

A Service-Based System Model with AI Features for Informal Labour

Akash Shinde¹, Ashish Vidhate², Gagan Dhanapune³, Vishal Khemnar⁴, Shikha Jain⁵

^{1,2,3,4,5}Department of Information Technology PDEA's College of Engineering, Pune, India

ABSTRACT

India's unorganized labour sector employs a large part of the workforce, yet it remains digitally fragmented due to the lack of reliable identity systems, trust mechanisms, and effective service discovery. This is mainly caused by dependence on manual verification and keyword-based matching. These methods do not adequately address issues such as fraud, biased ratings, low digital literacy, and large-scale hiring requirements. Current digital labour platforms therefore face limitations in ensuring reliability and fairness. This paper proposes an AI-based service model for the unorganized labour sector that utilizes machine learning, anomaly detection, and large language models (LLMs) to improve trust, detect fraudulent activities, and enhance job-worker matching. The proposed system includes an AI-driven trust and fraud detection engine, an LLM-based matching mechanism, and multilingual support to assist both workers and service seekers. Unlike traditional systems, this model analyzes behavioural patterns, document attributes, and rating dynamics to identify suspicious activities. It also applies embedding-based similarity techniques to match jobs and workers without relying only on keyword searches. The design aims to support low-literacy users through AI-assisted job description generation and conversational interfaces. This paper demonstrates how modern AI techniques can transform informal labour markets into a scalable, transparent, and reliable digital ecosystem.

Keywords—Unorganized Labour, Gig Economy, Artificial Intelligence, Trust Modeling, Fraud Detection, Large Language Models, Semantic Matching, Unorganized Sector, Skilled Worker.

INTRODUCTION

The unorganized labour sector is crucial to many developing economies, especially in India. Millions of workers, like electricians, plumbers, carpenters, masons, and artisans, rely on informal jobs. Despite their economic impact, these workers face ongoing problems. They lack formal identity, often have unstable jobs, struggle with visibility, and are vulnerable to exploitation. Clients and contractors also have trouble finding skilled and trustworthy workers. This leads to inefficiencies, safety issues, and inconsistent service quality.

In the last decade, various digital solutions have tried to bridge this gap by digitizing labour discovery and job allocation. However, most current systems function as listing-based platforms. They depend on keyword matching, manual verification, and simple rating systems. These methods do not scale well and overlook deeper problems, such as fake profiles, manipulated ratings, biased feedback, and the exclusion of users with low digital skills. Recent advancements in artificial intelligence, especially in machine learning and large language models, allow us to rethink labour platforms. We can transform them from static marketplaces into intelligent service systems. AI-driven trust modeling, a better understanding of job requirements, and adaptable user interactions can greatly enhance fairness, reliability, and accessibility. This paper looks into designing an AI-based service model that uses these technologies in the unorganized labour sector.

MOTIVATION

The main reason for this research comes from three ongoing gaps in current labour platforms. First, there is a lack of trust. Workers often do not have verified credentials to show their reliability, and clients often hesitate to hire unknown service providers. Checking credentials manually takes a lot of time and can be biased. Second, current job-worker matching methods rely only on keyword filtering. These methods overlook the context, depth of experience, complexity of services, and past performance, resulting in poor matches.

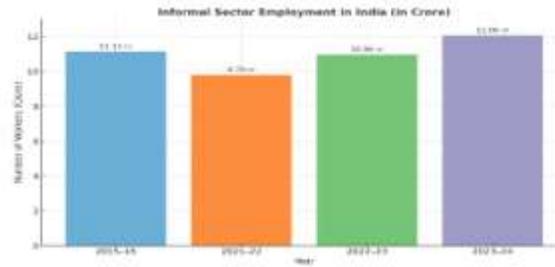


Fig. 1. Growth of Informal Sector Employment in India (in Crore), highlighting the large addressable user base.

Third, digital exclusion is still a big issue. Many workers and clients have trouble with text-heavy interfaces, English-dominated platforms, and complicated workflows. This limits usage in semi-urban and rural areas. This work aims to use artificial intelligence as an unbiased support tool that builds trust, improves match quality, and increases accessibility without replacing human oversight. By incorporating AI-based trust evaluation, contextual understanding, and multilingual support, the proposed system seeks to create a fairer and more inclusive labour environment.

OBJECTIVES

- To create a reliable and clear digital system that connects skilled workers with clients efficiently. This will reduce reliance on informal and unsafe hiring practices.
- To build an AI-powered trust and verification framework that uses machine learning techniques. This will help administrators spot fraudulent profiles, unusual behaviour, and patterns of misuse, while keeping final control with human oversight.
- To improve job-worker matching by introducing LLM-based semantic understanding. This allows the system to pair workers with job requirements based on meaning, experience, and context, not just keywords.
- To assist workers and clients with low digital or language skills, we will use AI-generated job descriptions and multilingual conversational interfaces. This will let users interact with the system using simple language or voice input.
- To ensure fairness and accountability in hiring, we will combine automated scoring, reputation systems, and complaint tracking with manual verification and review processes.
- To maintain a scalable and flexible architecture that can adapt to future improvements like analytics, fraud detection models, and smart recommendation systems for large informal labour markets.

RELATED WORK

Several studies have looked into the digitization of India's unorganized labour sector. Each study aims to tackle specific challenges like job discovery, trust, payment security, and accessibility. However, most solutions focus on individual problems and do not offer a comprehensive service model. Jadhav et al. introduced ServiceArc, an Android app designed to reduce financial exploitation and improve hiring efficiency by connecting labourers, contractors, and customers using multilingual and location-based features [1]. While the system enhances basic accessibility, it lacks a solid framework for local trust. It does not use AI for reputation analysis and has no way to address rating manipulation or long-term worker credibility.

Bhasker Rao et al. created a web-based system for hiring daily-wage workers aimed at temporary job placements, especially in the post-pandemic era [2]. Though the platform makes job discovery easier, it uses basic matching methods and does not tackle trust validation, fraud prevention, or worker verification beyond manual processes. Thomas et al. sought to formalize the unorganized labour sector by launching a web platform that uses Unique Identification Numbers (UINs) to tackle delayed payments, access to insurance, and legal awareness [3]. Myageri et al. developed KarmikConnect, a mobile app that aims to increase worker visibility and trust through document-based verification [4]. However, the system does not have ways to manage rating bias, resolve disputes, or analyze behavioural patterns, which limits its ability to maintain long-term trust. Kamble et al. used machine learning to recommend jobs based on worker skills [5]. While this method enhances the relevance of job recommendations, it focuses too narrowly on matching accuracy and overlooks broader issues like fraud detection, trust modeling, community engagement, and fairness across the system. Nirmal et al. created LabourLink, a mobile solution that emphasizes real-time labour sourcing using geolocation services for urban areas [6]. The system is effective for immediate hiring needs but is mainly urban-centric. It has limited focus on rural inclusivity, long-term trust building, or smart verification. Kumar et al. proposed a scalable framework to improve accessibility, affordability, and trust for skilled workers [7]. While the framework is technically strong, it mainly targets skilled and

digitally literate users and does not address the challenges faced by semi-literate or illiterate workers, who make up a large part of the unorganized workforce. Finally, Hasin offered a critical review of the government-led e-Shram portal, which focuses on registration and welfare linkage rather than interactive job discovery or trust-based hiring processes [8]. The study highlights the need for systems that move beyond data collection to genuinely support employment and trust formation. In summary, existing solutions lack a unified approach that integrates AI-based trust modeling, job-worker matching, fraud detection, and accessibility support into a single system. These shortcomings highlight the need for a smart, AI-driven service model that addresses trust, fairness, and inclusivity as interconnected elements rather than separate issues.

PROPOSED AI-BASED SYSTEM

A. System Overview

The proposed system is designed as an intelligent service model rather than a traditional application platform. It integrates data-driven intelligence with modular service components to support trust, matching, and user interaction.

B. Architecture Description

- Interaction Layer: Enables multilingual and AI-assisted communication through web and conversational interfaces.
- Presentation Layer: Manages REST API operations and secure request routing.
- Business Logic Layer: Controls authentication, validation, job management, reputation handling, and notifications.
- AI & Intelligence Layer: Hosts machine learning models, anomaly detection engines, LLM-based semantic services, and intelligent recommendation systems.
- Data Layer: Stores operational data, processed features, and training datasets for AI models.
- Security Layer: Ensures authentication, authorization, integrity, and auditability across the system.
- Operating Environment: Supports scalable execution using cloud infrastructure and external AI and messaging services.

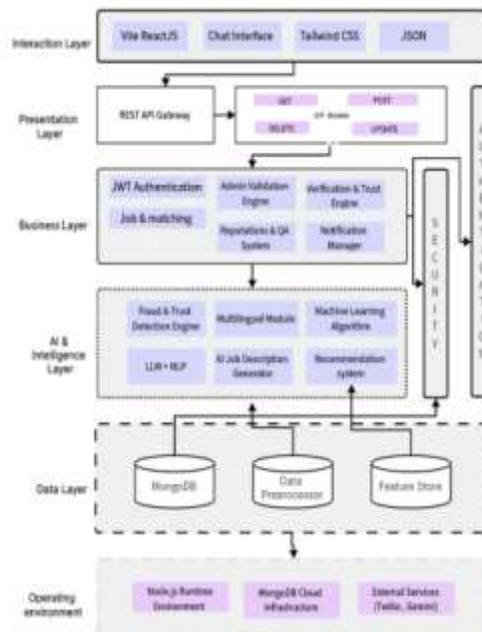


Fig. 2. High-Level Architecture of the Proposed AI-Based Service Model

C. AI-Powered Trust and Fraud Detection

To improve trust, the system employs a hybrid approach combining supervised learning and anomaly detection. Features include registration patterns, document metadata consistency, job cancellation frequency, rating variance, and login behaviour.

The feature vector is

$$x = [f_r, f_d, f_c, f_v, f_l]$$

Fraud likelihood is estimated using ensemble-based models:

$$P(\text{fraud}) = \frac{1}{N} \sum_{i=1}^N T_i(x)$$

Profiles exceeding a risk threshold are flagged for administrative review, ensuring accountability.

D. LLM-Based Semantic Job–Worker Matching

Job descriptions and worker profiles are transformed into dense embeddings using LLM-based encoders. Similarity is computed using cosine similarity:

$$\text{Similarity}(J_e, W_e) = \frac{J_e \cdot W_e}{\|J_e\| \|W_e\|}$$

E. AI-Assisted Job Description Generation

Many clients struggle to write clear and complete job descriptions because of language barriers or limited literacy. To tackle this issue, the proposed system includes a generative AI module that converts informal text or spoken input into structured job information. Users can describe what they need in simple local language or short phrases. The AI then creates a detailed job description, identifies the necessary skills, estimates the expected job duration, suggests a suitable budget range, and provides a basic safety checklist. This method improves job clarity, reduces communication gaps between clients and workers, and increases the accuracy of matching jobs with workers, all without needing any technical knowledge from the user.

F. Multilingual Intelligent Assistance

To improve accessibility and usability, the system has a multilingual conversational assistant that supports users in their local languages. This assistant helps users understand job details, worker profiles, ratings, and reputation scores in an easy and conversational way. It also guides users through platform rules, verification steps, and complaint or dispute procedures. By allowing interaction in familiar languages and simple words, this feature lowers the digital barrier for semi-literate users and makes sure that the system stays inclusive, easy to use, and clear for a diverse group of users .

CONCLUSION

This paper presents the design of an AI-based service model for the unorganized labour sector. By combining machine learning, anomaly detection, and large language models, the proposed system tackles important challenges related to trust, fraud prevention, matching efficiency, and digital inclusion. Instead of replacing human decision-making, the model treats AI as a support tool that improves fairness, scalability, and accessibility. The proposed structure shows how new AI technologies can lead to sustainable digital change in informal labour markets.

REFERENCES

- [1.] Jadhav, A., Atre, P., Andhare, A., Chaturvedi, U., Boraste, P. P., &Medhane, D. V. (2023). ServiceArc: A Systematic Approach towards Daily Wage Labour Management through an Automation System. 2023 4th International Conference for Emerging Technology (INCET).
- [2.] Bhasker Rao K, Angelin Sneha V, Humera Tasneem, & Lahari Tummalapalli. (2022). Daily-Wage Worker Hiring System. International Journal of Creative Research Thoughts (IJCRT), 10(4).
- [3.] Thomas, G., Mascarenhas, S., Michael, M., Patil, P., Badgujar, C., &Rukhande, S. (2024). Digitalizing Unorganised Labour Sector. 2024 IEEE 3rd International Conference on Data, Decision, and Systems (ICDDS).
- [4.] Myageri, V., Shetty, N., Adyanthaya, A. G., Achar, S., & Prajwal, C. A. (2024). KarmikConnect: Revolutionizing the Daily Wage Labour Market. International Journal of Advanced Research in Computer and Communication Engineering, 13(5).
- [5.] Kamble, A., Tambe, S., Bansode, H., Joshi, S., & Raut, S. (2023). Job Recommendation for Daily Paid Workers using Machine Learning. International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), 3(16).
- [6.] Nirmal, M. D., Navagire, R., Lahamge, G., Kusalkar, N., &Kandekar, A. (2025). LabourLink-On-Demand Labour Sourcing Web App. International Journal of Advanced Research in Science, Communication and Technology (IJARSCT), 5(7).
- [8.] Hasin, R. (2024). Prosthetics of the Indian State: The e-Shram Portal for Unorganized Workers in India. MA New Media & Digital Culture, University of Amsterdam.
- [9.] Kumar, G., Kumari, D., Bux, Q., Memon, M., & Baloch, Z. (2025). Architectural Framework for Scalable On-Demand Service Aid Platform. International Journal of Innovations in Science & Technology (IJIST), 07(02), 1132-1144.