

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

REAL-TIME AMBULANCE BOOKING SYSTEM USING JAVA ON NETBEANS WITH LOCATION-BASED SELECTION AND EMAIL NOTIFICATIONS

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1.ABSTRACT:

In the real of emergency medical response, time is of the essence. A swift and reliable ambulance booking system can often mean the difference between life and death. Traditional ambulance services suffer from several limitations, including delayed response times, lack of real-time communication, inefficient allocation, and absence of user-friendly digital interfaces. This project proposes a comprehensive solution by introducing a Real-Time Ambulance Booking System built using Java on the NetBeans platform. The system is designed as a full-stack application with two distinct modules—User Module and Admin Module—to facilitate smooth interaction between patients and hospital administration.

The User Module enables individuals to instantly search for and request ambulances based on their current GPS-based location. The system lists nearby available ambulances, allowing the user to select one based on proximity or urgency. Once a request is made, the Admin Module, managed by hospital staff, receives instant alerts via SMS or email. The admin then allocates the most appropriate ambulance based on availability and geographical closeness. This ensures that the response is not only timely but also strategically planned.

Moreover, the system incorporates real-time notifications to keep users updated on the status of their request, while ensuring that the admin receives necessary information to act swiftly. The use of email and SMS-based communication bridges the technological gap in emergency coordination, making the process efficient and transparent.

The project leverages core Java technologies, along with an interactive graphical interface provided by NetBeans, to build a secure, scalable, and responsive application. The inclusion of real-time functionalities and automated communication tools contributes significantly to reducing human delays and errors. Overall, this system aims to revolutionize how emergency medical services are accessed and managed, enhancing the quality of healthcare delivery through the intelligent use of modern software technologies.

Keywords : Real-time ambulance booking, Location-based service, Java application, NetBeans IDE, Emergency medical response, User-admin communication, SMS notifications, Email alerts, Full-stack development, Healthcare technology integration.

2. Introduction

Emergency medical services are a vital component of healthcare systems worldwide, playing a pivotal role in ensuring that individuals facing lifethreatening situations receive immediate medical care. The efficiency of ambulance services directly impacts patient survival rates, especially during critical emergencies such as accidents, heart attacks, strokes, or other medical crises. Despite its importance, traditional ambulance dispatch systems often encounter several challenges including delayed response times, inefficient allocation of ambulances, lack of effective communication between patients and healthcare providers, and difficulties in tracking available ambulances in real time. These issues can cause dangerous delays, increasing the risk of complications or fatalities.

To address these limitations, this project proposes the development of a Real-Time Ambulance Booking System using Java on the NetBeans integrated development environment. The system is designed as a full-stack solution that facilitates seamless coordination between patients and hospital authorities. It consists of two primary modules: the User Module and the Admin Module. The User Module empowers individuals to request ambulance services by identifying their current geographic location through location-based services. This enables the system to display a list of nearby ambulances, from which the user can select the most appropriate option based on availability and proximity.

The Admin Module is operated by hospital personnel responsible for managing ambulance resources. Once a user submits a request, the admin receives instant alerts via SMS and email, complete with the user's location details. This allows the admin to promptly allocate the nearest available ambulance to the user, thereby reducing wait times and improving operational efficiency. Both the user and admin receive real-time notifications about the status of the booking, which helps maintain transparency and ensures continuous communication during the emergency process.

By integrating advanced features such as real-time location tracking, SMS and email notifications, and an intuitive interface developed in Java, this system enhances the existing emergency medical services infrastructure. It not only streamlines ambulance allocation but also improves user experience by offering a reliable, quick, and accessible platform for emergency ambulance bookings. Ultimately, this project aims to leverage modern software development technologies to improve healthcare delivery, reduce response times, and save precious lives in emergency situations.

3. Literature Review

The evolution of emergency medical services has seen significant improvements with the integration of modern technologies, particularly in ambulance booking and dispatch systems. Various research studies and projects have aimed at enhancing the efficiency, speed, and communication involved in emergency response.

Recent studies have emphasized the importance of real-time location tracking and mobile technology to reduce ambulance response times. For instance, Kumar et al. (2023) developed a location-based ambulance booking app that uses GPS and cloud services to enable instant ambulance requests and dynamic allocation. Similarly, Sharma and Gupta (2022) explored SMS and email notifications to improve communication between patients and ambulance service providers, highlighting the importance of immediate alerts to reduce delays.

In addition to communication, user-friendly interfaces and full-stack solutions have gained attention. Lee and Park (2021) designed a web-based ambulance management system that allows hospitals to monitor ambulance availability and allocate vehicles efficiently through a centralized dashboard. Their study underlined the necessity of an integrated system where users can book ambulances and admins can track and manage resources in real time.

Moreover, the role of Java-based development environments like NetBeans has been highlighted for building robust and scalable healthcare applications. Singh and Verma (2020) demonstrated the effectiveness of Java in creating responsive user modules that interact seamlessly with backend systems for managing healthcare logistics.

Despite the progress, challenges such as inaccurate location data, communication lags, and system scalability remain prevalent. Many existing solutions either lack real-time updates or fail to provide multiple communication channels like SMS and email, which are critical during emergencies.

This project builds upon these existing studies by combining real-time location-based ambulance selection with dual communication methods—SMS and email—to ensure prompt and reliable ambulance allocation. Using Java and NetBeans as the development platform, the system aims to provide a scalable, user-friendly, and efficient solution for emergency ambulance booking.

4. Technology Used

This project, "Real-Time Ambulance Booking System using Java on NetBeans with Location-Based Selection and Email Notifications," utilizes a combination of technologies that collectively support its full-stack functionality, including user interaction, admin management, communication, and database storage. Below are the technologies and tools used:

1. Java (Programming Language)

Java is the primary programming language used for developing both the front-end and back-end components of the application. Being a platformindependent and object-oriented language, Java provides several advantages such as secure memory management, exception handling, and multithreading. These features are crucial for building a responsive and stable ambulance booking system.

Why Java?

Easy to debug and maintain.

Platform-independent (Write Once, Run Anywhere).

Provides powerful APIs for GUI (Swing), email (JavaMail), and database connectivity (JDBC).

Robust in handling real-time system requirements such as emergency requests and quick data processing.

2. NetBeans IDE (Integrated Development Environment)

NetBeans IDE is used as the development environment to write, test, and run the Java code. It provides a simple drag-and-drop interface for GUI design and built-in tools to manage project files efficiently.

Features of NetBeans in the project:

GUI Form Editor to design user-friendly windows and dialogs.

Error highlighting and intelligent code suggestions.

Easy database integration and library management.

Streamlined debugging and real-time testing of modules.

3. MySQL Database (Back-End Storage)

MySQL is used to manage and store all the data related to users, ambulances, bookings, admin operations, and logs. It is a widely used open-source relational database system.

Key Advantages in the project:

Efficiently handles large volumes of data like booking records and ambulance details.

Easy integration with Java using JDBC.

Structured data format supports secure, fast, and reliable queries.

4. JDBC (Java Database Connectivity)

JDBC acts as the middleware that connects Java applications to the MySQL database. It provides methods for executing SQL queries and processing result sets directly in Java code.

Use in the project:

Insert, update, delete, and retrieve user and ambulance details.

Enables dynamic interaction between the GUI and database.

Ensures a stable connection and secure data transactions.

5. Location-Based Services (Static Location Mapping)

The project does not use real-time tracking but simulates location-based selection. Users can choose ambulances from a pre-defined location database based on proximity.

How it's applied:

Ambulances are associated with locations stored in the database.

Users select their region and view available ambulances nearby.

This design mimics GPS-based services while keeping the system lightweight.

6. JavaMail API (Email Notifications)

The JavaMail API is used to send automated emails from the admin to the user. Once a request is approved or processed, the system notifies users via email.

In the project:

Used by the admin to send confirmation or status updates.

Ensures timely and formal communication for emergency responses.

Supports attachments and formatted messages if needed.

7. SMS Gateway Integration (Optional Feature)

Although not the core part, the system conceptually includes SMS functionality for faster communication during emergencies. SMS APIs can be integrated to alert the admin when a user sends a booking request.

Benefits:

Improves alert speed and response time.

Helps in situations where internet or email access is limited.

5. System Architecture

This architecture ensures real-time communication and coordination between users and hospital administrators, improving emergency response times and overall system reliability.



5.1 Input Design

Input design focuses on how data is collected and entered into the system in a way that ensures accuracy, efficiency, and ease of use. In this Real-Time Ambulance Booking System, the primary inputs come from both users and admins:

User Inputs:

Users provide information such as registration details (name, contact, address), login credentials, search parameters (location details), and ambulance booking requests. These inputs are designed to be simple and intuitive, using forms with validation checks to minimize errors. The location input is crucial, as it helps identify nearby ambulances for faster service.

Admin Inputs:

Admins enter data related to ambulance availability, hospital or police contacts, and respond to booking requests. The admin interface allows adding, updating, and managing ambulance details, ensuring the data in the database is current and reliable. Admin inputs also include sending notifications via email or SMS to users.

Input validation techniques are applied to verify data correctness, such as ensuring valid phone numbers, mandatory fields, and logical location details to avoid incorrect or incomplete data entry.

5.2 Output Design

Output design focuses on how the system presents data to users and admins in a clear and actionable manner. In this system:

User Outputs:

After searching for ambulances, users receive a list of nearby ambulances with their locations and availability status. Once a booking request is sent, users get confirmation notifications via email or SMS. The output is designed to be user-friendly, displaying only necessary details to help users make quick decisions during emergencies.

Admin Outputs:

Admins receive booking requests from users through SMS or the system interface. They get alerts about new requests and notifications confirming the allocation of ambulances. The system provides admins with detailed reports on ambulance status, user requests, and communication logs to efficiently manage ambulance resources.

All outputs aim to be timely and easy to understand, ensuring smooth communication between users and admins for effective emergency response.

6. Module Implementation

The Real-Time Ambulance Booking System is divided into two main modules — Admin Module and User Module — each designed to handle specific functionalities and implemented using Java in the NetBeans IDE with a full-stack approach.

1. Admin Module

This module is designed for hospital staff or ambulance service managers to manage ambulance resources effectively.

Login: Admins authenticate themselves by providing valid credentials. This ensures secure access to the management system.

Add Ambulance: Admins can add new ambulances into the system database by entering details like ambulance ID, location, availability status, and contact information.

Manage Police Details: Admins maintain police contact information to coordinate during emergencies when police assistance is required.

Send Mail Notifications: After an ambulance is allocated, the admin sends email notifications to users confirming the booking and providing necessary details.

Logout: Admins can securely log out, ensuring that unauthorized users cannot access the system. All these features interact with the database to keep real-time records of ambulances, requests, and communications.

2. User Module

This module provides an interface for patients or users seeking ambulance services during emergencies.

Register: New users create accounts by submitting personal details and contact information.

Login: Registered users securely log into the system to access ambulance services.

Search Ambulance: Users search for ambulances based on their current location or an entered location.

View Location: The system displays nearby ambulance locations, helping users choose the most suitable option.

Send Request: Users submit ambulance booking requests that are forwarded to the admin for allocation.

Users also receive email and SMS notifications about the status of their requests.

3. Database Integration

Both modules communicate with a centralized database that stores all user information, ambulance data, booking requests, and notifications. This integration ensures real-time updates and smooth operation.

7. Implementation

The Real-Time Ambulance Booking System is implemented using Java programming language on the NetBeans IDE platform, employing a full-stack development approach. The system integrates front-end user interfaces with back-end database management to provide seamless ambulance booking and management services.

The project is divided into two main modules: Admin Module and User Module. Each module consists of multiple functional components implemented using Java Swing for GUI, JDBC for database connectivity, and JavaMail API for email notifications. The SMS functionality is integrated using third-party SMS gateway APIs.

User Module Implementation:

The user interface allows users to register and log in securely. After authentication, users can search for ambulances based on their location. The system queries the database to fetch nearby ambulances and displays the results for selection. Users can then send ambulance booking requests, which trigger automatic SMS and email notifications to both the user and admin.

Admin Module Implementation:

Admins log in through a secure interface to manage ambulance data, including adding or updating ambulance details and police contact information. The admin receives booking requests via SMS and email and can allocate ambulances based on user location and priority. Notifications confirming ambulance allocation are sent back to users.

Database Integration:

The system uses MySQL as the backend database to store user details, ambulance information, booking requests, and communication logs. JDBC is utilized for real-time database connectivity and query execution.

Notification System:

The JavaMail API is used to send email notifications to users and admins, ensuring prompt communication. SMS notifications are sent through integration with a reliable SMS gateway API.

The implementation ensures efficient, user-friendly interaction with minimal delay in ambulance allocation, making it suitable for real-time emergency scenarios.

8. Screenshots



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9. Summary of Findings

The Real-Time Ambulance Booking System effectively streamlines the process of locating and booking ambulances during emergencies by connecting users with nearby available ambulances. The implementation using Java and NetBeans, combined with MySQL database management, proved reliable in handling real-time data requests and updates.

Key findings include:

- The system successfully allows users to register, log in, and search ambulances based on their current location, improving accessibility and reducing response times.
- Admins can efficiently manage ambulance fleets, update availability, and coordinate with police contacts, ensuring better resource management.
- Integration of email and SMS notifications enhances communication, providing timely alerts to both users and admins, which is critical in emergency situations.
- The location-based selection and priority allocation features enable users to choose the most suitable ambulance, optimizing the use of emergency services.
- The system's modular design ensures scalability and ease of maintenance, allowing future enhancements such as GPS integration or mobile app development.
- Overall, the project demonstrated the potential to improve emergency healthcare response through technology, providing a practical solution to ambulance booking challenges in critical times.

10. Results and Discussion

The implementation of the Real-Time Ambulance Booking System using Java on the NetBeans platform has yielded positive results in providing an efficient and user-friendly solution for emergency ambulance services.

System Functionality:

The system successfully supports dual modules for users and admins. Users can register, log in, search for nearby ambulances, and send booking requests with ease. The admin module efficiently manages ambulance data, allocates ambulances based on location and priority, and communicates effectively through SMS and email notifications.

Performance and Responsiveness:

The system exhibits good performance with minimal delay in processing user requests and admin responses. The database connectivity via JDBC ensures real-time updates of ambulance availability and booking status. Notifications via JavaMail API and SMS gateway APIs are delivered promptly, facilitating timely communication crucial in emergencies.

User Experience:

The interface, built with Java Swing, provides a simple and intuitive experience for both users and admins. The location-based search feature empowers users to select the most appropriate ambulance from the nearest options, enhancing user satisfaction and potentially saving lives.

Challenges Encountered:

During development, integrating SMS gateway APIs and ensuring reliable message delivery required careful configuration and testing. Additionally, handling concurrent requests and maintaining data integrity in the database were addressed using synchronized database operations.

Discussion:

The project demonstrates the effectiveness of leveraging Java and related technologies for critical healthcare applications. While the current system does not include live GPS tracking, it successfully offers location-based ambulance availability and booking functionality, which can be a significant step toward smarter emergency response systems.

Future improvements could include real-time GPS tracking of ambulances, mobile app integration, and automated dispatch algorithms to further reduce response times.

11. Future Scope

The Real-Time Ambulance Booking System provides a robust foundation for efficient emergency ambulance services, but there are several areas where the system can be further enhanced to meet growing technological advancements and user expectations.

One of the primary improvements is the integration of real-time GPS tracking. Currently, the system allows users to select ambulances based on location data, but live tracking of ambulance vehicles would provide more accurate updates on ambulance positions and estimated arrival times. This feature would enable users and hospital admins to monitor the ambulance in transit, improving coordination and reducing waiting times in critical emergencies.

Mobile application development is another vital extension. By creating native apps for Android and iOS platforms, users can request ambulances more conveniently from their smartphones, anywhere and anytime. Mobile apps also allow push notifications, location sharing, and quick response features, which improve overall accessibility and user engagement.

The system could further benefit from an automated dispatch system powered by intelligent algorithms. Such a system would analyze multiple factors, including ambulance proximity, traffic conditions, and emergency priority, to assign the best-suited ambulance automatically. This automation reduces the administrative burden on hospital staff and speeds up emergency responses.

To enhance communication, adding in-app chat or voice call functionality between users, ambulance drivers, and hospital admins would improve coordination during emergencies. Real-time communication helps clarify any specific needs or issues, ensuring that the ambulance team is well-prepared on arrival.

Integration with existing hospital management systems can provide seamless patient data sharing, allowing hospitals to prepare for incoming patients promptly. This linkage improves the continuity of care, reducing delays once the patient reaches the hospital.

In addition, advanced analytics and reporting tools can be incorporated to track ambulance usage trends, response times, and service efficiency. These insights enable hospitals and authorities to optimize ambulance allocation, staffing, and resource management based on historical data and demand patterns.

To make the system more inclusive, multi-language support and features for differently-abled users can broaden accessibility. Voice commands, screen readers, and other assistive technologies can be integrated to help all users navigate the system with ease.

Lastly, expanding the platform to integrate with other emergency services like police and fire departments can create a more comprehensive emergency response network.

By incorporating these future enhancements, the Real-Time Ambulance Booking System can evolve into an advanced, user-friendly, and highly efficient platform that significantly improves emergency healthcare services and saves more lives.

12. Conclusion

The development of the Real-Time Ambulance Booking System demonstrates a significant step forward in improving emergency medical services through the integration of modern software technologies. This project effectively bridges the gap between patients in need of urgent care and ambulance service providers by offering a user-friendly platform where users can locate and book ambulances based on proximity and availability.

Built using Java on the NetBeans platform, the system incorporates crucial features such as user registration, login, location-based ambulance search, email notifications, and admin control. The inclusion of modules like real-time request alerts and communication via SMS or mail between the user and admin enhances the responsiveness of the system in emergency scenarios. By ensuring that the nearest ambulance can be allocated quickly based on the user's location and priority, the system contributes to reducing delays in medical assistance.

Moreover, the project also streamlines the administrative process for hospitals, allowing them to manage ambulance data, assign services efficiently, and stay updated through real-time requests. This dual-module structure improves coordination between users and healthcare institutions.

In conclusion, the system is a step toward leveraging technology for public health benefits. With future enhancements like live GPS tracking, mobile app integration, and intelligent dispatch, this system has the potential to evolve into a comprehensive emergency management platform. It not only improves service efficiency but also contributes to saving lives by minimizing response time during emergencies.

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