CRISIS CALL

Submitted in partial fulfillment of the requirements of the degree

BACHELOR OF ENGINEERING IN COMPUTER ENGINEERING

By-
Vivek Venkatachalam/D12A/63
Vaishnavi Sonawane/D12A/58
Gouresh Madye/D12A/39
Nishika Gangwani/D12A/24

Name of the Mentor
Prof. Nusrat Ansari

Vivekanand Education Society's Institute of Technology,
An Autonomous Institute affiliated to University of Mumbai
HAMC, Collector's Colony, Chembur,
Mumbai-400074
University of Mumbai (AY 2024-25)

CERTIFICATE

This is to certify that the Mini Project entitled **" Crisis Call "** is a bonafide work of **Vivek Venkatachalam(D12A), Vaishnavi Sonawane(D12A), Gouresh Madye(D12A) and Nishika Gangwani(D12A),** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **"Bachelor of Engineering"** in **"Computer Engineering" .**

(Prof. Nusrat Ansari)
Mentor

(Prof. Nupur Giri)
Head of Department

(Prof. J.M. Nair)
Principal

Mini Project Approval

This Mini Project entitled "Crisis Call**"** by **Vivek Venkatachalam(D12A), Vaishnavi Sonawane(D12A), Gouresh Madye(D12A), Nishika Gangwani(D12A),** is approved for the degree of **Bachelor of Engineering** in **Computer Engineering.**

Examiners

1…………………………………………
(Internal Examiner Name & Sign)

2…………………………………………
(External Examiner name & Sign)

Date:

Place:

Contents

Abstract

The Crisis Call Project is an innovative real-time emergency response platform designed to address three major types of crises: medical emergencies, fires, and traffic accidents. In today's fast-paced world, where rapid response can significantly impact outcomes, this project aims to bridge the communication gap between individuals in distress and emergency responders, facilitating quicker access to essential services. The platform features a user-friendly interface that enables individuals to report emergencies, share their exact locations, and access vital information to assist them during critical situations. To enhance coordination and efficiency, the system incorporates dedicated panels for both users and emergency services, allowing users to swiftly notify nearby responders, while emergency service providers receive real-time notifications and relevant data for effective interventions. Additionally, the project utilizes data analytics to inform emergency services about trends and patterns in crisis occurrences, aiding in better resource allocation and preparedness. By integrating historical data and real-time tracking, the Crisis Call Project not only improves response times but also promotes proactive measures to prevent emergencies from escalating. Ultimately, this project seeks to enhance public safety outcomes, ensure timely interventions during emergencies, and create a more effective and reliable emergency response system for communities, fostering a safer environment for all.

Acknowledgement:

We would like to thank and express gratitude to all those who contributed and supported us to plan our project smoothly and successfully.

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1. Introduction

1.1. Introduction

Emergencies such as medical crises, fires, and traffic accidents require immediate attention, and delays in response can lead to severe consequences. The ability to connect individuals in distress with emergency services quickly and efficiently is crucial in reducing harm and saving lives. The **Crisis Call Project** is a real-time platform designed to facilitate faster communication between individuals facing emergencies and the respective responders. By providing a centralized system for reporting emergencies and sharing critical information, this project aims to enhance the efficiency of emergency services and improve public safety.

1.2. Motivation

The primary motivation behind the **Crisis Call Project** is the need for a more effective and streamlined emergency response system. In many emergency situations, delays occur due to miscommunication, lack of access to real-time data, or the inability to share accurate location information quickly. Current emergency response mechanisms often fall short of ensuring rapid intervention, especially in rural or high-risk areas. With advancements in technology, there is an opportunity to leverage real-time tracking, data analytics, and user-friendly interfaces to minimize these delays and improve outcomes. The project is motivated by the potential to save lives, reduce injuries, and provide better coordination between emergency responders and individuals in need.

1.3. Problem Statement & Objectives

In emergencies such as medical crises, fires, and traffic accidents, delays in receiving timely assistance can result in severe consequences. These delays often stem from difficulties in contacting emergency services, inaccurate location sharing, and the lack of access to crucial information. Medical emergencies require quick hospital coordination, fires demand immediate response to prevent damage, and traffic accidents need swift intervention to manage injuries and congestion.

Emergency responders also face challenges in receiving real-time alerts and accessing relevant details. This project aims to streamline emergency response by providing a platform that facilitates faster assistance through real-time notifications, accurate location sharing, and access to vital information across all three crisis types.

1.4. Organization of the Report

In this report, we further discuss the following points:

1. Literature Survey of Existing Systems: A review of current systems addressing medical, fire, and traffic emergencies, including platforms that provide real-time location sharing, emergency notifications, and crisis response, highlighting their methodologies and effectiveness in reducing response times.

2. Limitations of Existing Systems: An analysis of the challenges faced by existing emergency response systems, including delays in communication, lack of integration between emergency services, inadequate use of historical data, and limited real-time assistance during emergencies.
3. Project Contribution: This project uniquely integrates medical, fire, and traffic emergencies into a unified platform. The frontend UI/UX of the system was developed by Gouresh Madye and Vaishnavi Sonawane, ensuring a user-friendly and intuitive interface. The backend machine learning models were built by Vivek Venkatachalam and Nishika Gangwani, enhancing the system's ability to predict and respond to emergencies efficiently. Additionally, Vaishnavi Sonawane and Nishika Gangwani contributed to the creation of essential project documentation, including the report, logbook, and research paper draft, ensuring a comprehensive record of the project's development.
4. The Proposed System: A detailed description of the Crisis Call Project, explaining the architecture, methodologies, and technologies used to create a comprehensive emergency response system. The system integrates user and admin panels, predictive analytics for fire and traffic, and the ability to share medical records instantly during emergencies.
5. Details of Hardware and Software Used: An overview of the technical infrastructure and tools employed in the project, including software for real-time communication, machine learning models for predictive analysis, and hardware specifications required for server deployment and data handling.
6. Conclusion: A summary of the key findings and contributions of the project, emphasizing the improvement in response times, accuracy in emergency reporting, and the potential for future development. Suggestions for expanding the system to integrate additional emergency types and further enhancing user accessibility and data security are also provided.

2. Literature Survey

2.1 Survey of Existing System

Paper 1 : Application of telemedicine and eHealth technology for clinical services in response to COVID-19 pandemic [4]
Link
The literature on telemedicine and eHealth highlights their critical role in maintaining healthcare services during the COVID-19 pandemic. These technologies reduce infection risk, alleviate pressure on healthcare systems, and ensure continuous care delivery. However, challenges such as incomplete physical assessments, technological barriers like limited access to high-speed internet, and the absence of uniform regulatory frameworks impede the widespread and effective use of telemedicine. Despite these limitations, telemedicine and eHealth platforms have proven to be vital in providing safe and efficient healthcare services during the pandemic, warranting attention to overcoming these barriers for long-term implementation.

Paper 2 : Smartphone-based dispatch of community first responders to out-of-hospital cardiac arrest- statements from an international consensus conference [5]
Link
Smartphone-based activation (SBA) of Community First Responders (CFR) for out-of-hospital cardiac arrests (OHCA) has shown significant potential in improving survival rates by reducing no-flow time. European programs implementing SBA systems have experienced varied success due to differences in technology, responder qualifications, and integration with emergency services. While this approach underscores the importance of CFR in saving lives, its effectiveness is contingent upon the development of standardized, nationwide strategies. Future research and collaboration are necessary to optimize SBA systems and fully realize their potential in emergency medical response.

Paper 3 : Live video from bystanders' smartphones to medical dispatchers in real emergencies [6]
Link
Live video integration from bystanders' smartphones to medical dispatchers during real emergencies offers a promising enhancement in the accuracy of emergency response. By providing dispatchers with live visual data, resource allocation and decision-making can be significantly improved. However, challenges in integrating this technology into traditional dispatch systems remain, and its underutilization, along with a lack of outcome data, suggests that more research is needed. Dispatcher training and adjustment to existing protocols are crucial for successfully incorporating live video into emergency response systems.

Paper 4 : FLAME: A Parametric Fire Risk Assessment Method Supporting Performance Based Approaches [2]
Link
Fire risk assessment has transitioned from compliance-based approaches to more sophisticated performance-based methodologies. The FLAME method exemplifies this shift by offering a parametric, semi-quantitative approach that integrates human and property risks. While it serves as a valuable tool in early-stage fire risk assessments, the method's reliance on predefined strategies and assumptions about occupant behavior may limit its applicability across diverse scenarios. As such, it is recommended to complement FLAME with more detailed evaluation methods for a thorough assessment of fire safety strategies.

Paper 5 : Machine learning based approach for multimedia surveillance during fire emergencies [7]
Link
Machine learning has increasingly become a pivotal tool in enhancing fire emergency responses through multimedia surveillance. By combining an Adaboost-MLP model with CNN-based real-time video surveillance, the proposed system demonstrates high accuracy in fire detection. Despite its potential, the approach faces challenges, including high computational requirements, issues with data quality from sensor inputs, and concerns over false positives and negatives. Nevertheless, the integration of machine learning into disaster management systems represents a promising step toward more efficient and accurate fire emergency responses.

Paper 6 : Predicting 911 Calls Using Spatial Analysis [1]
Link
This study explores the use of spatial analysis methods, such as hotspot analysis, to predict and manage 911 emergency calls, emphasizing their importance in understanding factors that drive high call volumes. By aiding policymakers in resource allocation and developing proactive strategies, the study proposes regression models to anticipate and mitigate emergencies more effectively. However, the heavy reliance on historical data may limit the models' ability to account for sudden or unpredictable shifts in emergency patterns, and spatial variability further reduces the accuracy of predictions in diverse geographical contexts. While spatial analysis and predictive modeling show promise in improving emergency response by identifying call hotspots, the study highlights the need for refining models to enhance adaptability.

Paper 7 : Statistical and Machine Learning Models for Predicting Fire and Other Emergency Events in the City of Edmonton [8]
Link
The paper outlines the development of predictive models for emergency events in Edmonton, Canada, focusing on fire and rescue services (EFRS). It covers data collection from multiple sources, descriptive analysis of event types, feature selection, and the creation of prediction models using negative binomial regression. These models predict the likelihood of various emergency events at different spatial and temporal levels, with a focus on neighborhood and fire station areas. The study also examines the correlation between event types and socioeconomic factors and evaluates the models' performance during the COVID-19 pandemic, showing their applicability for planning resource allocation and mitigation strategies. The predictive accuracy is strong, particularly for weekly and monthly predictions, and the methods used are adaptable to other cities.

Paper 8 : A Real-Time, Automated and Privacy-Preserving Mobile Emergency-Medical-Service Network for Informing the Closest Rescuer to Rapidly Support Mobile-Emergency-Call Victims [9]
Link
The paper proposes a real-time, automated mobile emergency medical service (SMES) network that alerts the closest medical staff to respond to emergency calls, particularly in understaffed care centers, hospitals, and long-term care facilities. The system operates via mobile devices, allowing patients and staff to notify a central server of an accident's location, which then instantly informs the nearest available rescuer. This minimizes response time, enhances patient safety, and ensures that patients in distress receive timely medical attention. The system maintains privacy and security through features like data integrity, anonymity, authentication, and protection against location tracking and asynchronous attacks. The proposed solution, implemented on Android and Windows platforms, offers significant improvements in the efficiency of emergency response, with an average response time of 104ms.

Paper 9 : eEmergency System to Support Emergency call Evaluation and Ambulance dispatch Procedures [10]
Link
The study presents the design and implementation of the eEmergency system, developed to support the handling of emergency calls and ambulance dispatch procedures in Cyprus. The system, created for a central call center established in 2016, aims to streamline ambulance fleet management, emergency call evaluation, and communication between ambulances and the control center. It has been in daily use for over a year, successfully managing more than 62,000 incidents, including during the COVID-19 pandemic. The system enhances efficiency by automating the dispatch process, assigning paramedics and ambulances to

incidents dynamically, and minimizing human error. It is intended to improve patient outcomes by optimizing response times and ensuring proper triage.

Paper 10 : Development of an Extended Reality Simulator for Basic Life Support Training [11]
Link
The development of an Extended Reality (XR) simulator for Basic Life Support (BLS) training aims to enhance traditional CPR education by providing a more immersive and realistic experience. Using a combination of virtual and real-world environments, the simulator incorporates a half-torso manikin and follows the 2020 American Heart Association guidelines. Trainees use a head-mounted display (HMD) and hand-tracking device to perform chest compressions, ventilation, and defibrillation in a virtual setting. The system allows for BLS training without the need for instructors and trainees to gather physically, which is particularly useful during the COVID-19 pandemic. Expert surveys indicate that the XR-BLS simulator is user-friendly, delivers effective training, and the interaction with the AI instructor is clear and helpful.

2.2 Limitation of existing system or Research Gap

Paper 1 : Application of telemedicine and eHealth technology for clinical services in response to COVID‑19 pandemic [4]
Link
Telemedicine faces challenges like incomplete physical assessments and technological barriers, including limited access to high-speed internet and digital literacy. Additionally, the lack of uniform regulatory frameworks and concerns over data privacy hinder widespread adoption and effective use.

Paper 2 : Smartphone-based dispatch of community first responders to out-of-hospital cardiac arrest- statements from an international consensus conference [5]
Link
The study has several limitations, including language bias due to the conference being held in German and English, which may have excluded some perspectives. The diversity of participants, while broad, may not fully represent all stakeholders, and the influence of strong opinion leaders during discussions might have skewed some outcomes. Additionally, the focus on European CFR systems limits the generalizability of the findings to other regions.

Paper 3 : Live video from bystanders' smartphones to medical dispatchers in real emergencies [6]
Link
The study's limitations include the inability to assess the appropriateness of changes in emergency response due to a lack of outcome data from ambulance crews or hospitals. Additionally, the low usage rate of live video and low response rate from bystanders suggest a potential selection bias. The increased duration of calls with video may also have skewed results, complicating decision-making.

Paper 4 : FLAME: A Parametric Fire Risk Assessment Method Supporting Performance Based Approaches [2]
Link
The FLAME method, while innovative, is semi-quantitative and may not capture the full complexity of fire scenarios, particularly in diverse building types. It relies heavily on pre-existing fire strategies and assumptions about occupant behavior, which might not always align with real-world conditions. Additionally, the method's reliance on risk indices could oversimplify the nuances of fire risk, leading to potential gaps in safety assessments.

Paper 5 : Machine learning based approach for multimedia surveillance during fire emergencies [7]
Link
The proposed approach has limitations such as high computational requirements and the complexity of implementing the hybrid Adaboost-MLP and CNN models. The system depends on both sensor data and social media inputs, which may lead to issues with data quality and real-time processing. Additionally, while the model achieves good accuracy, false positives and negatives remain a concern, potentially affecting its reliability in fire detection.

Paper 6 : Predicting 911 Calls Using Spatial Analysis [1]
Link
Despite the promising use of spatial analysis and regression models, the study has limitations. It relies heavily on historical data, which may not account for sudden or unpredictable shifts in emergency patterns. The regression models also have limitations in addressing spatial variability, potentially reducing the accuracy of predictions in diverse geographical contexts.

Paper 7 : Statistical and Machine Learning Models for Predicting Fire and Other Emergency Events in the City of Edmonton [8]
Link
The study's limitations include its sole focus on Edmonton's data, which may not account for differences in other cities. Additionally, the models' performance is heavily influenced by the frequency of event occurrences and the granularity of the spatial and temporal data. The models could also benefit from integrating more dynamic data sources, such as weather and traffic information, to improve prediction accuracy and response time, particularly in high-incident areas.

Paper 8 : A Real-Time, Automated and Privacy-Preserving Mobile Emergency-Medical-Service Network for Informing the Closest Rescuer to Rapidly Support Mobile-Emergency-Call Victims [9]
Link
A key limitation of the system is that it relies heavily on mobile devices and real-time connectivity, which may not be consistently available in all care settings, especially in areas with poor network coverage. The system also assumes that the nearest responder is always the best-suited individual to handle the emergency, without accounting for the severity of the incident or the responder's qualifications. Additionally, while the system enhances security and privacy, its practical implementation in diverse care environments may face challenges related to integration with existing healthcare infrastructure and ensuring full compliance with privacy laws and regulations.

Paper 9 : **eEmergency System to Support Emergency call Evaluation and Ambulance dispatch Procedures** [10]
Link
A limitation of the system is that it currently lacks advanced features like real-time video exchange and automated data analysis, which could further improve decision-making and support for paramedics. Additionally, while part one of the system has been successfully implemented, part two is still in development, indicating that the system is not yet fully realized. Future enhancements, such as incorporating real-time guidance for paramedics and better decision-making tools, will be necessary to fully optimize the system's potential in emergency response situations.

Paper 10 : Development of an Extended Reality Simulator for Basic Life Support Training [11]
Link
It lacks a comparative study between XR-based and conventional BLS training methods, which is crucial for assessing its overall effectiveness. Future work includes conducting a multinational randomized controlled trial (RCT) to evaluate efficacy and developing design improvements, additional training scenarios, and upgrades for one-to-many training. This will help optimize the system for broader applications in BLS education and ensure its scalability.

2.3 Mini Project Contribution

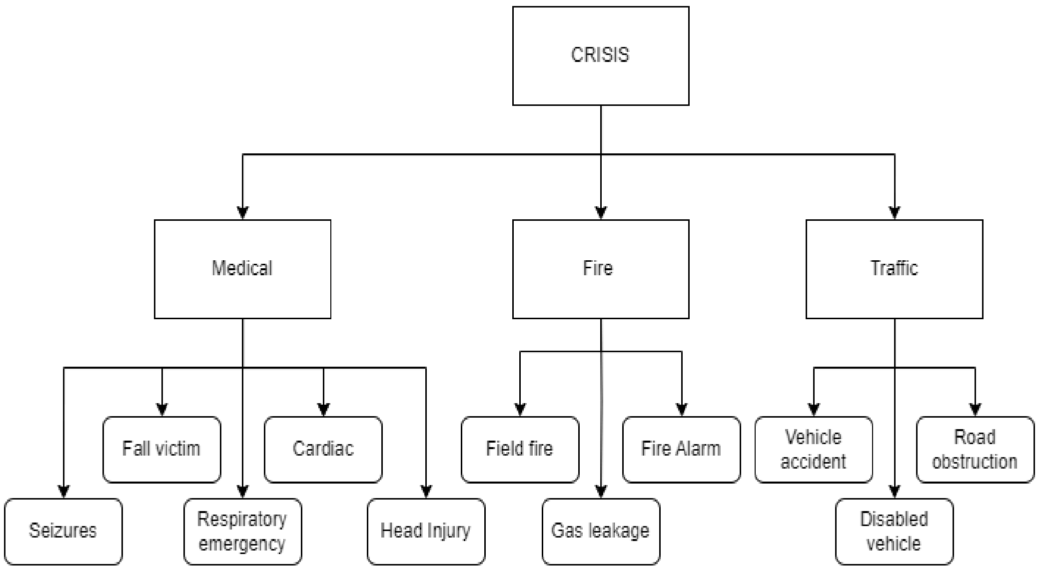
In my contribution to the Crisis Call project, I have focused on addressing key limitations in emergency medical response by developing a user-friendly, two-panel system that bridges the gap between people in need of urgent medical assistance and hospitals that can provide care. On the user side, I built a system where individuals can either choose to handle emergency situations or register their medical details. The emergency option allows users to instantly share their location, helping them connect with nearby hospitals for faster assistance, which addresses the critical issue of delayed response times in emergencies. The registration option lets users store medical records on the platform, enabling healthcare providers to have essential information upfront during an emergency, thus improving the accuracy and speed of treatment.
On the admin side, I developed a hospital-controlled dashboard where hospitals can access the registered users' medical records and receive real-time notifications of emergency cases, facilitating swift action. By integrating location-sharing technology, I ensured that hospitals can quickly send ambulances to emergency locations, reducing response time. This system not only addresses the common problem of incomplete or delayed information during emergencies but also offers a streamlined, centralized approach to managing patient data and emergency alerts, improving the overall efficiency and responsiveness of emergency medical services.

3. Proposed System

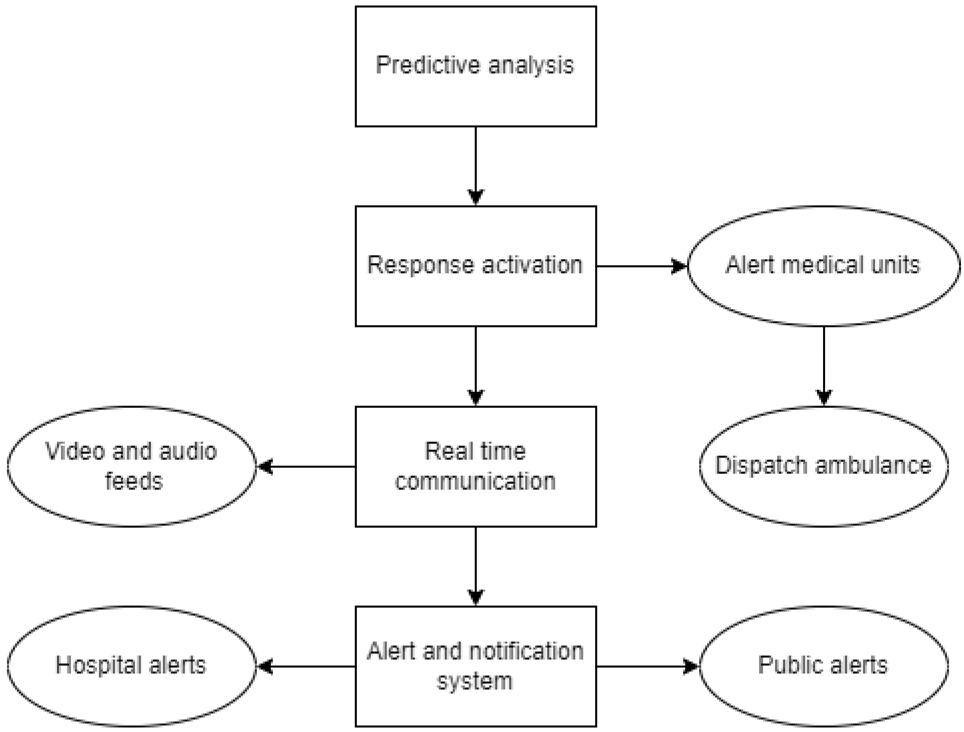
3.1 Introduction

The **Crisis Call Project** aims to create an integrated emergency response platform that connects users in distress with nearby hospitals, fire departments, and traffic management teams in real-time. This system bridges the communication gap, reduces response times, and ensures better coordination between responders. The design leverages both real-time user input and historical data for resource optimization and faster response to emergencies. In this chapter, we describe the architectural framework, process design, algorithms used, and the methodology applied in developing this system. Additionally, we analyze the results obtained through experimentation and testing.

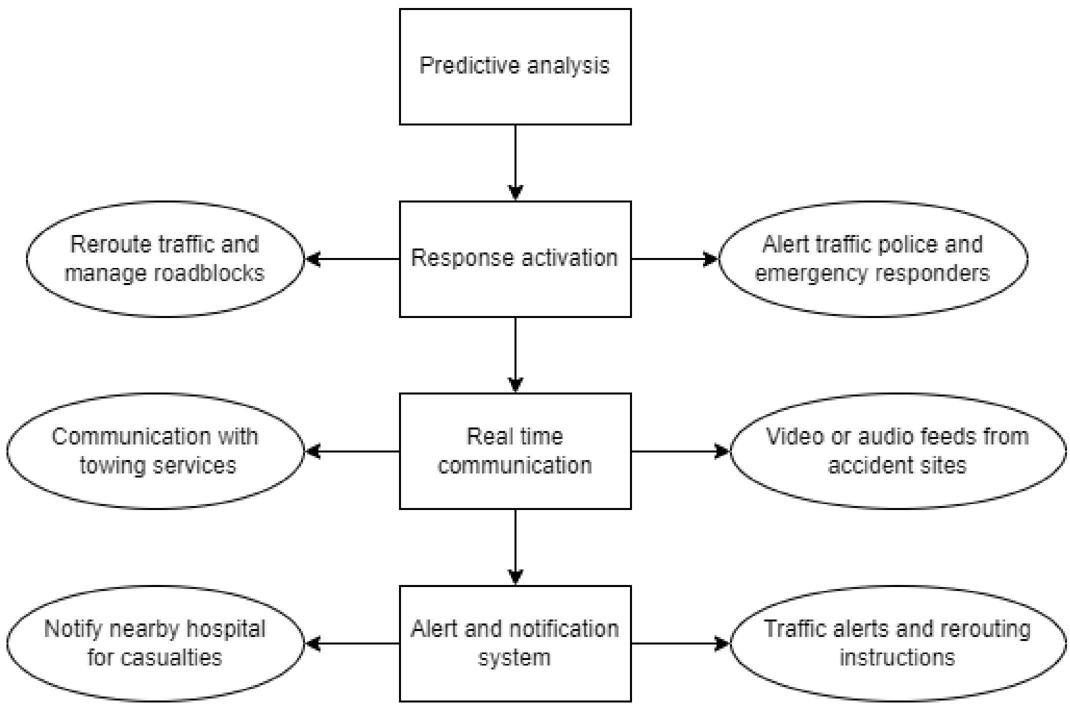
3.2 Architectural Framework / Conceptual Design



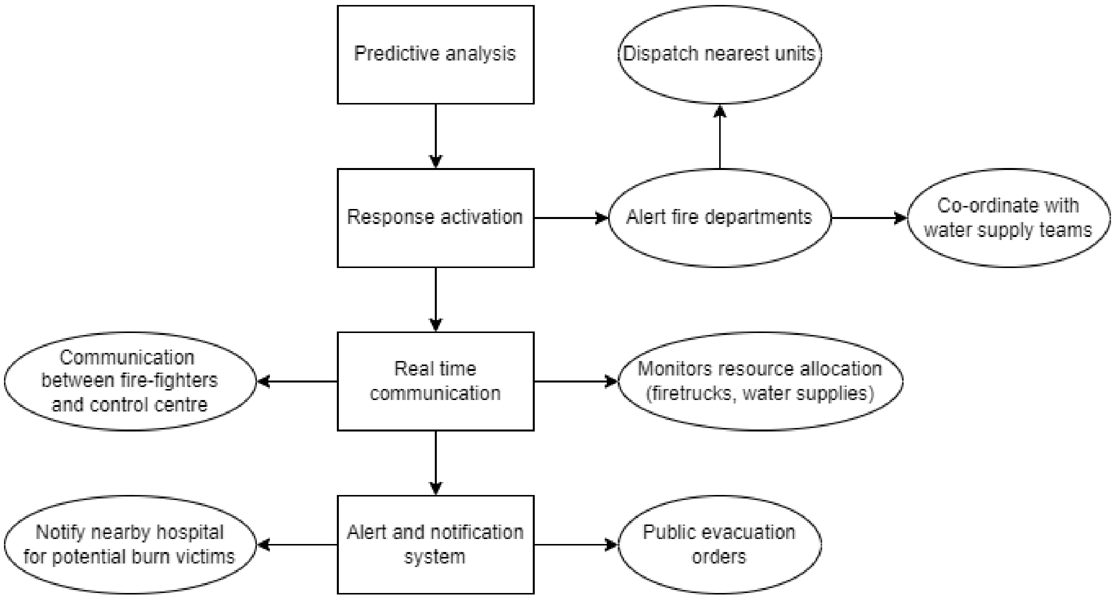
CrisisCall Flow Diagram



Medical Flow Diagram

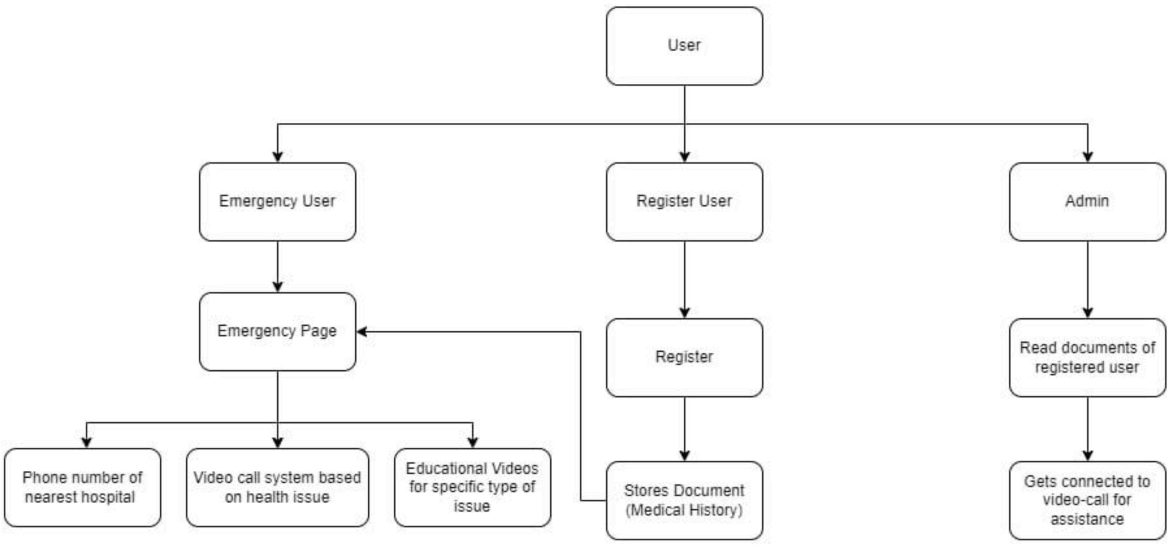


Traffic Flow Diagram



Fire Flow Diagram

3.3 Algorithm and Process Design

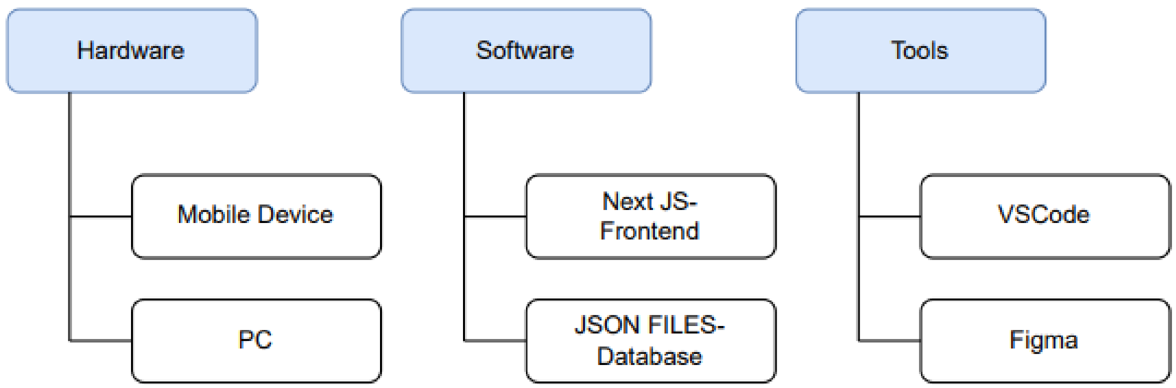


3.4 Methodology Applied

For medical emergencies, the system focuses on connecting individuals in distress with nearby hospitals, ensuring swift communication and faster intervention. The methodology involves:

1. User Registration and Medical Data Storage:
    - Users can register their personal and medical information on the platform, including details such as allergies, chronic illnesses, medications, and emergency contacts.
    - This data is securely stored in a database, making it available for future use during emergencies.
2. Real-Time Emergency Reporting:
    - When a medical emergency is reported via the user panel, the system collects crucial details, such as the user's location and nature of the emergency (e.g., heart attack, injury, etc.).
    - The system automatically retrieves the user's medical history from the database and includes this information in the alert sent to the nearest hospital.
3. Immediate Notification to Hospitals:
    - The platform leverages GPS technology[1] and Google Maps API to identify the closest hospital or medical facility. An automated notification is sent, containing the patient's current location and relevant medical details.
    - The hospital's response team is informed in real time, enabling them to prepare for the patient's arrival and dispatch an ambulance if necessary.
4. Data-Driven Medical Response:
    - Medical personnel receiving the alert can access the patient's medical history, such as allergies, current medications, and any chronic conditions, allowing for a more precise and rapid response.
    - This minimizes the chances of errors and speeds up the treatment process, enhancing the chances of a positive outcome.

3.5 Hardware & Software Specifications



3.6 Experiment and Results for Validation and Verification

To assess the performance and reliability of the Crisis Call Project in medical emergencies, a series of controlled experiments were conducted to simulate real-world scenarios. The focus was on evaluating the system's ability to deliver timely and accurate communication between users in medical distress and nearby hospitals, while also measuring the effectiveness of emergency response.

Experiment Setup:

1. Emergency Reporting Simulation: Users triggered simulated medical emergencies by selecting the "Emergency" option. Their real-time location and pre-registered medical information (such as medical history, allergies, and medications) were transmitted directly to the nearest hospital via the system.

2. Hospital Response: Upon receiving the alert through the admin panel, hospitals were notified with the user's details, allowing them to review the patient's medical records and prepare for the incoming emergency.

3. Response Time Tracking: The system's performance was measured based on the time it took from when the emergency was reported to when the hospital received the notification and dispatched an ambulance.

Validation Metrics:

- ➢ Response Time: The interval between the user initiating the emergency report and the hospital receiving the alert, as well as the time taken to dispatch an ambulance.
- ➢ Medical Data Accuracy: The system's capability to deliver complete and accurate medical information to hospitals.
- ➢ Location Accuracy: The precision of the user's real-time location data as transmitted to hospitals.[1]

3.7 Result Analysis and Discussion

The results of the medical emergency experiments demonstrate the Crisis Call Project's potential to significantly enhance the efficiency of emergency medical response. The integration of real-time location sharing and access to pre-registered medical records led to a marked reduction in response times, which is critical in life-threatening situations.

Faster Response and Preparedness:

One of the key outcomes was the system's ability to drastically reduce the time it took for hospitals to be notified and dispatch ambulances. By providing medical records instantly, hospitals were better prepared to handle specific conditions (e.g., allergies or pre-existing medical conditions), ensuring that appropriate care could be administered more quickly. This not only improved response times but also allowed medical personnel to tailor their care based on each patient's unique medical needs.

Challenges:

1. **GPS Accuracy**: Reliance on GPS accuracy was impacted by poor signal strength in rural or remote areas, potentially delaying ambulance arrival or causing confusion in locating emergencies.[1]
2. **Medical Record Retrieval**: While generally accurate, improvements are needed to integrate more comprehensive health records for better information availability.
3. **Response Time**: The system demonstrated significant improvements in emergency response time and preparedness.
4. **Hospital Actions**: Hospitals could act swiftly with access to accurate medical data, ensuring timely and effective care.

5. **Future Enhancements**: Enhancing GPS accuracy and ensuring continuous data updates will further strengthen the system's reliability and improve emergency outcomes.

3.8 Conclusion and Future work.

The Crisis Call project provides a substantial improvement in emergency medical response by creating a platform that connects individuals in crisis with nearby hospitals. Through its two-panel structure—one for users and another for hospitals (admin)—the project facilitates fast and accurate communication. Users can either register their medical details or send their real-time location in an emergency. This dual functionality ensures that individuals receive prompt assistance by allowing hospitals to access critical medical information in advance, which improves the speed and precision of the care provided. The system's focus on real-time location sharing for emergencies addresses the common delays in response times, helping users receive timely help.

On the hospital side, the admin panel streamlines the management of emergency cases by instantly notifying hospitals about incoming emergencies. This enables hospitals to assess situations more efficiently and dispatch ambulances promptly, reducing the time taken to respond to critical incidents. Although the project has only implemented the medical component, it lays the groundwork for a comprehensive emergency management system that will also address traffic and fire emergencies[2] in the future. By improving coordination between users and healthcare providers, Crisis Call enhances overall efficiency in handling emergency medical situations, ensuring faster and more reliable responses.

Future Work

The future scope of the Crisis Call Project includes several advanced features aimed at enhancing the system's functionality for fire, traffic, and medical emergencies. These future modules and improvements will make the platform more robust and efficient in handling diverse crisis scenarios:

1. Fire Crisis Module: A fire reporting and alert system will be developed to notify fire departments in real time when a fire emergency is reported. In addition, the system will integrate predictive analytics based on historical data to identify fire-prone zones. This feature will help authorities take preventive measures and respond more proactively to high-risk areas.

2. Traffic Crisis Module: An accident reporting system will be implemented with real-time traffic updates. The system will analyze historical traffic data to identify accident-prone locations and provide risk analysis. This will help emergency services manage accident scenes more effectively, allowing for faster interventions and improved traffic management.

3. Video Call System: To enhance communication during medical emergencies, a real-time video call feature will be integrated, enabling users to connect directly with hospitals. This feature will allow medical professionals to assess the situation visually and provide immediate advice, ensuring better assistance during critical situations.[6]

4. Community-Driven Emergency Response Network: A volunteer-based emergency response network will be introduced, allowing local citizens to register as responders. This network will enable volunteers to assist during emergencies, especially in cases where professional responders may be delayed. Community involvement will provide an extra layer of support in times of crisis.[5]

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