IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

An ambulance for fast and reliable emergency medical services - SWIFT EMS

[1] Dr. Vijaya Kumar A V, [2]Preetham A A, [3]Neesha Kundu, [4]Divya Prakash, [5]Owaiz Ahmed Shariff
[1]Professor, [2]Student, [3]Student, [4]Student, [5]Student
[1]School of CSE&IS,
[1]Presidency University, Bangalore, India

Abstract: This project endeavors to revolutionize emergency medical services through the development and implementation of an advanced "Ambulance Service Mobile App." With a primary focus on expeditious response times, the app aims to significantly reduce the arrival duration of medical assistance during critical situations, thereby enhancing the likelihood of saving lives and improving patient outcomes. Seamless coordination is sought between emergency helpline operators, ambulance services, and healthcare facilities, minimizing miscommunication and optimizing the entire response process from the initial call to arrival at medical facilities. Facilitating easy registration for ambulance drivers is a pivotal aspect, allowing them to register anytime and anywhere, ensuring the availability of their services 24/7. A user-centric design approach emphasizes creating an intuitive and stress-free interface for users encountering medical emergencies.

IndexTerms **– Ambulance, User-Centric, Efficient.**

INTRODUCTION

In today's fast-paced world, access to immediate emergency medical care can mean the difference between life and death. However, the existing systems for dispatching and coordinating ambulance services often fall short of providing the swift and reliable response needed during critical moments. This is where our ambitious project, "Swift EMS," comes into play. We are excited to introduce you to our groundbreaking initiative—a state-of-the-art Ambulance Service Web App. Our mission is clear: to transform the way emergency medical care is delivered, ensuring that help is just a few taps away when it's needed most.

The project is born out of a deep understanding of the challenges plaguing current ambulance services. Delays in response times, a lack of coordination between dispatch centers and ambulance drivers, and inefficient communication channels have all contributed to suboptimal emergency medical care.

LITERATURE REVIEW.

1. Ryo Katsuma, “Dynamic Routing for Emergency Vehicle[1]”, International Journal of Communications Network and System Sciences · ISSN(e): 1913-3723 · ISSN(p): 1913-3715 · PP:27-44 Vol. 11, Issue 02 (January, 2018)

When a natural disaster such as earthquake strikes, people go away to safety areas by cars. Some roads are broken and impenetrable by buildings falling down[1]. Furthermore, some fixed infrastructures for radio communication may be broken. In order to quickly bring ambulances and fire trucks to their destinations, it is necessary to provide real-time road conditions to these emergency vehicles via ad -hoc networks. In this paper, proposed a method to periodically reconstruct a route for an emergency vehicle by collecting real- time road conditions via vehicle ad-hoc networks. As simulation results, we confirmed that the proposed method

collects 12% more road conditions than existing method. We also confirmed that the proposed method achieves 10% faster arrival than the existing method.

2. EC Fradelos, "Geographic Information Systems (GIS) in Public Health[2]", Acta Inform Med· ISSN(e): 1986-5988 · ISSN(p): 0353-8109 · PP: 402-405 Vol. 22, Issue 06 (December, 2014).
The study highlights the versatile applications of GIS technology in addressing public health challenges[2], from disease surveillance and tracking to resource allocation and epidemiological analysis. It emphasizes the power of spatial data in decision-making, allowing public health professionals to visualize and analyze health trends, assess environmental factors, and plan interventions effectively. The paper showcases the potential of GIS in improving public health outcomes, offering a valuable resource for researchers, policymakers, and practitioners seeking to harness geospatial data for better health management.

3. Adriana Chammas, "A Closer Look on the User-Centered Design[3]", Procedia Manufacturing · ISSN: 2351-9789 · PP: 5397-5404 Vol. 03(December, 2015)
The paper underscores the fundamental idea that designing products and systems with the end user in mind is essential for creating effective, user-friendly solutions[3]. It delves into the various stages of UCD, from user research and needs analysis to prototyping and usability testing. The paper emphasizes the importance of iterative design, where user feedback informs refinements. UCD is shown to enhance user satisfaction, usability, and overall product success, making this paper a valuable resource for designers, developers, and anyone involved in creating user- centric solutions.

4. Gräsner J-T, Lefering R, Koster RW, et al., "Response Time and Survival Rates[4]" 27 Nations, one Europe, one Registry: A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. Resuscitation. 2016;105(1):1195–1880.
Cardiac arrests occurring outside of medical facilities are a major concern for public health. This medical condition is a leading cause of deaths that occur without any prior warning[4], particularly in developed countries. In the United States, approximately 420,000 cases of out-of-hospital cardiac arrest (OHCA) are reported annually, while in Europe, the number stands at around 275,000 cases. The emergency response and management of this condition in hospitals prioritize the survival of patients and the reduction of adverse outcomes.
The timely provision of medical attention plays a crucial role in improving survival rates for OHCA cases. Previous studies have shown that the prompt administration of cardiopulmonary resuscitation (CPR) can significantly impact patient survival rates and other health-related outcomes. Daya 2 discovered that emphasizing CPR quality, minimizing interruptions, and standardizing post-resuscitation care led to higher survival rates for OHCA cases. Dispatcher-initiated telephone CPR was also found to be independently associated with improved survival and functional outcomes after OHCA. One possible explanation for this is the reduction in the time between the occurrence of OHCA and the initiation of CPR. Rajan, Wissenberg, Folke, Hansen, Gerds, Kragholm, Hansen, Karlsson, Lippert, Køber, Gislason, Torp-Pedersen 9 conducted a study that examined the correlation between early CPR and OHCA survival, revealing a consistent positive relationship between early CPR and survival rates.
The time it takes to receive definitive care and the time it takes to initiate CPR are both influenced by the response of emergency services. These factors have a significant impact on the survival of individuals experiencing cardiac arrest. Ambulance response time directly affects the promptness of CPR and admission to a healthcare facility. However, there is a lack of empirical studies that specifically investigate the relationship between ambulance response time and patient survival in OHCA cases.

5. Pons, Peter T., Markovchick, Vincent. J, "Target Response Time Benchmarks[5]",2002. "Eight minutes or less: does the ambulance response time guideline impact trauma patient outcome". The Journal of Emergency Medicine. Vol. 23, No. 1, 43–48, PMID: 15995089
Response time, also known as waiting time, refers to the duration between a patient's call to emergency services and the arrival of the ambulance[5]. This time interval is crucial for people's health and is often used as a performance indicator in relevant literature. According to Pons (2002), ambulance dispatchers assign suitable ambulances to calls in order to minimize the response time. Lee (2012) identified various factors that influence the response time, including the number and location of ambulance fleets, traffic conditions, and potential delays in communication with the emergency control center. Mayer (1979) highlighted the focus of previous studies on determining the optimal placement and relocation of ambulances. Plastria and Nogueira

(2014) emphasized that ambulance dispatching and relocation decisions are primarily based on changes in temporal and geographical patterns of requests to ensure a greater coverage of calls within a specific timeframe. Wilde (2013) demonstrated that ambulance dispatching in emergency medical services plays a crucial role in making appropriate decisions for allocating ambulances to calls and reducing the response time. Thakore (2002) noted that ambulance dispatching decisions in EMS are typically made in two general situations: when the number of ambulances exceeds the number of calls, resulting in a low system load, and when the number of calls surpasses the available ambulances, leading to a high system load. The latter situation is more common during natural or man-made hazards or disasters, which often result in increased traffic, emergency calls, injuries, and fatalities. Lee (2012) mentioned that there are several methods for ambulance dispatching, with the nearest neighbor (NN) approach being the most commonly used, dispatching the closest available unit to the call. Diaz and Lim (2012) acknowledged that dispatching the nearest ambulance to the call reduces the response time.

6. A.S.Carvalho, "Future Directions[6]" ,November 2019 ·Integrating the ambulance dispatching and relocation problems to maximize system's preparedness. European Journal of Operational Research, 2020, vol. 283, issue 3, 1064-1080.

EMS managers have expressed growing concerns regarding the need to improve the performance of their systems[6]. This has led to an increased interest from operational researchers in studying EMS logistics. Over the years, different approaches, including exact methods, heuristic algorithms, and simulation, have been developed to incorporate real-life factors. The primary challenge lies in the requirement for a prompt response amidst high levels of uncertainty, such as unpredictable emergency demands, severity, ambulance availability, and population dynamics.

1. The integration of telemedicine: The discussion revolved around the expanding role of telemedicine in prehospital care, with a focus on the potential for real-time communication between EMS personnel and remote physicians. This integration has the capability to enhance decision-making at the scene and improve patient care.
2. Implementation of Community Paramedicine Programs: The review emphasized the significance of broadening the responsibilities of paramedics to include preventive care, post-discharge follow-ups, and addressing non-urgent healthcare needs. Community paramedicine programs have the potential to alleviate the burden on emergency departments and enhance overall healthcare accessibility.
3. Effective utilization of data: Prekker and colleagues stressed the importance of utilizing data-driven decision-making in EMS operations. By harnessing the power of big data and analytics, resource allocation, response times, and patient outcomes can be optimized.
4. Integration of mobile health technologies: The authors discussed the incorporation of mobile health technologies, such as wearables and smartphone apps, to enhance patient care and improve data collection and transmission in the field.
5. Foster interagency collaboration: The review highlighted the significance of collaboration among various emergency response agencies, including fire departments, law enforcement, and public health agencies, to establish a more efficient and coordinated emergency response system.

7. Roberto Aringhieri, "EMS Protocols and Training[7]" A taxonomy for emergency service station location problem. Optimization Letters, 6(6):1147–1160, 2012.

Despite some progress in recent years, there are still significant gaps in our understanding of equity principles in EMS systems. The existing literature on incorporating equity into EMS planning lacks a clear direction and fails to address important practical aspects. This may be due to the lack of consensus on equity measures for EMS[7]. Moving forward, it is crucial for future research to explore various aspects of equity in EMS planning and establish widely accepted evaluation metrics for equity-based models. A good starting point would be to examine the concept of equity from both horizontal and vertical perspectives. Currently, the focus of equity in EMS literature primarily revolves around the geographical distribution of demand, dividing it into urban and suburban/rural zones. The efficiency of EMS systems is evaluated based on the quality of service in urban areas, while the fairness of service is assessed by the coverage provided in suburban/rural zones. However, it is important to note that characteristics other than spatial distribution can also differentiate demand zones. Even within the same urban zone, demand zones may vary in certain aspects, necessitating different treatment. Additionally, considering the dynamic nature of EMS systems and the potential deviations from the original design, it is crucial to incorporate the temporal aspect into equity concepts and thoroughly investigate this

issue. By doing so, we can also address equity considerations in ambulance relocation, which is a common practice.

8. Ahjoku Amadi-Obi, "Telemedicine and Pre-Arrival Instructions[8]" July 2014· Tele-Medicine in pre hospital care · PMID: 25635190.
There is a significant global shortage of healthcare professionals, which poses challenges in providing quality healthcare, especially in under-resourced regions. To address this issue, telemedicine has emerged as a solution, allowing specialist medical services to be provided remotely using information and communication technologies. Telemedicine involves separating the client from the expert in terms of physical location. This concept has been utilized in various forms throughout history[8], such as using smoke signals in ancient African villages and bonfires during the Middle Ages in Europe to communicate about disease outbreaks. However, the invention of the telephone in the nineteenth century greatly facilitated the use of telemedicine, enabling the transmission of medical information over long distances. By the 1930s, remote regions in Australia and Alaska were already transmitting medical information to specialist medical centers. The advent of television in the 1950s further advanced telemedicine through closed-circuit television and video conferencing, allowing for patient monitoring and consultations. One of the earliest modern implementations of telemedicine was by NASA in the 1960s, where it was used to remotely monitor the physiological health of astronauts during manned space flights. NASA's involvement continued with the development of the STARPAHC project, which aimed to provide advanced healthcare to rural areas.

OBJECTIVES

1. To Improve Response Times: Our primary objective is to significantly reduce ambulance response times. We aim to ensure that when a medical emergency occurs, help arrives as swiftly as possible, increasing the chances of saving lives and improving patient outcomes.
2. To Enhance Coordination: We seek to establish seamless coordination between emergency helpline operators, ambulance services, and healthcare facilities. Our goal is to minimize miscommunication and streamline the entire process from call to arrival at the medical facility.
3. To Allow Easy Registration: The project aims to provide drivers to register anytime and anywhere to make their services available at any time.
4. To Have User-Centric Design: We aim to create an intuitive, hassle-free interface for users facing medical emergencies. The app should be easy to navigate, even in high-pressure situations, reducing user anxiety.

METHODOLOGY

Frontend Development:

- Integrated Development Environments (IDE): Visual Studio/ Android Studio
- Programming Languages: Java/ React Native
- UI/UX Design Tools: Figma

Backend Development:

- Web Application Framework: Firebase by Google
- Database Management: Firebase by Google
- APIs used: Google Map API

Source Control:

- Git for tracking changes in codebase.

The initial phase focuses on comprehensively understanding the current emergency response landscape. This involves extensive literature reviews on response time optimization, coordination in emergency services, mobile app technology in healthcare, and user-centric design principles.

Following this, a user needs assessment will be conducted to inform the app's design. Surveys, interviews, and usability studies will gather insights from potential users, emergency helpline operators, and ambulance drivers[9]. This user-centric approach aligns with the project's fourth objective.
The registration system for ambulance drivers will be developed to ensure accessibility and availability at any time. The integration with emergency helplines will be a focal point to establish seamless coordination. Geolocation and mapping technologies will be incorporated for real-time tracking, optimizing routes, and further reducing response times.

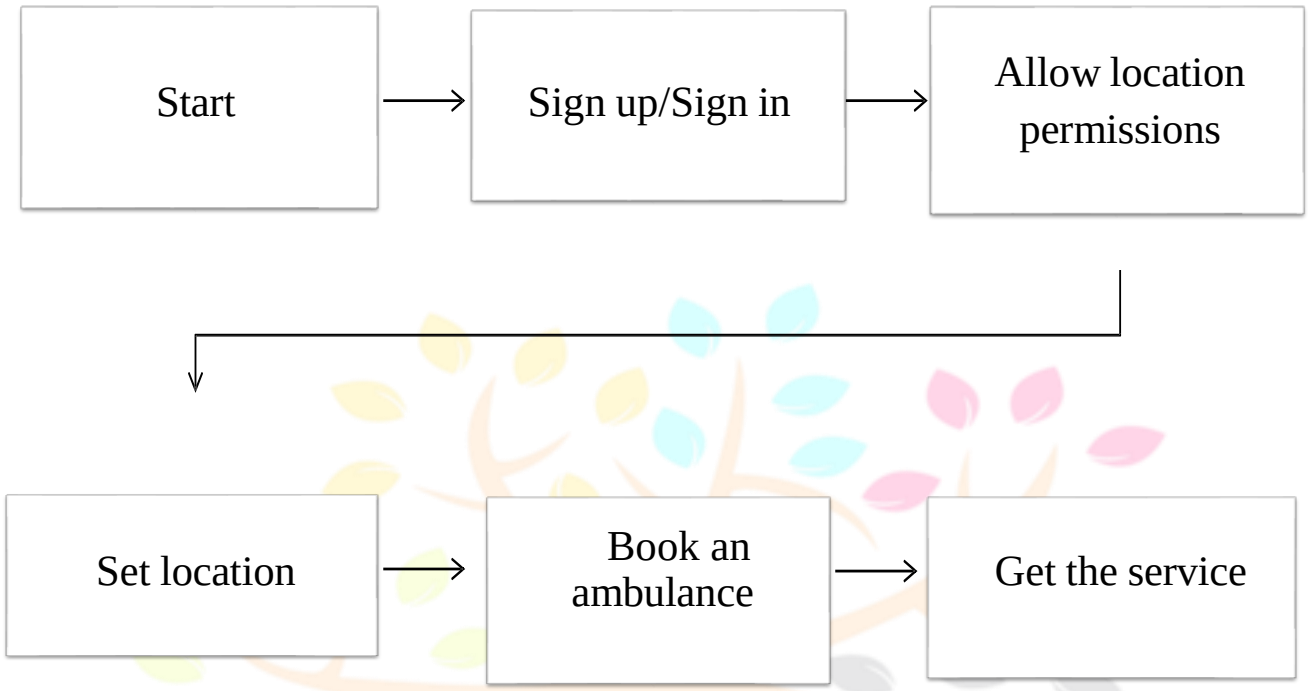

Figure- Ambulance booking flowchart

The aim of this study is to evaluate the usability and effectiveness of an online ambulance booking service for emergency situations.

When the user opens the app, he is first directed to the login/ sign up screen where the user is supposed to log into their account. The user is then prompted to allow location permissions to detect your current location automatically. Once the permission is granted, you'll be directed to a map with ambulances nearby. Click on an ambulance near you to see it's details and what life support it is carrying. The user can then book the ambulance for the service. The user can also give the feedback upon completing the service which reflects upon the ambulance, next time you book.

On the driver side of the portal, the driver must login/ sign up to enter their account. Here they can add an ambulance with necessary details like availability of life support, oxygen, defibrillator etc. also with the picture of the ambulance. The current location is automatically detected upon opening the driver portal. Once the ambulance is registered, it is ready to go on rescue missions. Also, it'll show up on the user's map.
The procedure involves the following steps:

- The participants are instructed to set their location on the app and book an ambulance as quickly as possible.
- The app records the distance traveled, and the feedback of the participants.

The data analysis involves comparing the performance and ratings of the participants with the existing methods of calling an ambulance, such as phone or SMS.

EXPECTED OUTCOMES

To Reduce Response Times: Swift dispatch and response to provide critical medical assistance promptly during emergencies.

To Find Shortest Route: Navigation assistance for ambulances to reach emergency locations efficiently.

To Have User-Friendly Experience: Intuitive interface even during high-pressure situations, alleviating user stress.

CONCLUSION

In conclusion, the development of an Ambulance Service Web App is a crucial step forward in transforming the way emergency medical care is delivered. This project addresses significant challenges in the current emergency medical care system and aims to provide a reliable, efficient, and user-friendly solution for individuals in need of urgent assistance. The project objectives are clear: to reduce ambulance response times, enhance coordination between emergency helplines and ambulance services, and improve communication between users and ambulance drivers[11]. The app is designed to ensure the safety and well-being of individuals during medical emergencies, offering a lifeline when it's needed the most.

The scope of the project encompasses a robust feature set for both users and ambulance drivers, as well as integration with an emergency helpline service. To ensure data security and compliance with healthcare regulations, the project places a strong emphasis on privacy and security. During the development phase, careful attention will be paid to creating user-friendly apps for both users and ambulance drivers, a scalable and efficient backend system, and comprehensive testing to ensure the app's reliability and performance.

REFERENCES:

1. Ryo Katsuma, “Dynamic Routing for Emergency Vehicle”, International Journal of Communications Network and System Sciences · ISSN(e): 1913-3723 · ISSN(p): 1913-3715 · PP:27 44 Vol. 11, Issue 02 (January, 2018)

2. EC Fradelos, “Geographic Information Systems (GIS) in Public Health”, Acta Inform Med· ISSN(e): 1986-5988 · ISSN(p): 0353-8109 · PP: 402-405 Vol. 22, Issue 06 (December, 2014).

3. Adriana Chammas, “A Closer Look on the User-Centered Design”, Procedia Manufacturing · ISSN: 2351-9789 · PP: 5397-5404 Vol. 03(December, 2015)

4. Gräsner J-T, Lefering R, Koster RW, et al., “Response Time and Survival Rates” 27 Nations, one Europe, one Registry: A prospective one month analysis of out-of-hospital cardiac arrest outcomes in 27 countries in Europe. Resuscitation. 2016;105(1):1195–1880.

5. Pons, Peter T., Markovchick, Vincent. J, “Target Response Time Benchmarks”, The Journal of Emergency Medicine. Vol. 23, No. 1, 43–48, PMID: 15995089. 2002.

6. A.S.Carvalho, “Future Directions”, November 2019 ·Integrating the ambulance dispatching and relocation problems to maximize system’s preparedness. European Journal of Operational Research, 2020, vol. 283, issue 3, 1064-1080.

7. Roberto Aringhieri, “EMS Protocols and Training”, A taxonomy for emergency service station location problem. Optimization Letters, 6(6):1147–1160, 2012.

8. Ahjoku Amadi-Obi, “Telemedicine and Pre-Arrival Instructions” July 2014· Tele-Medicine in pre hospital care · PMID: 25635190.

9. Dr.Vijaya Kumar A V, Mr.Vignesh K R, Mr. Kandi ururaja Rao, “The Reality of Augmented Reality & Virtual Reality- A Digital Transformation Contributing Towards Learning Simplified” Journal of Emerging

Technologies and Innovative Research (JETIR), ISSN No. 2349-5162, Volume 10 | Issue 8 | Year August-2023, and PP: h56-h62

10. Dr.Vijaya Kumar A V, Altaf Hussain, Raghu P V, "FIRE FIGHTING ROBOT WITH GSM TECHNOLOGY AND GPS" International Journal of Creative Research Thoughts (IJCRT), ISSN No. 2320-2882, (May 2022), Volume 10, Issue 5, PP:B440-B445,

11. Dr.Vijaya Kumar A V, Mr. Kandi Gururaja Rao, Mrs. H. M. Shamitha, Dr. Yerriswamy T, Mr. Venumadhava "Revamp of Natural Language Processing using Reinforcement Learning"October 2022 Volume 20, Issue 13, Page 1360-1366 doi: 10.14704/nq.2022.20.13.NQ88170, Neuroquantology

12. Dr.Vijaya Kumar A V, Deepa Puttal, Poornima, Souda, Veena "Securing Agricultural Crops Against Birds And Wild Animal Attacks" International Journal of Creative Research Thoughts (IJCRT), ISSN No. 2320-2882, (April 2022), Volume 9, Issue 4, PP:C267-C272