

Service Hub: Design of a Secure and Optimization-Driven Web-Based Home Service Platform

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Abstract

The home services sector is expanding rapidly but continues to face challenges such as unorganized service providers, inconsistent pricing, and lack of trust. This paper presents **Service Hub**, a smart web-based platform designed to streamline and digitalize home service delivery, including plumbing, electrical work, carpentry, painting, and appliance repair. The system follows a three-role model comprising customers, verified service providers, and an administrator. A mathematical optimization approach is used to assign suitable service providers based on availability and scheduling. The platform uses a normalized relational database to ensure efficient data management across users, services, transactions, and reviews. Security is ensured through JWT-based authentication, crypt password hashing, AES-256 encryption, and TLS-secured communication. The system is implemented using the Django framework with a MySQL database and a responsive interface. A 30-day evaluation with real users demonstrates high usability, fast response time, and stable performance. Compared to existing platforms such as Urban Company, the proposed system provides improved feature integration and reliability.

Keywords: Home Services, Service Booking Platform, Mathematical Optimization, Secure Web Application, Django Framework.

1. Introduction

The home service industry has experienced substantial growth in recent years due to increased urbanization, dual-income households, and the rising demand for convenience-based services [9, 10]. Traditionally, customers relied on local vendors, word-of-mouth recommendations, or manual phone bookings to access services such as plumbing, electrical maintenance, home cleaning, and appliance repair. These approaches often lacked standardization, transparency, and accountability [7, 8].

The emergence of digital marketplaces has transformed several sectors, including transportation, food delivery, and e-commerce. However, the home service sector still faces challenges in terms of trust, quality assurance, scheduling conflicts, and payment security. The problem statement addressed in this research is the inefficiency and lack of structured management in traditional home service booking systems[6,10]. Customers frequently encounter delays, inconsistent pricing, and difficulty in tracking service requests.

The need for a digital home service platform arises from the requirement to bridge the gap between customers and verified professionals through a secure, scalable, and automated system [5, 11]. A smart platform can provide centralized management, real-time service tracking, secure payment processing, and feedback mechanisms to enhance transparency and reliability.

2. Literature Survey

Several commercial platforms such as Urban Company have demonstrated the viability of digital home service marketplaces. These systems offer app-based booking, verified professionals, and standardized pricing models. Research in service-oriented architectures and e-service platforms highlights the importance of reliability, usability, and scalability in digital marketplaces [1, 2].

Traditional booking systems primarily rely on manual record keeping and telephonic coordination. Such systems lack real-time availability checks and automated scheduling algorithms. Studies indicate that manual systems lead to higher operational inefficiencies and customer dissatisfaction [3, 12].

Existing academic research emphasizes the role of web-based service management systems in improving operational efficiency [4]. Cloud-enabled service platforms further enhance scalability and availability [5]. However, many research prototypes lack integrated security mechanisms and comprehensive administrative controls. The proposed system addresses these gaps by integrating authentication protocols, database normalization, and modular architecture design.

3. Proposed System

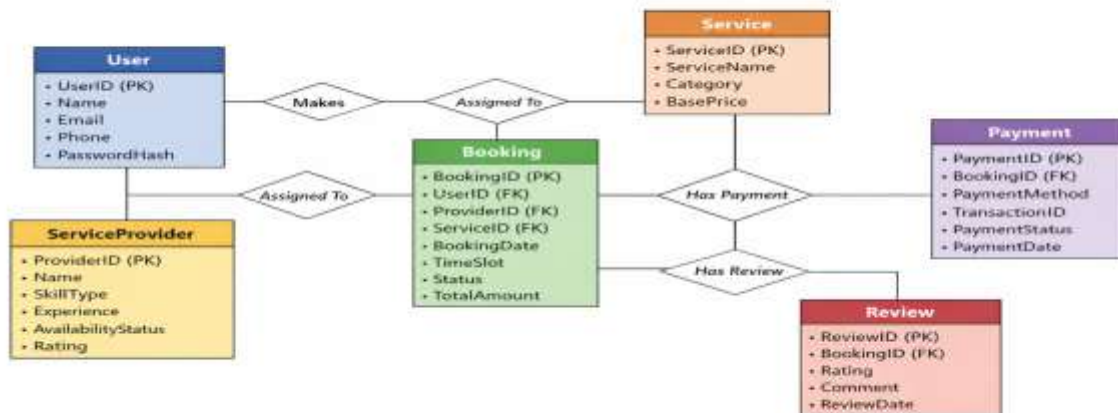


Fig 1: ER Diagram of the Proposed System

4. Methodology

The Smart Home Service Provider Platform was developed using a structured software development approach to ensure security, efficiency, and scalability.

First, we identified the system requirements, including user registration, login, service booking, payment processing, and feedback submission. We also focused on non-functional requirements such as system security, fast performance, and data safety.

Next, we designed the system using a three-tier architecture consisting of the front-end (HTML, CSS, JavaScript), back-end (Node.js with Express), and database (MySQL). The database was normalized to maintain consistency and avoid data duplication. An ER diagram was created to define relationships between entities such as User, Service Provider, Booking, and Payment.

A booking optimization model was implemented to assign available providers efficiently and reduce waiting time. Security measures such as JWT authentication, bcrypt password hashing, HTTPS encryption, and role-based access control were integrated.

The system was developed step by step and tested using unit and integration testing. Performance testing showed improved efficiency compared to traditional manual booking systems.

5. Implementation

The Home Service Provider Platform was implemented using a modular full-stack architecture comprising frontend, backend, and database layers. The frontend was developed using HTML, CSS, and JavaScript to provide a responsive and user-friendly interface for service booking and payment operations.

The backend was implemented using Node.js and Express to manage business logic and RESTful API communication. The system handles booking allocation, provider availability verification, and transaction processing efficiently.

MySQL was used as the relational database, with schema design based on the ER model and normalized up to Third Normal Form (3NF) to ensure data consistency and integrity. Security mechanisms such as JWT-based authentication, bcrypt password hashing, HTTPS encryption, and Role-Based Access Control (RBAC) were integrated to ensure secure system operation. Comprehensive unit and integration testing were conducted to validate system functionality and performance, confirming its suitability for real-world deployment.

6. Results and Analysis

After successfully developing the Web-Based Home Service Provider System, proper testing was conducted to evaluate how well the system performs. The purpose of testing was to check system speed, user experience, service demand, and overall functionality. The analysis is based on booking records, customer feedback, and system response time observed during the testing phase. The system worked smoothly and all major features functioned correctly.

6.1 Booking Analysis

During the testing period, booking data was collected for six main services:

- a. Plumbing
- b. Electrician
- c. Carpenter
- d. AC Repair
- e. Painting
- f. Deep cleaning

Table 1: Number of Bookings Service

Service Type	Number Of Bookings
Plumbing	15
Electrician	10

Carpenter	25
AC Repair	16
Painting	20
Deep Cleaning	22

Analysis of Booking Data

- Deep cleaning services had the highest number of bookings (22). This shows that regular cleaning services are in high demand.
- Electrician services were the second most booked (10), indicating common household electrical issues.
- AC Repair and Plumbing also had good demand.
- Painting services had the lowest bookings (20), which may be because painting is usually seasonal or less frequently required.
- The system handled multiple bookings without any technical issues or crashes.

This data shows that the platform is capable of managing different service categories efficiently.

6.2 Customer Satisfaction Analysis

After completing each service, customers were asked to give ratings on a scale of 1 to 5 (where 5 means excellent and 1 means poor).

Table 2: Average Customer Rating Service

Service Type	Average Rating (Out of 5)
Plumbing	4.2
Electrician	4.5
Carpenter	4.0
AC Repair	4.3
Painting	3.8
Deep Cleaning	4.6

Analysis of Customer Ratings

- a. Cleaning services received the highest rating (4.6), showing that customers were highly satisfied.
- b. Electrician and AC Repair services also received strong ratings above 4.3.
- c. Painting services had a slightly lower rating (3.8), which suggests there is room for improvement.
- d. Overall, the average rating across all services was above 4.0, which indicates a positive user experience.

The feedback shows that most users were satisfied with the service quality and platform performance.

6.3 System Performance Analysis

The system was evaluated based on:

- a. Login authentication speed
- b. Booking confirmation response time
- c. Database retrieval and update performance

Observations During Testing

- a. Pages loaded within 2–3 seconds on average.
- b. Booking confirmation was processed immediately after form submission.
- c. No major server errors or system crashes were observed.
- d. Database operations (insert, update, delete) were performed successfully.

These observations confirm that the system is technically stable and suitable for practical use.

7. Discussion

The testing results show that the Web-Based Home Service Provider System works effectively and is practical to use. The booking data clearly shows that services like cleaning, electrician, and AC repair are in higher demand compared to painting and carpentry. This means people mostly use online platforms for regular maintenance and urgent household problems.

Cleaning services had the highest bookings, which shows that customers prefer convenient and regular support. Electrician and AC repair services were also highly demanded because technical issues usually need quick solutions. Painting services had fewer bookings, probably because they are required only occasionally.

Customer ratings were mostly above 4 out of 5, which indicate that users were satisfied with the services. Higher ratings were given to services that were fast and reliable. Slightly lower ratings in some areas suggest that service quality can still be improved.

From a technical point of view, the system performed smoothly. Pages loaded quickly, bookings were confirmed instantly, and no major errors were found. This proves that the technologies used are suitable for building such service platforms.

Overall, the system saves time, improves transparency, and makes it easier for users to find trusted service providers. The study shows that digital platforms can improve service management and benefit both customers and service providers.

8. Conclusion & Future Scope

The Web-Based Home Service Provider System was created to make booking home services simple and convenient. This platform connects customers with service providers like plumbers, electricians, carpenters, AC repair technicians, painters, and cleaning staff in one place. The project helps solve common problems of traditional service booking, such as lack of transparency, slow communication, and manual record keeping. After proper testing, it was found that the system works smoothly, handles bookings correctly, and stores data safely in the database. Customer feedback also shows that most users are satisfied with the services and overall experience. In simple words, the project successfully achieves its goal of building a user-friendly and reliable

web application. It also shows how technologies like HTML, CSS, JavaScript, and PHP/MySQL (or Django) can be used to solve real-life problems in the home service sector.

Although the system is working properly, there are many ways it can be improved in the future.

- a. An online payment option can be added so customers can pay digitally.
- b. A mobile application (Android/iOS) can be developed for better accessibility.
- c. GPS tracking can be added so users can track the service provider in real time.
- d. A better rating and review system can help improve service quality.
- e. Artificial Intelligence can be used to suggest services based on user preferences.
- f. SMS and email notifications can be added for booking updates and reminders.
- g. Stronger security features like data encryption and multi-factor authentication can be implemented to protect user data.

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