

Real-Time Hyperlocal Task Allocation and Resource Optimization in Urban Crowdsourcing Networks

Penumarthi Venugopal
Department of CSE (AI & ML)
Seshadri Rao Gudlavalleru
Engineering College
Gudlavalleru, India

Nidamanuri Srija
Department of CSE (AI & ML)
Seshadri Rao Gudlavalleru
Engineering College
Gudlavalleru, India

Neelam Sai Teja
Department of CSE (AI & ML)
Seshadri Rao Gudlavalleru
Engineering College
Gudlavalleru, India

Pathon Rasool Meharaj Khan
Department of CSE (AI & ML)
Seshadri Rao Gudlavalleru Engineering College
Gudlavalleru, India

Shaik Farooq
Department of CSE (AI & ML)
Seshadri Rao Gudlavalleru Engineering College
Gudlavalleru, India

Abstract - In the modern fast-moving urban scenario, the requirement for on-demand services has grown manifold with the increasing demand for busy lifestyles and the rapid proliferation of mobile technologies. However, the conventional methods of hiring services are inefficient and time-consuming with no real-time coordination with the customers and the service providers. In this context, this paper presents the design and development of a real-time task allocation platform based on the mobile computing paradigm that facilitates the customers and the service providers to get in touch with each other with the help of location-based services. The proposed system comprises the development of two dedicated mobile applications for the customers and the service providers. The integration of the Google Maps APIs facilitates the real-time tracking and estimation of the distances. In order to make the system reliable and trustworthy, the proposed system has been designed with the integration of the OTP-based task verification and the feedback rating. The proposed system is highly scalable and costeffective with the integration of the mobile computing and cloud technologies.

Index Terms - Task Allocation System, On-Demand Services, Mobile Application, Location-Based Services, Real-Time Tracking, OTP Verification, Cloud Computing.

I. INTRODUCTION

In today's fast-paced society, individuals often don't have the luxury of time to seek quick and efficient service providers due to their busy schedules. Conventional methods of hiring service providers, such as advertisements, are generally slow,

inefficient, and lack real-time coordination. Moreover, most of the conventional service provider allocation mechanisms don't take into account real-time user locations, worker

availability, and resource optimization, which causes significant delays in service delivery.

Due to the rapid growth of mobile computing technologies and the advent of cloud computing, today's service provider allocation systems are incorporating smart task allocation mechanisms, which use real-time data to improve service delivery times. These smart service provider allocation systems use various parameters such as user locations, service types, worker availability, and distances to efficiently allocate service providers to meet user demands. Moreover, the use of cloud technologies enhances the efficiency of service provider allocation through real-time processing.

Recent research has focused on improving allocation efficiency by considering factors such as worker availability, service diversity, and task priority. The transition from manual allocation methods to intelligent real-time systems demonstrates how location-aware technologies can significantly improve service accessibility and operational efficiency.

The objective of this work is to develop a scalable and secure mobile-based task allocation system that leverages mobile computing, cloud computing, and location-based technologies to enable efficient real-time matching between customers and nearby workers.

II. PROBLEM STATEMENT

The busy lifestyle and the growing need for instant service platforms have made it hard for people to access timely and effective services via traditional service channels. Most of the existing task allocation systems utilize generalized and manual methods of task allocation that do not take into consideration various factors such as user location, worker availability, and task requirements in real-time. This has led to long waiting times and inefficient services for the users.

Although modern service platforms employ advanced technologies in the allocation of tasks, they are mostly complex and do not promote user trust and ease of usage. The above-mentioned issues and challenges in the traditional and modern service systems have emphasized the need for the development of a simple and user-friendly real-time task allocation system that can effectively allocate tasks to the users with the assistance of location-based services.

III. OBJECTIVES

- Develop dual mobile apps for customers and workers to simplify task requests and acceptance.
- Implement real-time task matching by broadcasting requests to nearby workers for quick allocation.
- Enable live tracking and navigation between customer and worker using Google Maps APIs.
- Ensure secure task completion with OTP-based verification to confirm service and prevent misuse.
- Build Trust Through a rating and feedback system for both customer and workers.
- Design the system to be scalable for multiple service types and a growing user base.

IV. LITERATURE REVIEW

Due to the rapid development of mobile technologies, users are increasingly relying on digital technologies to meet their daily service needs. The conventional service system faces issues such as delays in service delivery and the lack of personalization in task allocation. In order to address these issues, researchers have proposed the development of automated task allocation systems that make use of real-time location and availability information for better service matching.

The location-based approach has been identified as an effective way of identifying the right set of workers based on their proximity and availability. However, the conventional approach is based on the application of fixed rules and algorithms for task allocation that do not take into consideration the preferences and skills of the workers.

This has led to the development of rule-based task allocation systems that aim to improve the efficiency of the overall system. The conventional approach is based on the application of fixed rules and algorithms for task allocation that do not take into consideration the preferences and skills of the workers. Recent studies have also emphasized the need for user interaction improvements, focusing on better communication mechanisms. Although these improvements are useful, there are still limitations in task allocation systems that offer adaptive solutions. Therefore, there is a need for task allocation systems that are simple, flexible, and efficient in a real-time environment.

Recent advancements in mobile and cloud-based intelligent systems have also improved task management solutions. The improvements are based on the ability of the system to process information in a real-time environment and make efficient decisions. However, there are limitations in automated task allocation systems, where decisions may not be very clear. Additionally, rule-based task allocation systems may not be

efficient in a dynamic environment. Therefore, there is a need for rule-based task allocation combined with efficient user communication mechanisms.

Based on the analysis of the limitations of task allocation systems, this paper proposes a task allocation system that uses rule-based task allocation and efficient user communication.

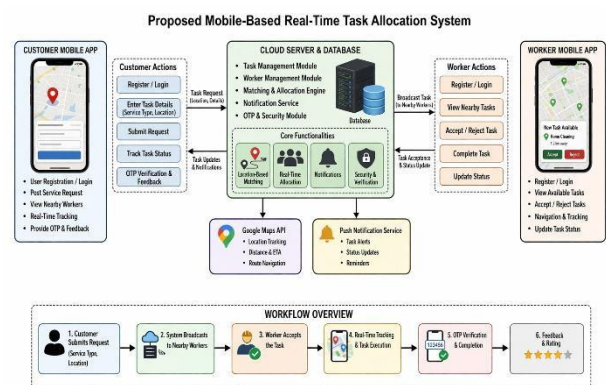
V. PROPOSED SYSTEM

The proposed system, which is mobile-based task allocation, can allow users to easily find workers who can perform the requested service in their area. The proposed system can allow customers to request services through their mobile devices, whereas the worker can receive notifications of the requested service depending on their availability. The proposed system can be user-friendly, with minimal knowledge of how to use it.

A. System Architecture

The architectural design of the proposed system is based on the structured workflow for the efficient allocation of tasks. In the proposed system, the customer enters the details of the tasks that need to be completed, such as the type of service and the location. The request is then sent to the nearby workers based on the location. The interested worker can view the details of the request and accept the request if they are free. The system then facilitates the real-time tracking and navigation of the location with the help of the Google Maps Application Programming Interface.

For the purpose of safe completion of the tasks, the OneTime Password verification process is incorporated in the proposed system. The customer needs to provide the generated OTP after the completion of the service. The structured workflow facilitates the real-time notifications and updates for the customers and the workers.



VI. METHODOLOGY

A. Collection of User Information

The mobile applications for both customers and workers collect information that is necessary for task allocation. The information for the customer includes service requirements and location information. The information for the workers includes basic information like availability and service category. The information is then used for efficient task allocation while maintaining data privacy and security.

B. Input Validation and Data Preparation

The system validates the information that is input into it. This is to ensure that there is no missing or incorrect information. The system also checks if there is a relationship between task location, task requirements, and worker availability. This ensures that there is accuracy in the data. After validation, it is then sent to the task broadcasting and worker matching module.

C. Location Processing and Worker Grouping

The system collects information on the real-time location of workers. This helps in identifying workers who are available and near the task location. The workers are then filtered to ensure that only available workers receive task notifications. This improves task allocation efficiency and reduces response time for task allocation.

D. Task Allocation Using Rule-Based Logic

The system utilizes rule-based logic in allocating tasks based on certain criteria, such as proximity, type of task, and availability of workers. The system assigns a task to a worker as soon as the task is broadcast, and the first available worker accepts the task. This rule-based logic helps in the fair and efficient allocation of tasks.

E. Real-Time Tracking and Communication

As soon as a task is accepted, the system allows for realtime tracking of the task route and location, utilizing Google Maps APIs. The system allows for better transparency and coordination between customers and workers through notification and update features, as shown in references.

F. Task Completion and Verification

For effective task completion in a secure manner, the system uses a One-Time Password (OTP) verification system. Once the customer completes the task, he/she sends the OTP to verify that the service is complete. The system also enables users to rate each other in order to build trust in service reliability.

G. Working Flow

The overall workflow of the system is summarized as follows:

- Customer submits a task request through the mobile application.
- The system validates task details and user information.
- Nearby available workers are identified using location data.
- Tasks are allocated based on predefined rule-based criteria.
- Real-time tracking and communication are enabled.
- Task completion is verified using OTP authentication.
- Feedback and ratings are collected to improve service quality.

VII. RESULTS

The proposed system for real-time task allocation was implemented with the aim of assessing its effectiveness in

enhancing service matching efficiency and minimizing response time in urban crowdsourcing environments.

A. Implementation Results

The developed system effectively enables customers to send service requests, while workers are able to receive notifications for tasks allocated to them. The integration of location-based filtering enables workers to receive relevant notifications. The implementation indicates that coordination is effectively enhanced for both customers and workers in comparison with traditional allocation mechanisms.

B. Performance Metrics

The performance of the developed system was assessed using the following parameters:

- Task allocation time

- Worker response time
- Task completion verification efficiency
- System usability/reliability

The results indicate that real-time broadcasting is effective in minimizing time allocated for tasks. Moreover, location-based filtering is effective in enhancing worker matching, while OTPbased verification is effective in enhancing service completion.

C. Experimental Observations

The system was subjected to various scenarios of task request by customers to assess the functionality of the system. From the observations, it is clear that the system reduces the amount of work in coordinating tasks by using automated task broadcasting. The use of real-time tracking enhances the level of transparency between customers and workers. The use of a rule-based system for task allocation ensures fairness in task allocation to available workers.

D. Comparative Analysis

TABLE I
 COMPARISON OF TRADITIONAL AND PROPOSED SYSTEM

Parameter	Traditional System	Proposed System
Task Allocation	Manual assignment	Automated real-time allocation
Worker Matching	Manual selection	Location-based matching
Response Time	High	Reduced
Tracking	Not available	Real-time tracking
Task Verification	Not available	OTP-based verification
User Communication	Limited	Real-time notifications

E. System Efficiency Improvements

The implementation of the proposed system was successful in improving various efficiencies, including:

- Improved task allocation speed through the use of automated matching.
- Improved worker response speed through the use of real time notification.
- Improved service reliability through OTP.
- Improved transparency through the use of real-time tracking.
 - Improved user experience through the use of a simple workflow.

From the experimental analysis, it is clear that the proposed system improves the efficiency of task allocation, reduces waiting time, and enhances service reliability.



Fig 1: application initialization

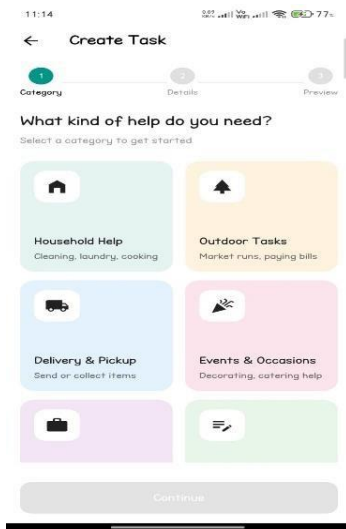


Fig 2: creating task

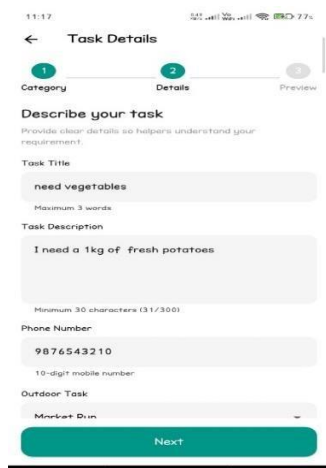


Fig 3: Filling task details

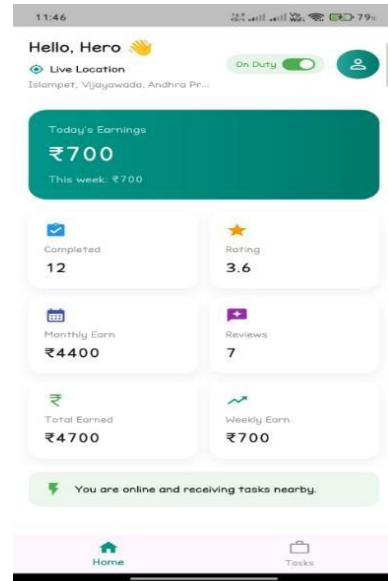


Fig 4: Customer App

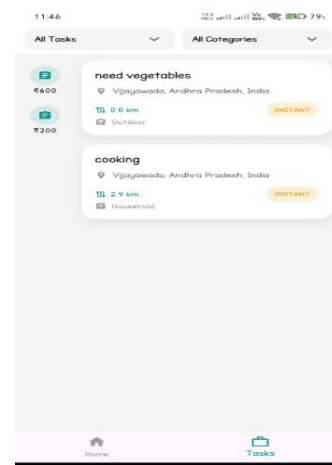


Fig 5: List of tasks

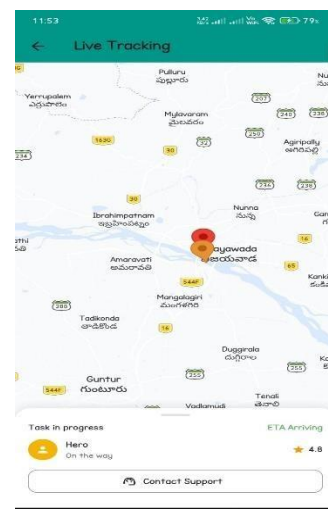


Fig 6: Tracking system

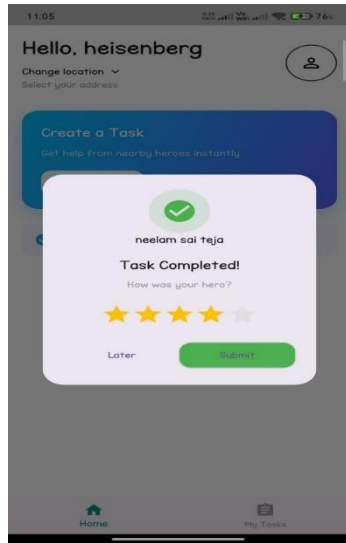


Fig 7: Rating System

VIII. DISCUSSION

This shows that the use of real-time location tracking and rule-based allocation of tasks improves the efficiency of task allocation. The results also show that the proposed system improves the coordination of customers and workers.

Although the proposed system has shown promising results, there are a few limitations. The efficiency of task allocation depends on the accuracy of location information and user information. However, the proposed system does not consider the experience of workers, workload, and task complexities, which may affect the performance of task allocation.

If the proposed system is improved, there are a few possibilities. The proposed system may consider additional parameters, such as the experience of workers and service history. The proposed system may also consider optimization techniques and analytics, as this may improve the adaptability of the proposed system.

Overall, it is seen that the proposed system offers an effective framework for real-time task allocation through its integration of location-based filtering, decision logic, and security features, thus illustrating the potential that exists in terms of mobile and cloud computing.

IX. CONCLUSIONS

This paper has discussed the development of a real-time task allocation system using mobile-based technology, which relies on the integration of location-based service and decision rules to efficiently match customers with available workers around their geographical locations. This is in contrast to the conventional task allocation system, which relies on the use of manual allocation techniques.

The system has been designed to efficiently gather essential user information and utilize the allocation mechanism rules to match workers with the required tasks. Additionally, the system has been designed to utilize real-time tracking, notification

systems, and verification through OneTime Password authentication, which improves the transparency and trust of the system among the users. The system has demonstrated the potential of integrating the use of location-based service with the communication system to improve the efficiency and reliability of the system. Additionally, the proposed system has demonstrated the potential of mobile and cloud computing in the development of real-time service allocation systems. With the addition of more features, the system has the potential to be utilized in the development of more complex service allocation systems.

X. FUTURE WORK

The future improvements that can be made to the proposed system may be focused on improving the intelligence and scalability of the system. Machine learning algorithms can be incorporated to make the selection of the worker intelligent based on the historical performance of the worker and the skill levels of the worker. In addition, predictive analysis can be incorporated to improve the efficiency of the task allocation process.

The system can be further improved by integrating the payment gateway and billing systems to enable complete service transactions. Other optimization algorithms can be incorporated to further improve the efficiency of the task allocation process.

The improvements that can be made to the proposed system in the future may be focused on incorporating AI-based recommendation systems and real-time analytics for the system. In addition, the system can be made scalable for multiple cities and further improved with additional security features and the ability to operate in multiple languages.

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