International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Surakshit Bharat: A Comprehensive, Centralized Emergency Response System for India

Rakshita Sarap[1], Mangesh Pangam[2], Saish Rane[3], Martina D'souza[4]

[1,2,3]Student, Department of Information Technology, Xavier Institute of Engineering
[4]Professor and Project Guide, Department of Information Technology, Xavier Institute of Engineering

Abstract
This research paper introduces Surakshit Bharat, a centralized and all-encompassing emergency response system for India. Although India has adopted the 112 emergency system, it is still quite ineffective in comparison to its equivalents, including the 911 system in the United States and the 112 system in the European Union. The current system does not have extensive coverage of various emergency services and does not offer quick response mechanisms like the 911 model. In the 911 system, there are dedicated dispatchers who take emergency calls and immediately deploy the required emergency services. Our application will try to adopt a similar, centralized response system in which different emergency services can be contacted depending on the location of the victim. The system will alert the nearest emergency service stations automatically, and a quick response will be ensured. By consolidating several emergency services on one platform, our solution does away with memorizing various emergency contact numbers, hence saving precious time during emergencies. Furthermore, identifying conditions under which users might be unable to call or communicate orally, our system offers backup options for interaction in the form of text messages and chat support. The application further includes sharing the real-time location and a camera feature for improved situational awareness for the emergency responders. In addition, an AI-driven chatbot has been incorporated to give users critical first aid instructions until the arrival of emergency responders. With the help of cutting-edge technology, Surakshit Bharat hopes to increase emergency response services' efficiency and availability in India, which should lead to increased public safety and lowered response times.

Keywords: Emergency Response System, Chatbot, Emergency Services, Real-time Location, Centralized System

1. Introduction

'Surakshit Bharat' is an all-in-one, centralized system for emergency responses meant to make the process easy and straightforward for users, who are provided with convenient access to an extensive set of emergency services in a single platform. It increases efficiency and cuts response times for critical cases by ending the process of having to recall a plethora of emergency numbers.

The app enables individuals to reach emergency services by various modes of communication such as calling or texting, making it accessible even in situations when a phone call is not feasible. It also features real-time sharing of location and live image capture to present emergency responders with vital situational

context. Last but not least, it has an AI-driven chatbot providing vital first aid instructions until expert help can be reached. 'Surakshit Bharat' has been created as a desktop and mobile application, thus ensuring wide availability and convenience of use.

2. Literature Survey

2.1 Chatbot Innovations

2.1.1 Chatbot for Communicating with University Students in Emergency Situations: This paper discusses a chatbot developed using Google's Dialogflow to support university students during crises like COVID-19. Evaluated by over 160 users, the chatbot demonstrated effectiveness in facilitating communication with university services.

2.1.2 Rescue.io: A Chatbot Solution for Emergency Situations: This paper presents Rescue.io, a multi-channel chatbot that allows users to send silent distress signals. The authors highlight the inadequacies of traditional emergency systems and emphasize the chatbot's potential for rapid, discreet communication during emergencies.

2.2 Mobile Applications

2.2.1 A Mobile Based Emergency Reporting Application for the Philippine National Police Emergency Hotline 911: The i911 app is designed to enhance the efficiency of emergency reporting for the Philippine National Police by using geolocation and user registration. Surveys indicate high user satisfaction with its features, suggesting its effectiveness in real-time response scenarios.

2.3 Blockchain and Location-Based Services

2.3.1 BEST—Blockchain-Enabled Secure and Trusted Public Emergency Services for Smart Cities Environment: This research proposes a blockchain framework to improve public emergency services, addressing trust and efficiency issues in traditional systems. Simulation results indicate potential benefits in response times and service delivery.

2.3.2 Framework for Location-Based Emergency Services in India: This paper outlines a framework for integrating the National Spatial Data Infrastructure (NSDI) with location-based services to enhance emergency response capabilities. It emphasizes the importance of interoperability and spatial data sharing.

Table 1: Summary of existing solutions

Sr. No.	Title	Methodology	Advantages	Disadvantages
1.	Chatbot for Communicating with University Students in Emergency Situations [2]	This paper discusses a chatbot developed using Google's Dialogflow to support university students during crises like COVID-19. Evaluated by over 160 users, the chatbot demonstrated effectiveness in facilitating communication with	1. Embedding the website with an inbuilt chatbot or telegram messaging, can help users to communicate effectively and efficiently. 2. Having a single system to all our doubts and queries is helpful.	If the chatbot provides too much of information, then it can result to creation of unnecessary confusion.

Sr. No.	Title	Methodology	Advantages	Disadvantages
		university services.		
2.	Rescue.io: A Chatbot Solution for Emergency Situations [1]	This paper presents Rescue.io, a multi-channel chatbot that allows users to send silent distress signals. The authors highlight the inadequacies of traditional emergency systems and emphasize the chatbot's potential for rapid, discreet communication during emergencies.	1. People are spending less time on the phone and more time in messaging channels. 2. As the number of wireless 911 calls in the United States are expected to double to 92 million annually by next year. Many of these phone calls will be unintentional or misused.	If the messaging is dependent on Internet Connectivity, then it can be a constraint in situations when the Internet Connectivity is compromised.
3.	A Mobile Based Emergency Reporting Application for the Philippine National Police Emergency Hotline 911 [4]	The i911 app is designed to enhance the efficiency of emergency reporting for the Philippine National Police by using geolocation and user registration. Surveys indicate high user satisfaction with its features, suggesting its effectiveness in real-time response scenarios.	1. Using the mobile's geolocation to get access of the victim's locations leading to accurate location tracking.	This mobile based system required the users to be registered on the app beforehand, but if one is not then the app is of no use.
4.	BEST—Blockchain-Enabled Secure and Trusted Public Emergency Services for Smart Cities Environment [3]	This research proposes a blockchain framework to improve public emergency services, addressing trust and efficiency issues in traditional systems. Simulation results indicate potential benefits in response times and service delivery.	1. Use of the IoT controller and blockchain framework provides a two-layer security to the overall system.	1. Requires creation of an interconnected IoT devices system in the overall range which is not cost effective. 2. Failure of the IoT device or the IoT controller can lead to wrong predictions or no predictions at all.
5.	Framework for Location-Based Emergency	This paper outlines a framework for integrating the National Spatial Data	**1.** Implementation of location-based services and fast SMS	

Sr. No.	Title	Methodology	Advantages	Disadvantages
	Services in India [5]	Infrastructure (NSDI) with location-based services to enhance emergency response capabilities. It emphasizes the importance of interoperability and spatial data sharing.	system. 2. Integrating the system with the NSDI can lead to proper location tracking and help in providing quick response.	

3. Research Gap

The existing 112 emergency response system in India is not efficient and does not implement various emergency services into one, unified system. Even though it is a national helpline, its major implementation is confined to police services, without being coordinated with other emergency services like medical aid, fire brigades, and disaster management teams, etc.

One of the biggest drawbacks of the 112 system is its failure to reduce response delays. The system itself suggests users to call respective emergency services directly, instead of using a single point of contact, thus contradicting the idea of a centralized response system. The system does not provide a text-based mode of communication, which is important in situations when making a call is not possible, like medical emergencies, dangerous situations, or for those with hearing or speech disabilities. There is no feature for real-time location sharing, making it difficult for responders to easily get to the location of an incident. In addition, there is no provision for a live image capturing feature thereby restricting responders from immediate situational awareness and obtaining essential evidence, which would otherwise improve decision-making as well as incident investigation.

This study seeks to bridge these gaps through the development of an integrated, technology-based solution that improves response effectiveness to enhance emergency management in India.

4. Objectives

The main objective of this study is to create a centralized emergency response system that effectively connects users to the appropriate emergency services, such as the police, ambulance, and fire departments. The proposed system aims to fill the current gaps in emergency response by providing smooth communication, quicker intervention, and enhanced coordination among various service providers.

One of the most important areas of this research consists collecting and integrating information related to emergency services within users geographic areas. Utilizing real-time data gathering, the system will provide responders with up-to-date and accurate data to ensure rapid and efficient provision of assistance. The deployment of this system will occur in phases to ensure expandability:

1. **Major Area Coverage** – The first phase will concentrate on creating emergency response coverage in priority areas, including densely populated urban areas, high-risk areas, and critical infrastructure sites.
2. **Consolidation of Services** – The second phase will entail integrating different emergency services into one central, streamlined platform to facilitate collaborative responses and avoid fragmentation in the management of emergencies.

The final aim of this study is to create an entirely operational, centralized emergency response system that

integrates emergency services all over Mumbai city and its outskirts. This composite system is designed to increase efficiency in response, reduce delays, and generally contribute to better overall public safety, serving as an example for widespread application in other areas.

5. Scope

The research focuses on developing a centralized emergency response system which will help connect users with relevant services such as police, ambulance, and fire departments. The system will initially be implemented in major regions of Mumbai and its suburbs, with potential scalability for nationwide deployment. Surakshit Bharat aims to integrate real-time location tracking, text-based communication, live image capture, and an AI-driven chatbot for first-aid guidance. It examines mobile and desktop-based applications for emergency response. The research focuses on using AI, GPS, and real-time data transmission to improve emergency service efficiency. The system is designed for individual users, emergency responders, law enforcement agencies, medical practitioners, and disaster management teams. It will benefit citizens in distress, ensuring quick and coordinated assistance.

The study is limited to Mumbai city and suburbs for the initial phase. The research does not focus on any hardware implementation, such as physical emergency devices, but rather on software solutions. It does not address cybersecurity threats in detail, though data security will be considered.

6. Methods and Procedure

Surakshit Bharat was developed through a methodical process to achieve an emergency response system that is safe, efficient, and instantaneous. The application converges several emergency services into one interface so that users can receive help in a timely manner through calling, chatting, and location-based service discovery. The following is a step-by-step explanation of the methods and procedures adopted during development.

1. User Interface and Navigation

The system begins with a static HTML home page that is the informational front page. This page gives the users an idea of emergency response system & its main features.

- If one is in a state of emergency, he/she can click the Panic Button, which will lead him/her to the registration page of the chatbot system at once.
- The registration process involves entering vital information like name, email, phone number, and location coordinates.
- Once registered successfully, users have access to emergency services like real-time chat, emergency calls, location sharing, and first-aid advice through an AI-driven chatbot.

2. Backend Implementation for Emergency Call and Chat Application

For smooth operation and rapid response, the backend of application is developed with Node.js and Express.js. These technologies support a rapid, scalable, and event-driven architecture that can process several user requests at a time.

The backend handles the following important tasks:

a. User Registration and Authentication:

- Users need to register in order to avail emergency services.
- MongoDB is utilized to store user credentials such as name, email, phone number, and current location (latitude and longitude).
- Bcrypt is utilized for encrypting and storing user passwords securely.

b. Emergency Call and Chat Services:

- Users can call emergency services (police, ambulance, fire department, etc.) directly from the application.
- A chat-based communication system is implemented, enabling users to communicate with emergency responders in real time.
- Users with speech disabilities in cases of an emergency can utilize the chat feature to pass vital information.

3. Important Features and Technologies Utilized

a. User Authentication and Data Handling

In order to provide secure access and retain user details, the following technologies are utilized:

- MongoDB is the main database, effectively storing user data as well as service requests.
- Mongoose is applied to handle interactions with the MongoDB database, resulting in fluid data retrieval and storage.
- Bcrypt offers a secure method of encrypting user passwords, which further strengthens data security.

b. Location-Based Emergency Service Discovery

- Identifying the closest emergency service provider based on the current location of the user is one of the fundamental features of Surakshit Bharat.
- Geographical distance between the user's location and available emergency services is calculated using the Haversine Formula.
- This equation enables the system to present dynamically the nearest available emergency contacts, shortening response time and providing immediate aid.

c. Real-Time Chat and Image Sharing

In order to ensure effortless communication between emergency responders and users, the application provides:

- A real-time chat functionality that provides text-based dialogue between emergency operators and users.
- Cloudinary integration for image storage and handling during conversations. Users can share live images of the emergency incident, giving the responders vital visual information.

d. Emergency Call Functionality

- For users who prefer direct contact, the system has an emergency call feature that allows for instant calling of service providers.
- The backend handles API requests effectively in connecting calls securely and reliably.
- Users are able to quickly make one-tap calls to police, medical, or fire services depending on their emergency.

e. AI-Powered First Aid Chatbot

- In realizing that instant first aid is lifesaving, the app features an AI-powered chatbot that aids users with step-by-step advice in how to manage medical emergencies.
- The chatbot provides initial first-aid advice specific to the described emergency.
- It assists people in handling circumstances like bleeding, choking, burn, and fractures until the time help from the experts reaches them.

7. Tools and Technologies Employed

The creation of Surakshit Bharat encompassed the incorporation of different tools and technology in order

to ensure effective performance, security & real-time connectivity.
Frontend: HTML, CSS, JavaScript (for an interactive and responsive user experience).
Backend: Express.js, Node.js (to handle server-side operations).
Algorithm/Formulae: Haversine Formula (to determine the nearest emergency service). and Bcrypt (for secure encryption of user data).
Database: MongoDB (for storing user data), Mongoose (for MongoDB connection management).
Media Storage: Cloudinary (for secure image storage and sharing).

8. Backend Implementation

The backend of 'Surakshit Bharat' has been developed using Node.js and Express.js, providing a robust and scalable solution for handling server-side operations. This application enables users to access emergency services such as police, ambulance, and other critical contacts based on their real-time location. Users can either call or chat with the nearest emergency services whenever needed.

Key Features & Technologies Used:

1. User Authentication & Data Management:
- MongoDB is used to store user information, including name, email, phone number, latitude, longitude, and other essential details.
- The bcrypt library has been implemented to securely encrypt and store sensitive user data.

2. Location-Based Emergency Service Discovery:
- The Haversine formula is used to calculate the distance between a user's current location and nearby emergency services.
- This allows the system to dynamically display only the closest available emergency contacts, ensuring quick response times.

3. Real-Time Chat & Image Sharing:
- The application provides a chat feature that enables direct communication between users and emergency services.
- Cloudinary is integrated for storing and managing images exchanged during conversations, ensuring secure and efficient media handling.

4. Emergency Call Functionality:
- Users can directly call emergency contacts through the application.
- The backend efficiently manages API requests to facilitate smooth and reliable call connections.

This backend infrastructure ensures security, real-time accessibility, and reliability, making the application an essential tool for users in need of urgent assistance.

9. Results

A. Desktop View

Fig 1a : Landing Page - Header and Hero Section

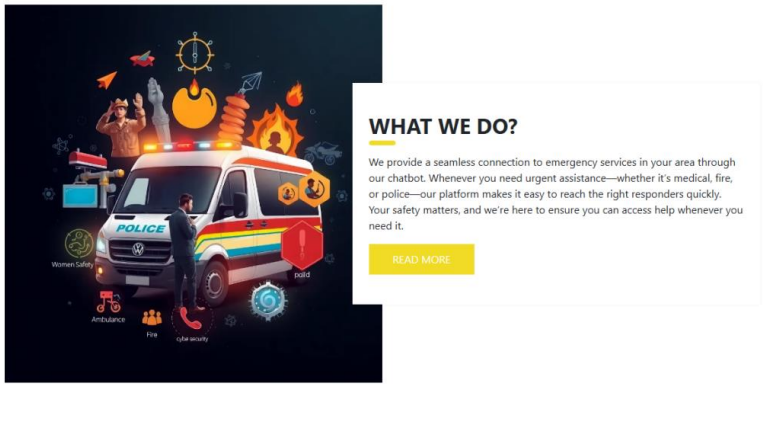

Fig 1b: Landing Page - What we do?

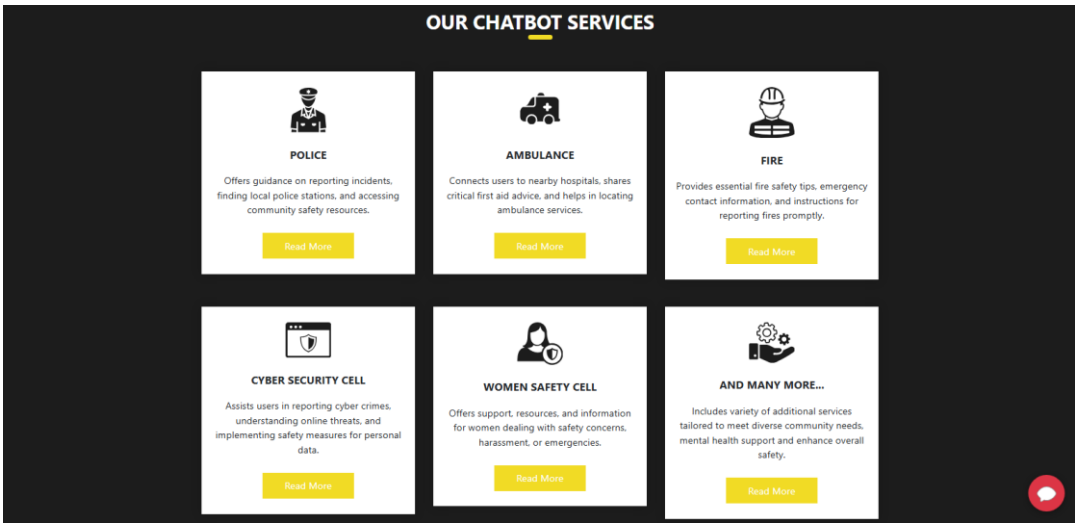

Fig 1c: Landing Page - Our Chatbot Services

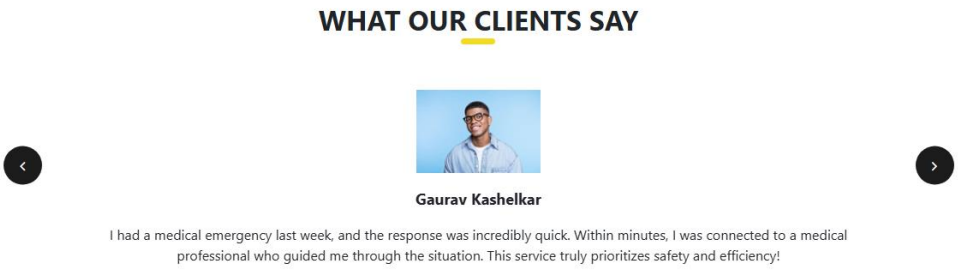

Fig 1d: Landing Page - What our Clients Say

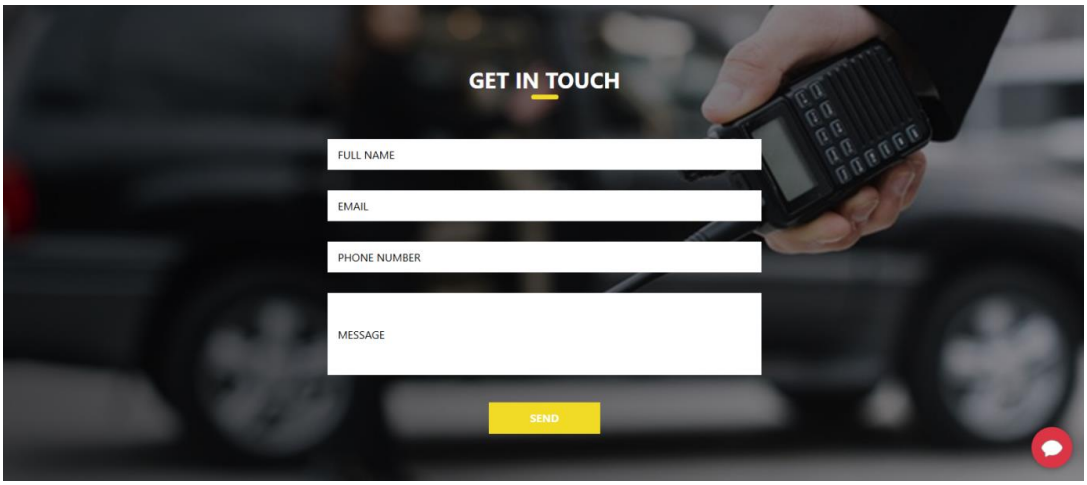

Fig 1e: Landing Page - Contact Us

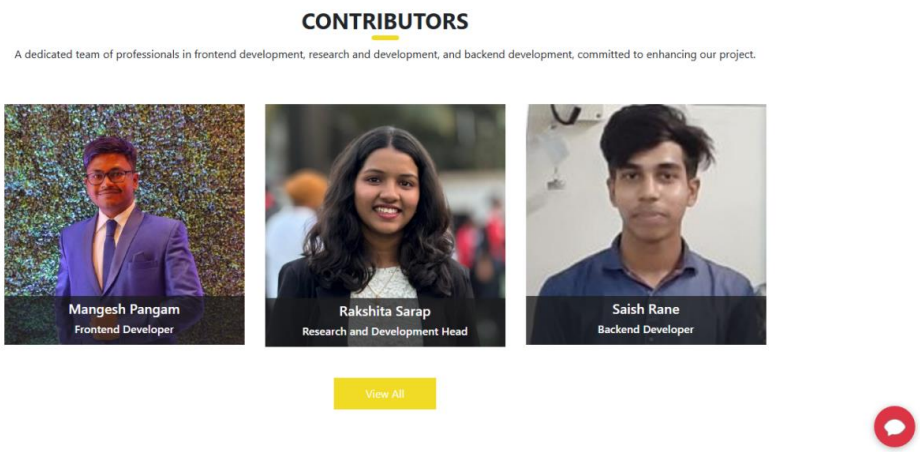

Fig 1f: Landing Page – Contributors

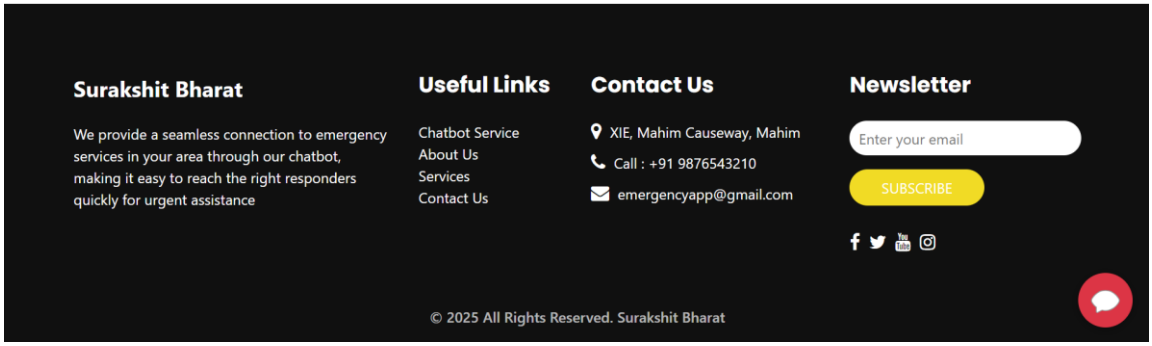

Fig 1g: Landing Page - Footer

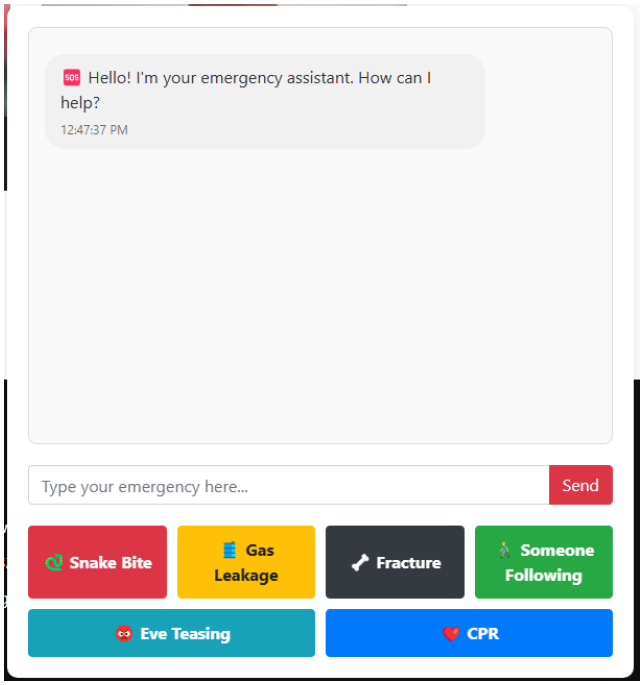

Fig 1h: Landing Page – Chatbot

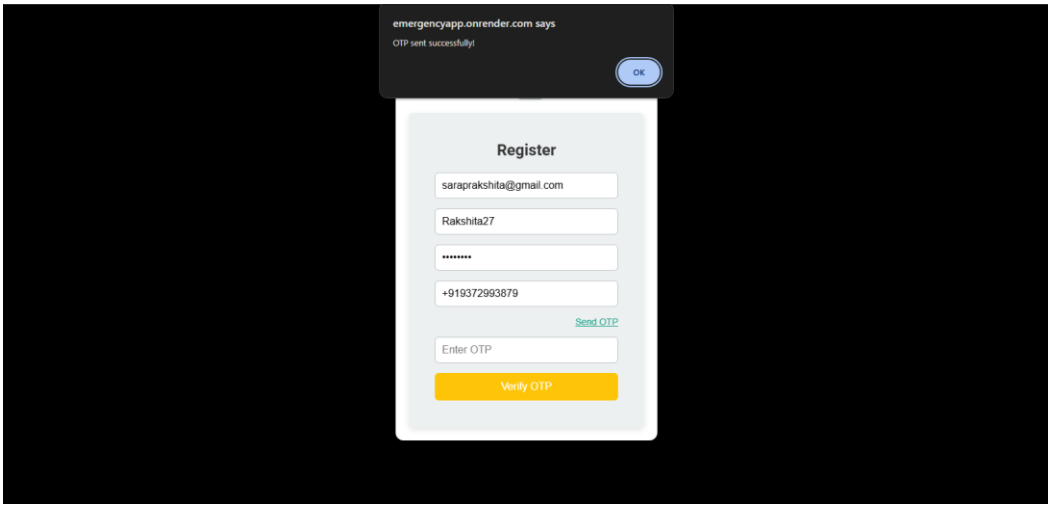

Fig 2a: SignUp Page - Requesting OTP

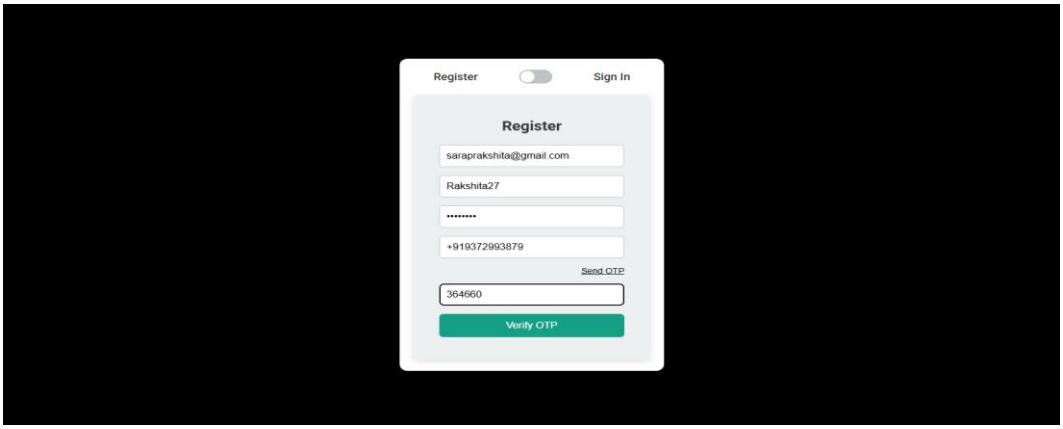

Fig 2b: SignUp Page - Entering OTP

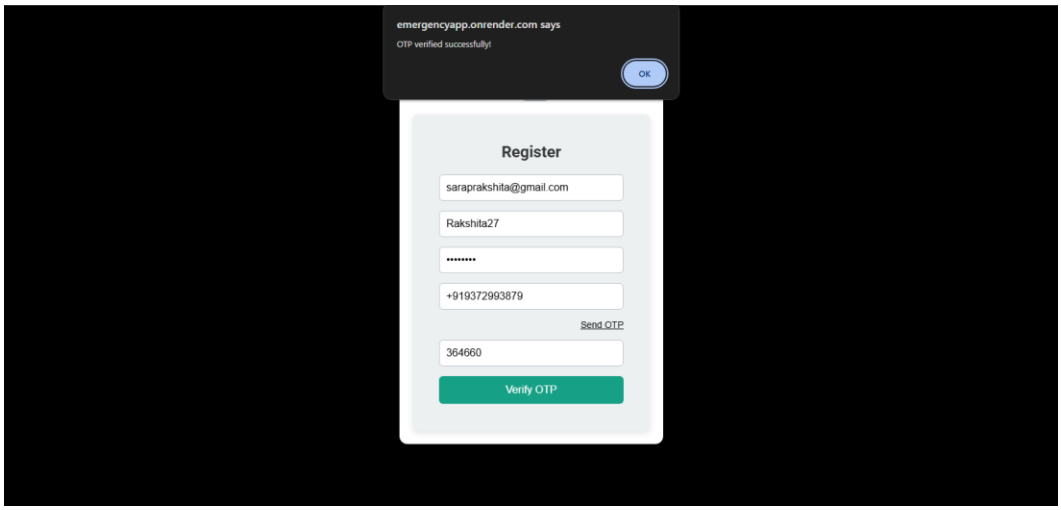

Fig 2c: SignUp Page - Verifying OTP

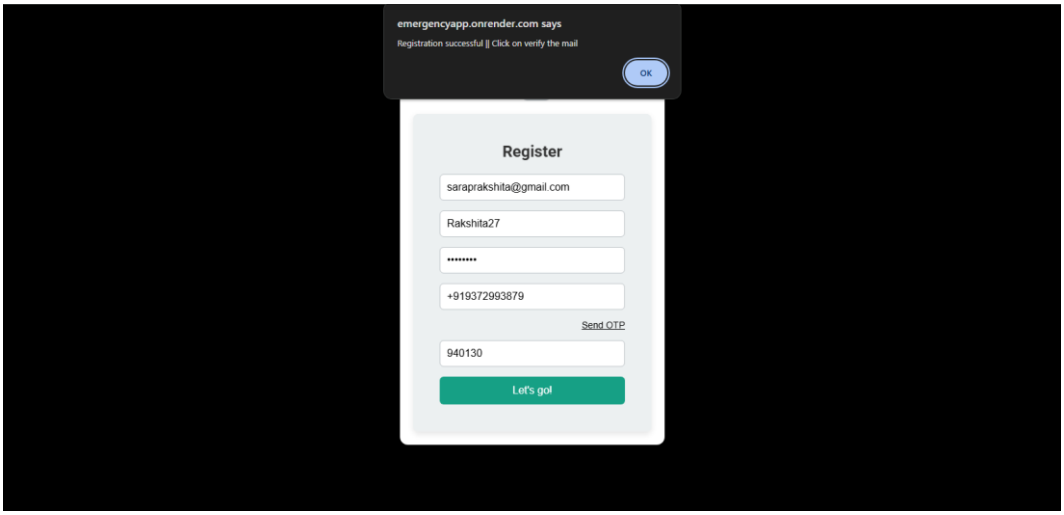

Fig 2d: SignUp Page - Requesting for Email Verification

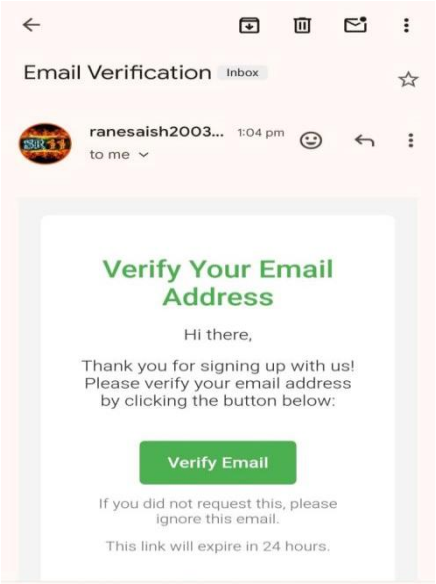

Fig 3: Verifying the Email

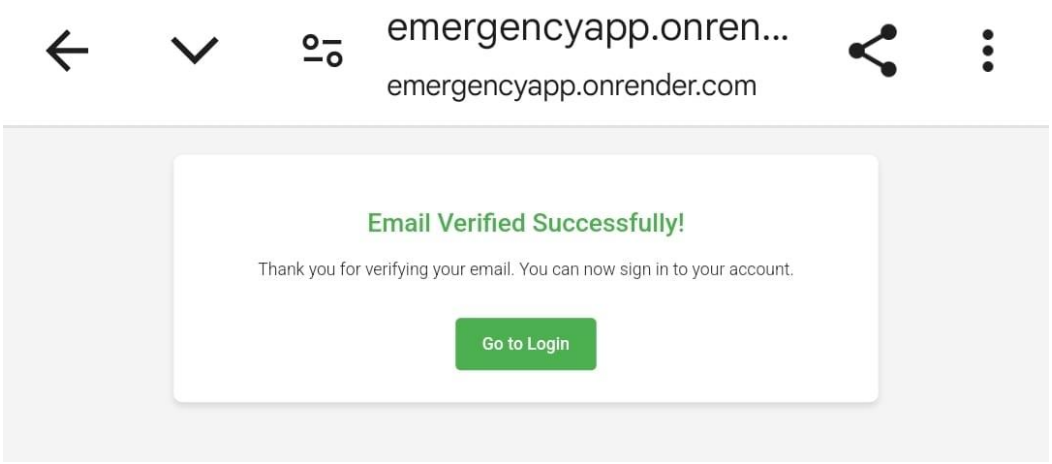

Fig 4: Email Verified Successfully

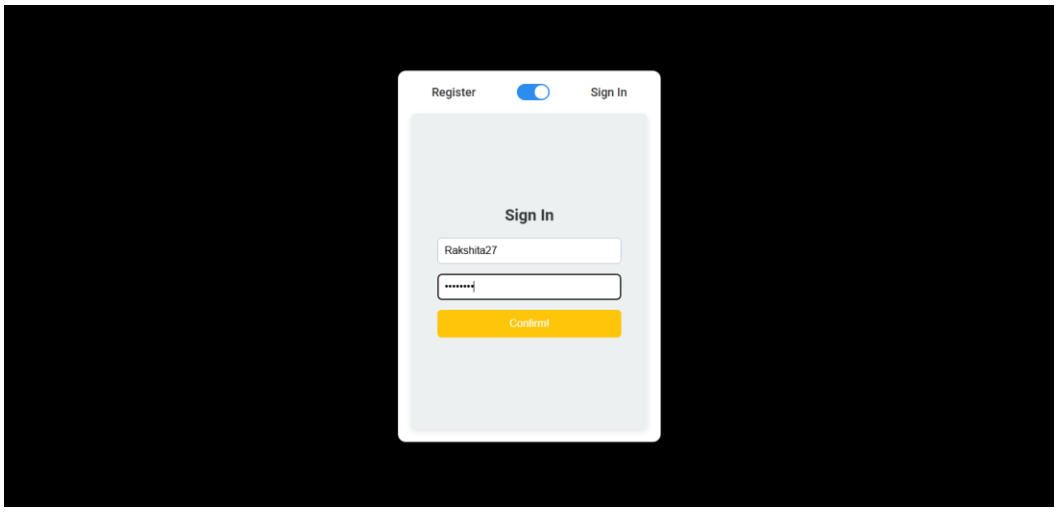

Fig 5: Login Page

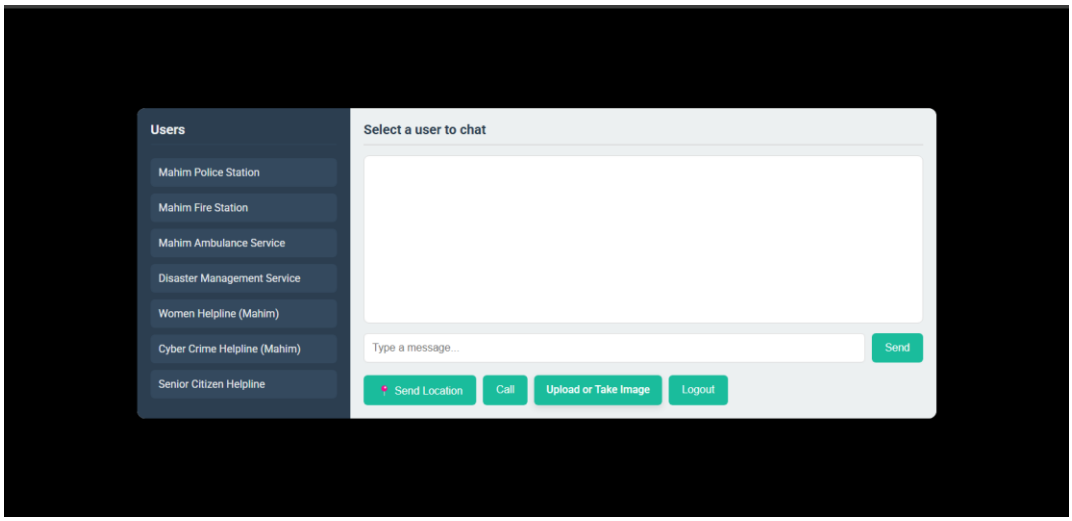

Fig 6a: Centralized Emergency App Chat Interface

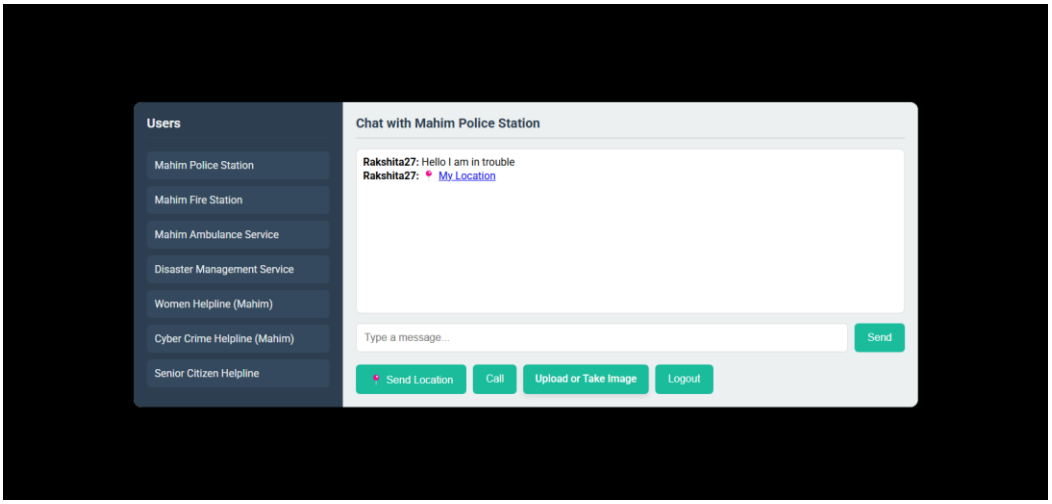

Fig 6b: Established a connection with Mahim Police Station (nearest)

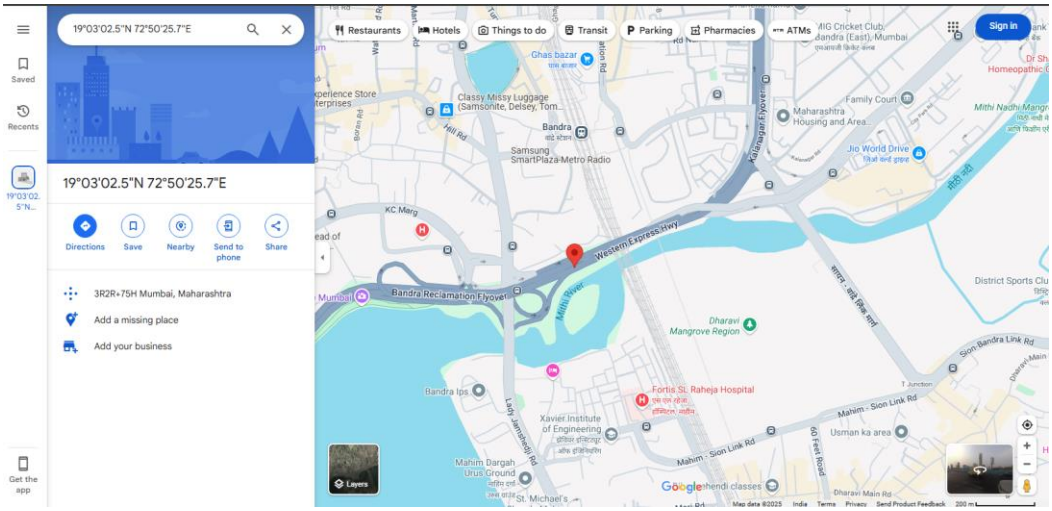

Fig 6c: Exact Location shared with the Mahim Police Station Cell

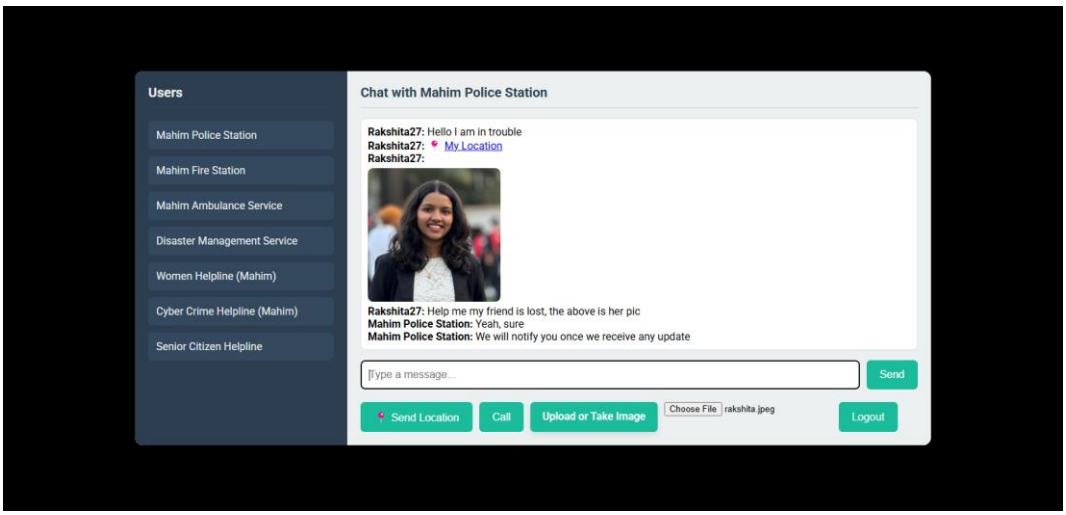

Fig 6d: Extra Features of the Interface

B. Mobile View

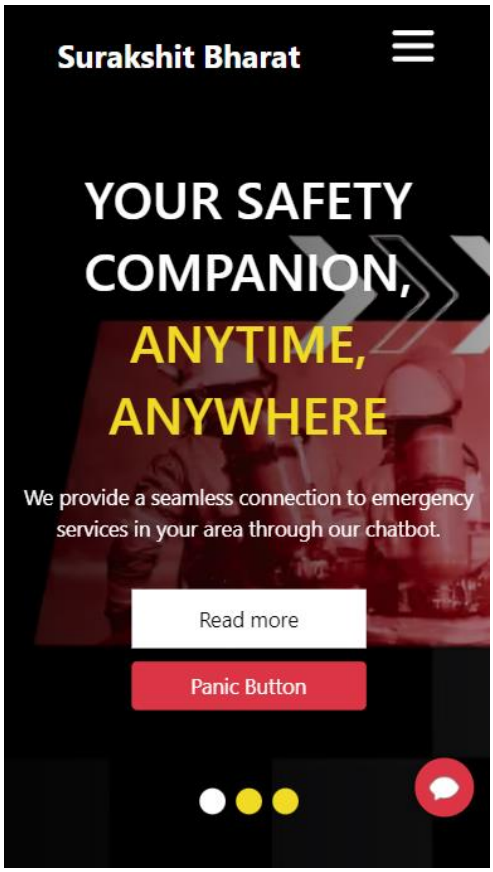

Fig 7: Home Page

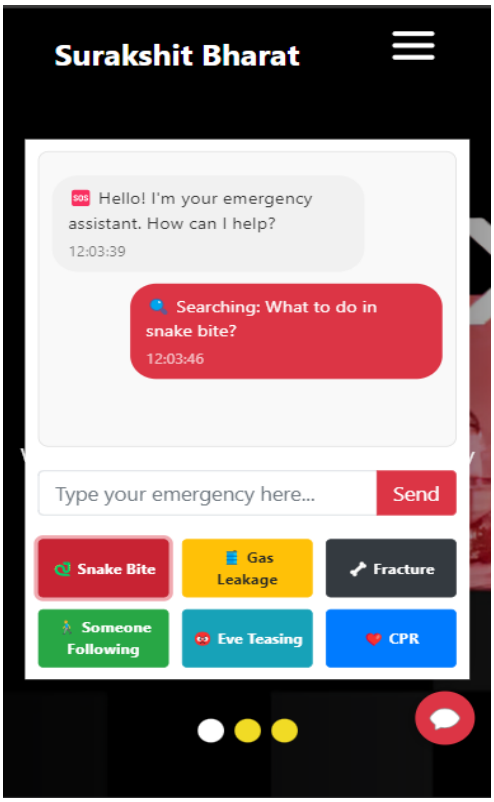

Fig 8: Chatbot

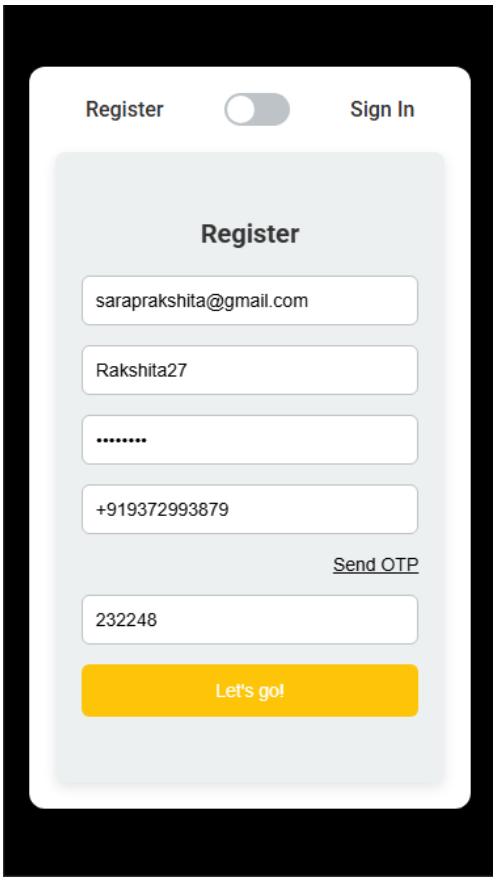

Fig 9: Register Page

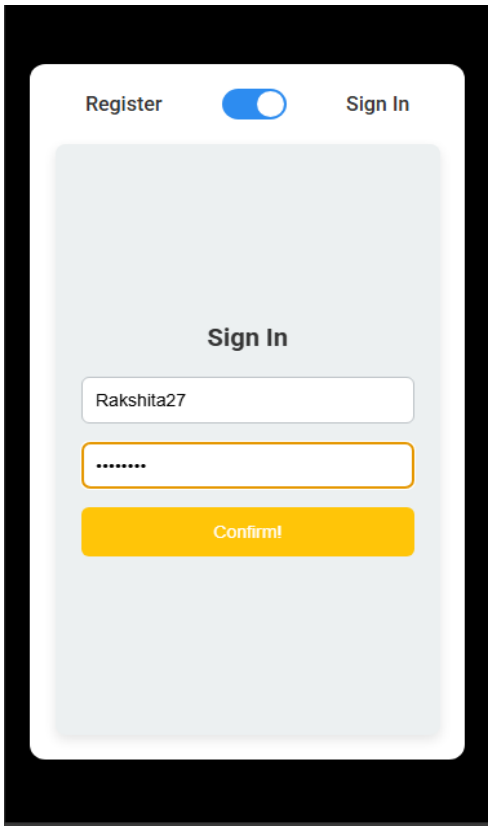

Fig 10: Sign in Page

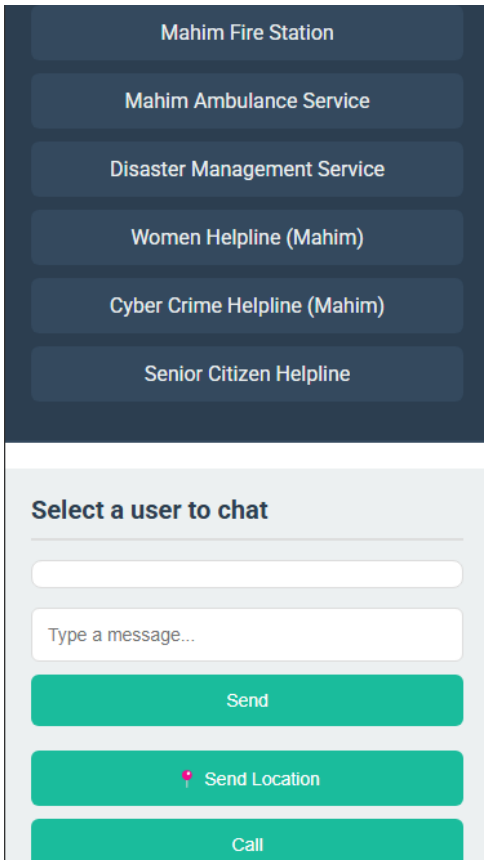

Fig 11a: Centralized Emergency App Chat Interface (Mobile View)

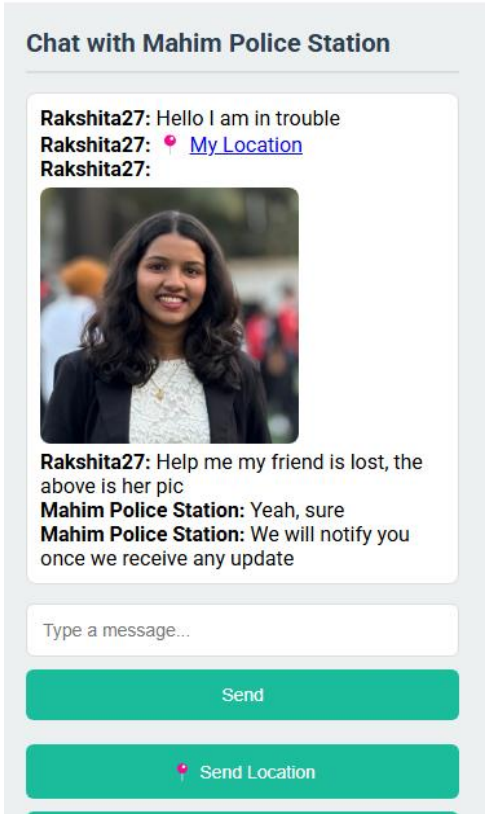

Fig 11b: Centralized Emergency App Chat Interface (Mobile View)

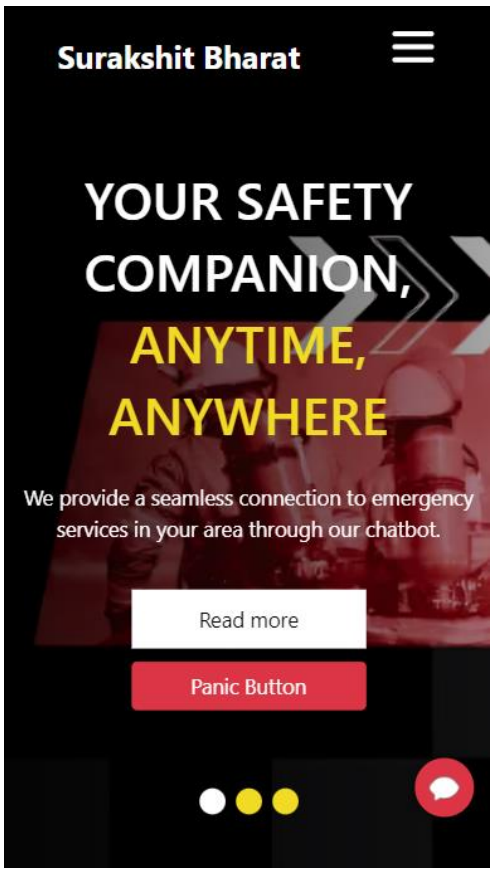

Fig 12: Home Page with Mobile Skeleton

10. Discussions

We have created a software emergency response system named 'Surakshit Bharat'. To access our system, users need to register themselves, registration is completed with mobile number verification and email verification. Once the verification is complete, users can login into our system. Once logged into the system, users have access to nearest helpline account according to their location. Users can text, call, send their live location and also capture live images to send. All these features are accessible both through desktop application as well as mobile application. Users can also use the in-built AI chatbot to ask for crucial first aid information till the time emergency responders arrive.

11. Conclusion

The Surakshit Bharat app is intended to automate emergency response activities through the provision of distressed people with immediate and direct access to relevant emergency services. Through the consolidation of various services within one integrated platform, the system is expected to reduce response time, optimize coordination, and overall increase efficiency in response to critical incidents.

In order to provide for a structured and effective implementation, the project adopts a phase-by-phase execution, starting from large areas of Mumbai City as well as the suburbs. By this gradual coverage strategy, the functionalities are refined continuously, bugs are tackled on the go, and user inputs and operational problems are addressed in an adaptive mode. With scale, the system will increasingly target the whole Mumbai area, providing a foundation for future deployment in the entire country.

Through the use of high-end technology, real-time data transmission, and AI-based support, Surakshit Bharat can transform emergency response services in India so that interventions become faster, the public is safer, and the urban emergency management system is more robust.

12. Future Scope

The Surakshit Bharat system has the potential for significant future advancements, aiming to enhance its efficiency, scalability, and security. One of the main challenges is the accurate integration of emergency contact information. The system will be expanded to seamlessly integrate verified emergency contact numbers from various government and private emergency response units. It will include dynamic updates so that the latest and correct contact information is readily available to users. Although the initial phase covers Mumbai city and its suburbs, the long-term goal is to extend coverage across the entire nation, creating a centralized emergency response system. This expansion will involve collaborations with regional emergency service providers to ensure smooth integration and efficient response coordination. Lastly the system must be secured and safe from cyber-attack and threats, ensuring data protection.

13. References

References within Main Content of the Research Paper

1. Clegg J., “Rescue.io: A chatbot solution for emergency situations”, Medium, 2017. Available at: https://medium.com/square-one-labs/rescue-io-a-chatbot-solution-to-emergency-situationsdd267f174554
2. Balderas A., García-Mena R. F., Huerta M., Mora N., Dodero J. M., “Chatbot for communicating with university students in emergency situation”, Heliyon, 2023. Available at: https://pubmed.ncbi.nlm.nih.gov/37809667/
3. Bhawana, et al., “Best-blockchain-enabled secure and Trusted Public Emergency Services for Smart Cities Environment”, Sensors, 2022. Available at: https://www.mdpi.com/1424- 8220/22/15/5733
4. S. B. Edillo, et al., “A mobile based emergency reporting application for the Philippine National Police Emergency hotline 911: A case for the development of I911”, IEEE Conference publication, 2017. Available at: https://ieeexplore.ieee.org/document/8330110
5. Indian Institute of Remote Sensing. Available at: https://www.iirs.gov.in/iirs/sites/default/files/StudentThesis/aditi_finals_thesis.pdf
6. R. Sarap, M. Pangam, S. Rane, and M. Dsouza, "Enhancing Emergency Response: A Comprehensive Review of Technological Solutions", International Journal for Multidisciplinary Research, vol. 6, no. 6, pp. 1–5, Dec 2024, doi: 10.36948/ijfmr.2024.v06i06.34372. Available at: https://www.ijfmr.com/research-paper.php?id=34372

References in the Reference List at the End of the Research Paper

1. Cabral E.L. dos S., et al., “Response time in the emergency services. systematic review”, Acta Cirúrgica Brasileira, 2018. Available at: https://www.scielo.br/j/acb/a/f3jpSRsjg7tdZqqzf5Q7vKJ/
2. Snyder S., “Integrated fire and ambulance siting: A deterministic model”, Socio-Economic Planning
2. Sciences, 1995. Available at: https://www.academia.edu:443/27679844/Integrated_fire_and_ambulance_siting_A_deterministic_model

3. Carret M.L.V., Fassa A.C.G., Domingues M.R., "Inappropriate use of emergency services: A systematic review of prevalence and associated factors", Cadernos de Saúde Pública, 2009. Available at: https://www.scielo.br/j/csp/a/QZvVddHCK8d8nzDbJjRC3Gy/?lang=en
4. Kobusingye O.C., "Emergency medical services", Disease Control Priorities in Developing Countr
5. ies, 1970. Available at: https://www.ncbi.nlm.nih.gov/books/NBK11744/
6. Christ M., et al., "Modern Triage in the emergency department", Deutsches Arzteblatt international, 2010. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC3021905/
7. Banu Soylu, et al., "A hub-and-spoke network design for relocating emergency service vehicles", Computers & Operations Research, 2024. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0305054824003708
8. Eeva Saario, et al., "Nutritional risk screening by the Emergency Medical Services: Agreement with In-Hospital Assessment", International Emergency Nursing, 2024. Available at: https://www.sciencedirect.com/science/article/pii/S1755599X24001484
9. Misra S., et al., "From sensors to safety: Internet of emergency services (IOES) for emergency response and disaster management", Journal of Sensor and Actuator Networks, 2023. Available at: https://www.mdpi.com/2224-2708/12/3/41
10. Rajanikanth Aluvalu, et al., "The novel Emergency Hospital Services for patients using Digital Twins", Microprocessors and Microsystems, 2023. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0141933123000406
11. Nathan B. Roberts, et al., "Current summary of the evidence in drone-based Emergency Medical Services Care", Resuscitation Plus, 2023. Available at: https://www.sciencedirect.com/science/article/pii/S2666520422001473
12. Joseph El Dahdah MD, et al., "CHATGPT: A valuable tool for Emergency Medical Assistance", Annals of Emergency Medicine, September 2023. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0196064423003542
13. Villas-Boas S., Kaplan S., et al., "Patterns of US Mental Health–Related Emergency Department Visits During the COVID-19 Pandemic", JAMA Network Open, July 2023.Available at: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2807138
14. Schumacher Jessica R., et al., "Potentially Preventable Use of Emergency Services: The Role of Low Health Literacy", Medical Care, August 2013. Available at: https://journals.lww.com/lwwmedicalcare/abstract/2013/08000/potentially_preventable_use_of_emergency_services_.4.aspx
15. Ceyhun Araz, et al., "A fuzzy multi-objective covering-based vehicle location model for emergency services", Computers & Operations Research, March 2007. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0305054805001164
16. Daniel Coles, et al., "Beyond 'flood hotspots': Modelling emergency service accessibility during flooding in York, UK", Journal of Hydrology, March 2017. Available at: https://www.sciencedirect.com/science/article/pii/S0022169416308022
17. Marks P.J., et al., "Emergency (999) calls to the ambulance service that do not result in the patient being transported to hospital: An epidemiological study", Emergency Medicine Journal, September 2002. Available at: https://emj.bmj.com/content/19/5/449.short

18. Silva F., Serra D., "Locating emergency services with different priorities: The priority queuing covering location problem", Palgrave Macmillan, London, 1970. Available at: https://link.springer.com/chapter/10.1057/9781137535696_2
19. Nicholl Jon, Coleman Patricia, Parry Gareth, Turner Janette, Dixon Simon, "Emergency priority dispatch systems - A new era in the provision of ambulance services in the UK", Pre-hospital Immediate Care, January 1999. Available at: https://www.researchgate.net/publication/255611643_Emergency_priority_dispatch_systems_-_A_new_era_in_the_provision_of_ambulance_services_in_the_UK
20. Segal S.P., Bola J.R., Watson M.A., "Race, quality of care, and antipsychotic prescribing practices in psychiatric emergency services", Psychiatric services (Washington, D.C.), March 1996. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7306413/
21. Mahama M., et al., "Emergency response time and pre-hospital trauma survival rate of the National Ambulance Service, Greater Accra (January – December 2014)", BMC emergency medicine, October 2018. Available at: https://link.springer.com/article/10.1186/s12873-018-0184-3
22. Tansley G., et al., "Spatial access to emergency services in low- and middle-income countries: A GIS-based analysis", PLOS ONE, November 2015. Available at: https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0141113 22. Sanjuan-Quiles, et al., "Handover of Patients from Prehospital Emergency Services to Emergency Departments: A Qualitative Analysis Based on Experiences of Nurses", Journal of Nursing Care Quality, 2019. Available at: https://journals.lww.com/jncqjournal/fulltext/2019/04000/handover_of_patients_from_prehospital_emergency.14.aspx
23. Purnell Tanjala S., et al., "Clinician Perceptions of an Electronic Medical Record During the First Year of Implementation in Emergency Services", Pediatric Emergency Care, February 2010. Available at: https://journals.lww.com/peconline/abstract/2010/02000/clinician_perceptions_of_an_electronic_medical.7.aspx
24. T. Erden, et al., "Multi-criteria site selection for fire services: the interaction with analytic hierarchy process and geographic information systems", Natural Hazards and Earth System Sciences, October 2010. Available at: https://nhess.copernicus.org/articles/10/2127/2010/nhess-10-2127-2010.pdf
25. Al-Shaqsi S., "Models of international emergency medical service (EMS) systems", Oman medical journal, October 2010. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC3191661/
26. Tansley G., et al., "Population-level spatial access to prehospital care by the National Ambulance Service in Ghana", Prehospital emergency care, 2016. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC5153373/
27. Syi Su, et al., "Modeling an emergency medical services system using Computer Simulation", International Journal of Medical Informatics, December 2003. Available at: https://www.sciencedirect.com/science/article/abs/pii/S1386505603001515
28. Eckstein M., Schlesinger S. A., Sanko S., "Interfacility Transports Utilizing the 9-1-1 Emergency Medical Services System", Prehospital Emergency Care, April 2015. Available at: https://www.tandfonline.com/doi/full/10.3109/10903127.2015.1005258
29. Koichi Tanigawa, et al., "Emergency medical service systems in Japan: Past, present, and future", Resuscitation, June 2006. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0300957206001511

30. Sharma M., Brandler E.S., "Emergency medical services in India: The present and future: Prehospital and disaster medicine", Cambridge Core, April 2014. Available at: https://www.cambridge.org/core/journals/prehospital-and-disaster-medicine/article/abs/emergencymedical-services-in-india-the-present-and-future/E91F6B69AB28EEA6E4D92865C81434FE
31. Duncan E.A.S., et al., "Epidemiology of Emergency Ambulance Service calls related to mental health problems and self-harm: A national record linkage study", Scandinavian journal of trauma, resuscitation and emergency medicine, 2019. Available at: https://sjtrem.biomedcentral.com/articles/10.1186/s13049-019-0611-9
32. David Matthias, Schwartau Imke, Anand Pant Hans, Borde Theda, "Emergency outpatient services in the city of Berlin: factors for appropriate use and predictors for hospital admission", European Journal of Emergency Medicine, December 2006. Available at: https://journals.lww.com/euroemergencymed/abstract/2006/12000/emergency_outpatient_services_in_the_city_of.8.aspx
33. Burkholder T.W., Hill K., Calvello Hynes E.J., "Developing emergency care systems: A human rights-based approach", Bulletin of the World Health Organization, September 2019. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC6705504/
34. Martinez Alpiste I., et al., "5G-based Smart Ambulance: The future of the emergency service in the global pandemic and beyond", IEEE ComSoc Technology News, October 2020. Available at: https://research-portal.uws.ac.uk/en/publications/5g-based-smart-ambulance-the-future-of-theemergency-service-in-t
35. Snooks H., et al., "NHS emergency response to 999 calls: Alternatives for cases that are neither life threatening nor serious", BMJ, August 2002. Available at: https://www.bmj.com/content/325/7359/330.1.short
36. Meents E., Boyles T., "Emergency medical services: Poor response time in the rural Eastern Cape", SAMJ: South African Medical Journal, December 2010. Available at: https://www.scielo.org.za/scielo.php?pid=S0256-95742010001200009&script=sci_arttext
37. Ahmed S., et al., "Impact of traffic variability on geographic accessibility to 24/7 emergency healthcare for the Urban Poor: A GIS study in Dhaka, Bangladesh", PLOS ONE, September 2019. Available at: https://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0222488
38. Goldenberg M.N., Parwani V., "Psychiatric Emergency Department volume during covid-19 pandemic", The American journal of emergency medicine, March 2021. Available at: https://pmc.ncbi.nlm.nih.gov/articles/PMC7263232/
39. Baker T., et al., "Emergency and critical care services in Tanzania: A survey of ten hospitals - BMC Health Services Research", BMC Health Serv Res, April 2013. Available at: https://link.springer.com/article/10.1186/1472-6963-13-140
40. Douglas D. Brunette, John Kominsky, Ernest Ruiz, "Correlation of emergency health care use, 911 volume, and jail activity with welfare check distribution", Annals of Emergency Medicine, 1991. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0196064405808340