases around the world that are relevant to the integration of IoT and AI in emergency management.

Research Question

- How can the integration of IoT and AI technologies enhance the efficiency and effectiveness of rescue operations in Dubai Police: Transport and Rescue Department?

Significance of the Study

This study will add to the Dubai Police's constant attempts to enhance public safety. Through the examination of IoT and AI applications, it will present practical recommendations for making emergency operations more efficient, minimizing response time, and improving resource management. These outcomes are projected to direct the utilization of intelligent technologies, enhance resource management, and help responses to emergencies be more rapid and accurate, thus ensuring the safety and welfare of the community.

LITERATURE REVIEW

The combination of smart technologies, in particular the application of AI and the IoT, has emerged as a priority in the current-day investigations whose goal is to reinforce rescue operations. AI, together with other advancements in the respective fields like IoT, blockchain, and others, is causing a great impact in various sectors, such as rescue operations. The studies suggest that disruptive technologies such as AI, IoT, blockchain, 5G, and 3D printing are the most significant shaping tools in the sectors related to emergency response (Păvăloaia & Necula, 2023). These technologies have not just revolutionized fields such as business and healthcare but also play a vital part in reengineering rescue operations through enhancing the efficiency, response time, and situational awareness. However, the literature is very useful in that it demonstrates the scope of the technological changes, but it is highly inadequate and doesn't present enough facts and examples from real-time situations in urban rescue scenarios, particularly in the Arab region.

The smart technology, especially IoT, has been the force behind the revolution in data collection and monitoring in times of crisis. IoT allows for applications that connect devices of various types, like drones and sensors, through which the incident is monitored in real-time. This feature of IoT allows gathering of data from the accident scene, which in turn is of vital importance in the rescue operations (Alahi et al., 2023). Nevertheless, several researchers miss the aspect of not only the interoperability but also the maintenance difficulties in such a case of the management of massive sensor networks in tough field conditions. While IoT's applications are increasing, the extent of its utilization in organizations is still at an early stage. Ahmetoglu et al. (2022) claimed that there are several key factors affecting the IoT acceptance, including technological, organizational, environmental, and human factors. To improve the SAR operations, one of the most important things is to deal with these factors satisfactorily. This framework is a useful tool, though theoretical in its majority. Still, there are minimal studies that look at the connections between the factors when under field pressure and similar hierarchical institutions such as police bodies.

In addition, IoT combined with cloud and edge has proven to be an effective tool used in improving the response time of a search and rescue team. These operations usually require fast data collection and instant analysis; therefore, a connection between the IoT, edge, and cloud technologies will drastically improve the operational efficiency of these systems (Militano et al., 2023). For instance, IoT-based wearable sensor networks for detecting hazardous

environmental conditions will alert first responders about likely threats such as toxic gas or hot temperatures. Quick notification as such ensures safety by allowing rescue members to take the necessary protective measurements and lead them to make the right decisions at the scene, thus increasing safety and the effectiveness of the operation (Wu et al., 2018). Moreover, the progress in long-range wireless connectivity technologies leads to IoT devices working well in remote or hard-to-reach areas, where traditional infrastructure usually fails. During crucial missions, the capacity to transfer data over long distances without frequent battery changes is significant (Mahmood et al., 2022). On the other hand, research about durability costs, power supply reliability, or the lifecycle of these gadgets in emergencies with high use is still very scarce.

Most articles examine the interconnection of smart cities, public safety, and rescue operations. A particular study presents a Safe City Idea as an Integral part of smart cities and deals with the benefits of such technologies as IoT and AI that can be applied to reduce crime and enhance public security (Risdiana & Susanto, 2019). Such a strategy is especially suited for integrating smart technologies into public safety systems. Besides that, in the context of smart cities, Pathik et al. (2022) stated that the incorporation of AI and IoT technology into the transportation networks consequently shortens the time required for emergency responders to intervene in crashes. For instance, a cognitive AI agent is applied to identify crashes, and then it sends information directly to emergency services, by which the police officers can get the accurate details on time, which supports the search. This mechanism not only saves lives, but additionally, it manages the delays caused by accidents and forces. Yet, these types of studies often present the results of one system as if they perfectly reflect all the systems, failing to recognize that in different agencies or local authorities, the digital maturity levels might not be uniform.

Furthermore, autonomous drones powered by AI and IoT data sources are being established to cover the usage of SAR operations by identifying the inevitable hazards within them. These types of drones can find lost persons, inspect the fire danger level, and measure the air pollution, and are changing life-saving operations completely by transmitting the real-time information to the rescuers (Kumaran et al., 2023). Furthermore, AI-driven Unmanned Aerial Vehicles (UAVs) are increasingly used in search and rescue (SAR) operations, showcasing their ability to bring down the response time to a considerable extent and ensure the success of the missions through the self-guided technology and the highly complex image recognition system (Farsath et al., 2024). However, even though they are promising, these studies usually leave out the ethical or legal issues like the privacy of people on public sites, in case of AI-assisted surveillance or AI-generated mistakes.

AI is vitally important to analyze the large amounts of data collected from IoT devices. The AI algorithms can recognize the seriousness of the incidents, predict possible hazards, and optimize the allocation of resources. For instance, AI can evaluate data from various sources to identify the shortest possible routes for the ambulance, determine the need for extra resources, and predict additional incidents (Alahi et al., 2023). This possibility is supported by the introduction of a smarter packet scheduling schema, which gives high preference to this critical data transmission in the time of emergency and comes with its timelier updates for the rescue team (Qiu et al., 2017; Qiu et al., 2018). Besides, the combination of AI and edge computing offers real-time data processing on the edge, which is important for applications with small delays, such as emergency response (Michie et al., 2020). Through the analysis of data on the site, rescue teams can take prompt decisions, which in turn improves the possibility

of successful results. Despite this, the literature rarely asks questions about algorithmic bias, the reliability of AI systems under stress, or user trust in decisions made by machines during crises.

Decision Support Systems (DSS) assist in the decision-making process by using data management solutions, AI, and real-time information. Nasar et al. (2023) discovered that the result of the SAR operation can be enhanced by DSS, yet it still faces difficulties in the expansion to maritime SAR areas. It was also emphasized that the information gained from the land and sea-based SAR solutions must be shared with each other to enable Al to be utilized more effectively in all environments.

Effective marine search and rescue operations depend largely on the Automatic Identification System (AIS), which is a system that provides essential navigational guidance and situational awareness during emergencies. By using IoT and AI together with AIS, the Dubai Police can produce better control between rescue teams and enhance their sea rescue skills (Balduzzi et al., 2014). Yet cybersecurity issues present a serious problem, as the maintenance of the quality and accuracy of the AlS data is an important task for successful rescue operations. Nevertheless, both cases show no unified data governance or standardized procedures, a thing which affects the real-time interoperability of the sea, land, and air systems negatively.

Effective communication and coordination are the key factors for successful search and rescue operations, especially in top-priority situations such as the ones faced by the Transport and Rescue Department of Dubai Police. IoT and AI technologies catalyze these processes by real-time information sharing and collaboration among the first responders. For example, these technologies, which make communication instantly active, can be instrumental in getting the critical materials updated for the help of the incident location, resource availability, and victim statuses (Freire, 2023). Through deploying broadband radiocommunication systems, as specified by the public protection studies, emergency management has been considerably developed. Also, the I4EM framework, which is the product of Industry 4.0 development, increases the level of situational awareness and operational coordination, thus making it possible to speed up the process of the respondent and regain the trust of citizens in the public safety services (Alshamsi, 2022). However, the feasibility of such a model in big and diversified cities such as Dubai has not been rigorously checked or judged in longitudinal research.

The study by Ammar Bajwa (2025), titled "AI-Based Emergency Response Systems: A Systematic Literature Review on Smart Infrastructure Safety," provides a rich overview of 424 papers that deal with the combination of AI technologies into emergency response frameworks, with a particular focus on smart infrastructure systems. His review is showing the real change in AI technologies tools that involve machine learning, deep learning, computer vision, and IoT-enabled analytics in decision-making, risk analysis, and real-time incident management. Such tools are useful in different locations of natural disaster prediction, healthcare emergency response, industrial safety, cybersecurity, and intelligent traffic systems. Especially, AI-powered predictive models and self-triggered detection devices were the key to having the response recovered swiftly, the situation under control, and resources deployed in time, all of which led to a decrease in casualties and an increase in work efficiency. However, according to Bajwa (2025), there are still some problematic points, in particular, the lack of interoperability, the existence of regulatory and ethical issues, the possible presence of cyber threats, and the reality of the biased algorithm, which are the obstacles that need to be tackled

to the end that responsible and scalable implementation is secured. All in all, it is a significant review that provides valuable ideas for decision-makers, technologists, and emergency management professionals, since it will enable them to make use of AI in their emergency response systems and thus be more resilient and efficient. Even though the review paper has covered almost every aspect of the subject, it just describes. It lacks a critical analysis of the challenges' realizations and provision of solutions that are limited to high-risk urban situations specifically. A richer discussion of obstacles at the point of implementation, like the preparedness of the institutions or the differences in regional regulation, would make the findings more practical, vividly, for example, cities like Dubai that are in search of new perspectives for local intervention.

METHODOLOGY

Research Methods

This research will adopt a mixed-methods approach to give a comprehensive examination of how IoT and AI tools can boost rescue missions. The qualitative part, using interviews, will explore the subject matter experts' experiences and the challenges that come with it, thus providing rich, detailed information on the operational and strategic aspects of integration. At the same time, observations of the preparatory phases, like coordination meetings and the release of the resources, will deliver the additional context information.

Furthermore, the quantitative part, which will be done through surveys, will consist of collecting measurable data on the key metrics like response times, resource allocation, and operational effectiveness, and analyzing the results, identifying the broader patterns and trends across all sample groups.

To improve data validity, a triangulation approach will be utilized, drawing information from interviews, observations, and surveys to see the patterns and discrepancies, hence giving a very solid and complete comprehension of technologies' impact on rescue operations. Besides the primary data types, the inclusion of secondary data from global case studies and academic resources will make the research more solid and the conclusions more convincing, in addition to a balanced evaluation of the subject.

Data Collection and Analysis Plan

Interviews:

Selected subject matter experts from the T&R department who handle rescue operations will be interviewed during these semi-structured interviews so that they can recount daily activities, tasks, obstacles, and prospects for better performance and technology's benefits.

Observation

Aiming to confirm the validation of self-reported data, observations of rescue operations will be carried out, which will help understand the real-world use of lot and Al in emergency response. Aspects of the rescue process, such as operation reports, preparation stages, coordination meetings, and resource deployment, will be observed to add to the data collected from self-reports and will provide a more comprehensive understanding of the operational context.

Thematic analysis will be performed to evaluate interview responses as well as the observational data from the research. NVivo or ATLAS.ti is a coding software that will be used to study common themes, patterns, and insights related to the effects and challenges of IoT and

AI integration. This combination analysis will be a source of a full and all-sided understanding of the operational dynamics and the technology's impact.

Survey

An online structured survey will be distributed to a larger sample of T&R staff, including multiple-choice, Likert scale, and open-ended questions. Their responses will be analyzed to collect the data on their opinions on IoT and AI technologies' contribution in their work, efficiency, and problems encountered in the field.

Moreover, a pilot study will be conducted with a small sample of 5 testing the survey instrument. This will help find out the mistakes of question clarity, survey length, and flow. Opinions of the participants will be the basis for reworking the survey, which will not only correct the irrelevant part but will also provide for increased reliability and relevance before the full-scale data collection.

After receiving the responses, a statistical software (Excel / ClickUp) will be utilized for descriptive and inferential statistics to summarize perceptions and measure operational effects and to look for relationships between variables like technology use and response times, and the findings will be visualized through charts and graphs for clarity.

Secondary Data

An in-depth review of relevant global smart city case studies will be included to give comparative perspectives in addition to government reports, news articles, and academic journals that investigate the application and effects of IoT and AI technologies in rescue operations.

This data will be analysed systematically to identify trends, best practices, and the impacts of IoT and AI to complement the primary data findings.

Sample Scope and Selection

The participants in this research are going to include the Transport and Rescue staff who are working in or with the Search and Rescue (SAR) division. This sample consists of emergency responders, who are the first-line rescue workers and give firsthand information, such as the experience of the accident. Second, operations staff, for example, managers or coordinators, are responsible for managing and coordinating rescue missions and providing some insights into strategic and operational aspects. Third, equipment technicians who are dealing with the maintenance and integration of IoT and AI tools provide their technical insight on the technologies that are in use.

In total, 10 subject matter experts will be interviewed to gain qualitative insights, while 50 participants will be surveyed to collect data. To make sure the survey is reliable and clear, the pilot study of the survey instrument will be done with 5 out of the 50 survey participants. This collection of samples ensures that the study deals with a wide variety of viewpoints, from administrative to technical, thereby giving a holistic perspective on the extent to which the IoT and AI unfold into different duties within the rescue operations.

Ethical Considerations

Ethical integrity is the core of this research, as all participants must give informed consent before being part of the study. To address these dilemmas, all the participants will get the full information concerning the purpose, scope, and possible results of the study by the means of a well-written informed consent process. The anonymity of each participant will be guaranteed

during the entire study, data will be scrubbed, leaving out all forms of personal identifiers to protect participants' privacy.

Furthermore, the research will be held within the ethical boundaries set by the university and Dubai Police. The cultural aspects will be an additional focus, so through this, the communication and the interaction will fit into the local customs and values of the participants. To minimize potential ethical risks even more, the study will additionally include regular reviews of the data collection process to make sure that no information is misused, and the findings are communicated transparently and responsibly.

Limitation

The study has some challenges, some of which are associated with the depth and generalizability of its findings. One major obstacle is the scarcity of indigenous studies concerning IoT and AI during the rescue operations in the UAE. While the global research provides valuable insights, the absence of regional studies reduces the possibility of placing the findings into the operational context of the UAE. The study will try to confront this by using real case studies, government reports, and expert insights, which will be possible.

In addition, the restricted access to real-time rescue operations is another limitation that directly prohibits direct observations of active missions. Even though the secondary data, such as incident reports and mission logs, would be used, it is subject to approval, whose scarcity might lead to inadequate data acquisition. Also, it should be considered that the IoT and AI technologies are not still being fully incorporated into the rescue operations; therefore, it will not be possible to use simulations entailing these technologies at the practical level and, thus, the exploring of their practical application.

Apart from that, the study is based on data provided from self-reported surveys, which might be tainted with personal biases that potentially affect the truthfulness of responses. Another factor that may affect the quality of the data collection is the language barriers, which may lead to limited communication with the study instruments.

Despite these limitations, the exploration will involve different data sources and research methods that will help reduce their effect, thereby providing a comprehensive study of IoT as well as AI applications in the rescue operations. The study will be exhaustive despite all the limitations.

Conclusion

Expected Findings

The research is anticipated to highlight how the existing gaps in rescue operations due to slow response time, sub-optimal resource allocation, and lack of situational understanding can be improved with IoT and AI technologies. In this context, it is also expected that best practices regarding the challenges and success strategies from other parts of the world will be adapted to the specific needs of the T&R Department. As an example, Indonesia's AI-driven flood warning system, which was linked to the JAKI app, showcased how live sensor data and predictive analytics can indeed help in reducing the time and effort needed to respond to disasters (Salamati, n.d.). Similarly, the virtual Singapore platform from Singapore uses the city's digital twin to simulate emergency scenarios for preparedness (OPSI, 2024). Brazil's InterCity IoT system, which was implemented in the COVID-19 crisis, demonstrates agile and adaptable changes that can be integrated into the crisis (Santos et al., 2024). The Sentilo platform by Barcelona is a real-time data platform that repositions the emergency vehicles dynamically

(Bakici et al., 2013). Moreover, FireMap, the wildfire risk-assessment software by Los Angeles, uses satellite and other environmental data to deliver predictions in advance (Crawl et al., 2017). The purpose of the ResilienceDirect in London is to create a shared system for information exchange, real-time data sharing, and mapping among the different agencies (Cabinet Office, 2025). The results of the current study will also most probably point out some challenges, such as technological, organizational, and operational issues, and suggest practical ways to address them. The goal of the research, therefore, is to offer a comprehensive plan for the incorporation of IoT and AI technologies in rescue operations to help the T&R Department enhance its efficiency and the practice of emergency missions overall.

Conclusion

This research aims to close the distance that has traditionally existed between technology and its implementation in rescue operations, thus providing the T&R Department with concrete ideas on how the use of IoT and AI should be done. The results will prove to be worthy in the field of emergency management as they will display the relevance of the technology that can be effectively connected to the fast-escalating urban rescue missions.

The employment of a robust mixed-method approach that includes qualitative interviews, quantitative surveys, internal observations, and global case studies enables the research to articulate well the conclusions that are based on a variety of concrete real-world examples and data. This strength in methodology allows the knowledge gained from the study to be more dependable and practical.

By identifying obstacles to drive the successful application of smart technologies, such as technical limitations, infrastructure readiness, and skill gaps, the study will propose a roadmap to overcome these barriers and render the smart technologies successful. In addition, the research will contribute to Dubai's aspiration to be a role model in smart governance and innovation, which follows its wider strategic goals.

This research will not only improve the efficiency and speed of rescue operations in Dubai but also become a template for other regions trying to improve their emergency management systems. It brings to the forefront the fundamental role that technology plays in boosting public safety and emergency preparedness, thus ensuring that rescue operations adapt and survive in the modern changing world.

Finally, according to Alshamsi (2022), the UAE is investigating general concepts of Industry, which will enable the incorporation of IoT and AI more easily, thus providing a promising trend in the emergency management system. This alignment with technological progress ensures that the Transport and Rescue Department of Dubai Police is not only quick to respond to accidents but also can forecast and prevent crises from being unfavorable more rapidly.

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