

Emergency Ambulance Healthcare Support System

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Abstract: Mobile-telecommunication and applications are intertwined in human society and our culture. While a respectable 64.8% of the Indian population is educated, the numbers shy away in front of the 79.8% of the population who own a mobile device and the numbers have only increased exponentially in the post-pandemic years. But the post-pandemic era has also shone a light on the fragile healthcare infrastructure in our country. Our solution solves this vast infrastructure by taking advantage of the mobile computing power in the hands of the majority of the people. Our solution is very simple at its core, yet proves to be very effective. Our android application serves as a simple interface to book an ambulance in any medical emergency to reach the nearby hospitals. This application tackles all the problems faced by the common people when they are trying to obtain an ambulance in high-pressure situations. Thus this solution is the fastest and safest way to get an ambulance for any patient on a ticking clock.

Keywords — Ambulance management, Critical healthcare system, Email alerting system, Emergency services, Maps routing, Mobile system

I. INTRODUCTION

Interest in mobile computer applications has been growing for the past few years. The healthcare sector has also begun recognizing the potential to provide access to care points in mobile devices applications, to health care professionals. Emergency Medical Services around the world are under increasing pressure to increase the efficiency and effectiveness of their service delivery and to improve accountability. One of the key features of this is the continuous annual increase in the volume of calls. There are several ways in which Emergency Services tries to address these challenges. An effective solution to this could be a mobile system to simplify the process of booking an ambulance.

II. LITERATURE SURVEY

The literature survey provides an overview of emergency medical services and how mobile systems could be used to improve ambulance booking processes.

1. A Web-based Medical Emergency Guiding System

In this paper, the authors explain a solution in which a call center was set up to handle emergency phone calls and according to the caller's location and type of ambulance required, the call center personnel tried to contact ambulance drivers who could take the patient to nearby hospitals [1].

2. An Emergency Medical Service Support System for Patients in Rural Areas - an example from Taiwan

In this paper, the authors explain a system that combines the existing emergency medical service systems and the real-time traffic information and communication system provided by the Ministry of Transportation and Communications. It shows how real-time traffic awareness could make the ambulance booking process easier and help patients in accident situations [2].

3. Accident Alert and Ambulance Tracking System

In this paper, the authors explain how the car accident detection system provides emergency responders with important information as quickly as possible but the unavailability of the system is limited by their inconvenience and cost, while the smartphone offers a promising platform with similar sensors at a cheap price and convenience. Cell phones can surpass the normal operation of auto accident detection systems. The software will immediately notify friends or family of the client.

4. eEmergency System to Support Emergency call Evaluation and Ambulance dispatch Procedures

In this paper, the authors explain the development and implementation of an electronic system aimed at supporting the Health Department of Cyprus. This small system includes modules for recording emergency events as well as management of ambulance vessels. A major contribution of

this project is the construction of an emergency support platform for allowing flexible allocation of ambulance services to emergencies and monitoring processes to minimize errors and create an effective emergency management system.

5. A Mobile Solution for Fast and Accurate Medical Emergency Reporting

In this paper, the authors explain a solution to improve the reporting of emergencies and the dispatch of an ambulance [5]. In contrast to the models presented in previous publications, this solution considered a reduction in the time taken to report a case and not just travel time. The app allows citizens to quickly, easily, and accurately report an incident.

6. The Internal Value of Mobile Computing in Emergency Medical Services: An Australian Case Study

In this paper, the authors explain how the use of a mobile system improves efficiency and effectiveness in various fields and thus brings about an increase in internal value to the organization [6]. In the case study, it became clear that the mobile system could provide assistance to paramedics and the organization. The system allows faster and easier capture of data that can be used in more efficient management. The mobile information system also provides a wealth of information that will enable the organization to manage its operations more effectively.

7. Ambulance Emergency Response Application

In this paper, the authors explain how the Android apps can be used to send location coordinates of a user to nearby ambulances and book an ambulance [7]. GPS technology which is generally available in Android mobiles was used to find the user's location coordinates. As a future enhancement, the authors have mentioned the need for a better GUI and the use of Google Maps so that users might also be aware of the ambulance driver's current location.

8. GPS Locator: An Application for Location Tracking and Sharing Using GPS for Java Enabled Handhelds

In this paper, the authors explain how GPS technology can be used to find the current location of a user and how location-based services can be developed using a client-server system [8].

Apart from these studies, an Indian startup named StanPlus has shown how technology can be used to reduce ambulance arrival time and is proved to be more efficient than the existing system [9]. The startup claims it has an average response time of fewer than 15 minutes [10].

III. EXISTING SYSTEM

The current option which is generally used to book an ambulance in India is to call the hotline number which is set up by the government and share the user's requirements

over the telephone or directly call a third-party ambulance service. There are multiple issues that can take place during this process. Multiple human errors like pronunciation errors, noting down incorrect user addresses, the wrong type of ambulance might be booked, additional user requirements like bringing a wheelchair might not be conveyed to the ambulance driver.

Apart from these, the driver might not be aware of the path to the user's location or the best path to reach there, according to real-time traffic data. Apart from this, the user generally doesn't have information like the ambulance's live location, driver's name, and phone number.

IV. ALGORITHMS

A. Ambulance booking algorithm

Once a user requests an ambulance in the app, the user's precise location is calculated using Google Maps API and stored in the 'Realtime database' in Firebase. This request is sent only to drivers that operate in the same pincode as the user and those who operate the same ambulance type as requested by the user.

Due to the horizontal scalability of 'Realtime Database' in Firebase, multiple drivers are able to see the request on their app without any delay. As soon as one of the drivers accepts the request, the user's precise location, and path to reach there are displayed on the driver's app, thus making it easier for the driver to reach the user's location.

B. Path-finding algorithms

Once the ambulance driver and user's booking is confirmed, the driver's current location is automatically fetched using Google Maps API.

Google Maps gets live data, powered by drivers all around the world and it aggregates this data to find current traffic estimates and it predicts traffic by analyzing historical traffic patterns using advanced machine learning techniques [11].

Along with predictive traffic models, two other sources of information that are used for recommending the best routes are authoritative data from local governments and real-time feedback from users [11].

This is how our solution is able to recommend the best path for an ambulance driver to reach the user and from the user to the hospital.

C. Email alerting system

When a user is registering on the app, the user's emergency contacts are asked and stored in the app. Whenever an ambulance is booked, the app automatically emails an alert about the user's current location to all the emergency contacts.

V. PROPOSED SYSTEM

The system contains 2 parts:

A. User-side:

Users first have the option to select if it's a normal or an emergency use case in which case the user needs the ambulance as soon as possible.

Normal use case (Fig 1): User manually selects the pickup location (initially the current location will already be selected automatically). The user then selects a hospital from the nearby area (according to the pin code/location entered). The user then selects the Ambulance type namely, Patient Transfer, Neonatal, Basic Life Support, Advanced Life Support, etc.

Emergency use-case (Fig 2): The application auto-fetches the current user's location and selects the nearest multispeciality hospital automatically (only multispeciality hospitals are chosen since in an emergency the patient may not have time to input any details about the nature of illness). The nearest ambulance driver is intimated and automatically booked.

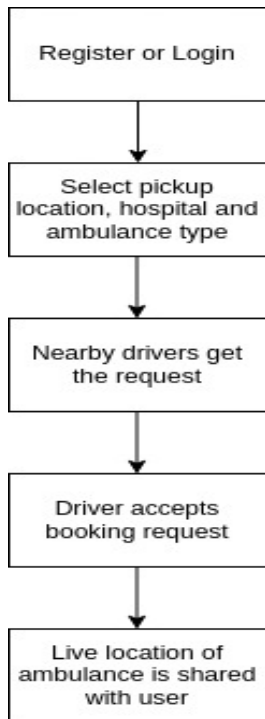


Fig 1: Normal use case

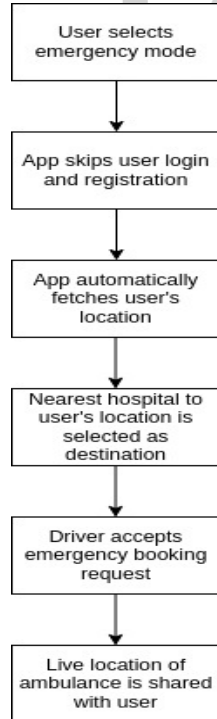


Fig 2: Emergency use case

B. Ambulance driver side

The driver concurrently sees all the incoming requests from all the users in their area. A driver only receives the requests of their own ambulance type. They can then select any request after reviewing the details of the booking.

Once the request is accepted by the driver, they then follow the directions to the patient's location. They are guided by the routing algorithms through the fastest possible route depending on distance and traffic.

Once they reach the user and pick up the patient, then they will follow directions to the hospital guided by the same routing algorithms. All the while the driver's live location is updated on the user's app.

Outcomes:

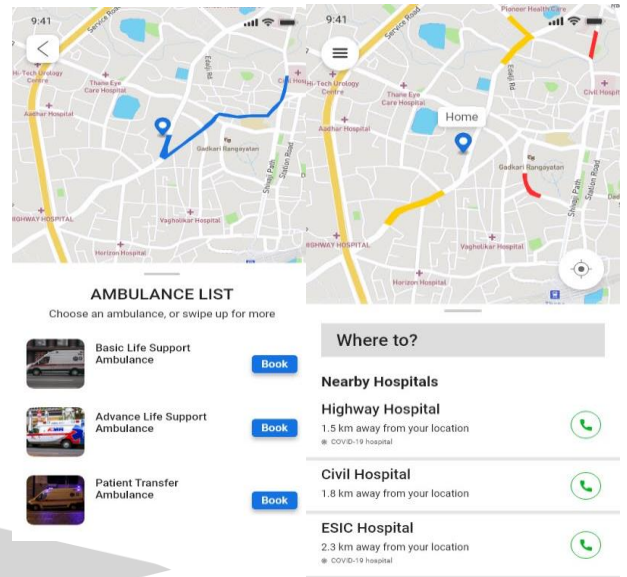


Fig 3: App home page

Fig 4: Ambulance list page

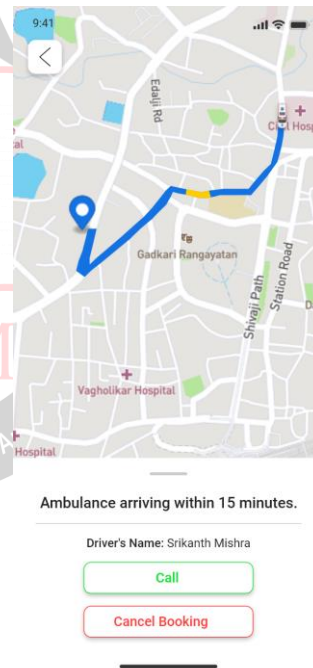


Fig 5: Ambulance booking page

When the emergency mode is selected, the app follows the methodology shown in (Fig 2), and once a driver confirms booking, the Ambulance booking page (Fig 5) is displayed.

When normal booking mode is selected, the app's home page (Fig 3) is displayed. Here a google map showing the user's current location, a list of hospitals near the user, and a text bar to search for a specific hospital is shown. Along with this a button to directly call the hospital, the distance

of the hospital from the user, and a text box showing if the hospital accepts COVID-19 patients or not is shown.

Once a hospital is selected, the ambulance list page (Fig. 4) is displayed where users can book the desired ambulance type. Once a driver confirms booking, the Ambulance booking page (Fig 5) is displayed.

VI. SURVEY

We also conducted a survey to understand the problems users faced while booking an ambulance in India. We asked 50 different users to participate in our survey and analyzed their responses. Table I shows which questions were asked, the options which each question had, and the percentage of total users who selected a particular option. Questions that were asked during the survey:

Question 1: Which method do you generally use to book an ambulance?

Question 2: Have you had problems while booking an ambulance over the phone call?

Question 3: Have ambulance drivers faced problems while searching your address?

Question 4: After booking an ambulance, do you think knowing the live location of the ambulance will be beneficial?

Question 5: Are you aware of all the hospitals in your area?

Questions	Options		
Question 1	Calling a 3rd party ambulance service	Calling government ambulance helpline number 102	Other
Percentage of total	42%	42%	16%
Question 2	Yes	No	Sometimes
Percentage of total	22%	40%	38%
Question 3	Yes	No	Don't know
Percentage of total	38%	30%	32%
Question 4	Yes	No	
Percentage of total	98%	2%	NA
Question 5	Yes	No	
Percentage of total	54%	46%	NA

TABLE I: A LIST OF SURVEY QUESTIONS WITH OPTIONS

It is evident from the survey that the majority of the people who have been in need of ambulance services have at some point faced issues in either getting correct ambulance contacts and information, or faced problems guiding the driver to the exact location of the patient, or were generally unaware of the hospitals in the area. Thus, in accordance with the results of the survey, the need and the use of our emergency system are justified.

VII. CONCLUSION

The recent COVID-19 pandemic has shown light upon the fragile healthcare infrastructure that exists in India. The most potent of the problems is the ambulance service response time. While the recommended ambulance response time is around 8 minutes, the response time observed in India is over 25 minutes in urban areas due to multiple factors. If the driver is unfamiliar with the locality of the user who booked an ambulance over the telephone, he may take time to reach the exact destination, furthermore, human errors may increase the delay. This issue is solved while using our proposed solution as ambulance drivers are provided with a precise location of the user along with the fastest path to reach the user's location. Some of the limitations of the traditional methodology are that one remains in complete chaos, uncertainty, and panic as they are unaware of the status of the ambulance booked and its location. It was also observed that 98% of people who took the survey, knowing the location of the Ambulance after the booking is a needed feature and our solution helps to mitigate this as one is able to track the live location of the ambulance using an Android app. Today digitization is transforming each and every sector of India and the use of technology in healthcare would prove to be a boon as India has the second-largest smartphone users by percent in the world, and 95.84% of these users are Android users. Thus by leveraging this immense market, we have come to the conclusion that an Android application is an efficient solution to tackle the multiple issues that remain while booking an Ambulance.

ACKNOWLEDGMENT

We got the inspiration for this idea when one of our team members went through a nightmare situation to get his father to hospital on time due to a delay in the ambulance. Taking inspiration from applications like Uber, we decided upon this application. We also extend our gratitude to the judges of the Thane Smart City Hackathon, where we won third place out of 181 teams. The feedback from these judges was invaluable and allowed us to fine-tune our application further.

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