

ShramSaathi: A Skill-Based Digital Platform for Blue-Collar Worker Employment and Job Matching

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Abstract - The informal labor market constitutes a substantial segment of the global workforce; however, blue-collar workers continue to face significant barriers in accessing reliable and efficient employment opportunities through existing digital platforms. Conventional job portals predominantly rely on resume-driven hiring mechanisms, which are inherently unsuitable for skill-oriented professions that require practical demonstration rather than formal documentation. To address these limitations, this paper proposes *ShramSaathi*, a comprehensive web-based employment platform specifically designed to bridge the gap between skilled workers and potential employers through a skill-centric and proximity-aware matching framework. The proposed system integrates multiple parameters, including worker skills, experience, reputation scores, and geographical location, to generate accurate and relevant job recommendations. Furthermore, the platform incorporates multilingual support to enhance accessibility for diverse user groups and introduces video-based skill demonstration features to establish trust and transparency in the hiring process. The system is implemented using React.js for the frontend, Spring Boot for backend services, and MySQL for efficient data management. Experimental evaluation conducted on a representative dataset demonstrates that the proposed approach significantly reduces job search time and improves matching efficiency compared to traditional resume-based recruitment systems. The results highlight the potential of *ShramSaathi* to transform digital hiring practices in the informal labor sector by enabling inclusive, efficient, and skill-driven employment opportunities.

Index Terms - Blue-Collar Workforce, Skill-Based Hiring, In-formal Labor Market, Job Recommendation System, Web-Based Platform, Employment Matching

I. INTRODUCTION

Digital recruitment platforms have significantly transformed employment processes by enabling structured, large-scale, and efficient hiring mechanisms. Widely used platforms such as LinkedIn and Indeed primarily rely on resume-driven evaluation systems, where candidates are assessed based on educational qualifications, certifications, and formal work experience. While such approaches are effective for white-collar professions,

they are inherently inadequate for blue-collar occupations that emphasize practical skills over formal documentation. The informal labor sector, which includes professions such as electricians, plumbers, carpenters, mechanics, and construction workers, constitutes a substantial portion of the workforce, particularly in developing economies. Despite its scale, this sector remains largely underserved by existing digital recruitment systems. Workers often depend on informal channels such as local contractors, word-of-mouth referrals, and personal networks to secure employment. These methods suffer from several limitations, including lack of transparency, inconsistent job availability, limited geographic reach, and absence of reliable skill verification mechanisms. From the employer's perspective, the hiring process is equally challenging, as there is no standardized method to evaluate the practical competencies and reliability of workers prior to engagement. This mismatch between worker capabilities and employer requirements highlights a critical research gap in current digital hiring ecosystems. With the rapid proliferation of smartphones and increasing internet penetration, there exists a significant opportunity to design technology-driven solutions that cater specifically to the needs of the informal labor market. Leveraging these advancements, this paper proposes *ShramSaathi*, a web-based job platform designed to facilitate efficient and trustworthy connections between skilled workers and employers. The proposed system adopts a skill-centric and proximity-aware approach to job matching, incorporating multiple parameters such as worker skills, experience levels, reputation scores, and geographic location to improve recommendation accuracy. Additionally, the platform introduces innovative features such as multilingual support to enhance usability across diverse populations and video-based skill demonstration to enable transparent and verifiable representation of worker capabilities. The key contributions of this work are summarized as follows:

- Design and development of a skill-oriented digital job portal tailored for blue-collar workers
- Integration of video-based skill verification to enhance trust and transparency in hiring
- Implementation of location-aware job discovery using map-based services
- Development of a multi-parameter job matching mechanism based on skills, experience, reputation, and proximity
- Empirical evaluation demonstrating improved job matching efficiency and reduced search time

The remainder of this paper is organized as follows: Section II reviews related work, Section III presents the proposed system architecture and methodology, Section IV discusses experimental results, and Section V concludes the paper with future research directions.

II. RELATED WORK

Digital recruitment systems have evolved significantly with the emergence of online professional networking and job portals. Platforms such as LinkedIn and Indeed primarily rely on resume-centric hiring mechanisms, where candidates are evaluated based on educational qualifications, certifications, and structured work experience. While such systems are effective for formal employment sectors, they fail to adequately address the requirements of informal labor markets, where practical skills and hands-on expertise are of greater importance [4]. The informal economy represents a substantial portion of the global workforce, particularly in developing countries, as highlighted by reports from the International Labour Organization (ILO) [1]. However, the integration of this workforce into digital hiring ecosystems remains limited. Gig-based platforms such as TaskRabbit and Urban Company have attempted to bridge this gap by enabling service-oriented hiring. Despite their contributions, these platforms often impose commission-based models, which can significantly reduce worker earnings and limit financial inclusivity. Government-led initiatives such as the eShram portal aim to digitally register unorganized workers and provide access to welfare schemes [5]. While these systems contribute to worker identification and policy support, they lack critical functionalities such as real-time job discovery, direct employer-worker interaction, and intelligent job matching mechanisms. Recent research has explored the application of advanced technologies to improve employment matching in informal sectors. Geospatial job matching approaches emphasize the importance of location-aware systems for improving accessibility and reducing search overhead [2]. Similarly, studies incorporating secure digital identity frameworks using blockchain and IoT highlight the need for trustworthy verification mechanisms in skill-based hiring environments [3]. Furthermore, machine learning-based talent acquisition frameworks demonstrate the potential of skill-oriented matching models in improving recruitment efficiency [4]. Despite these advancements, existing systems and research efforts do not provide a unified solution that integrates skill verification, geospatial matching, and trust-building mechanisms into a single platform tailored for blue-collar workers.

A. Research Gap

Despite the proliferation of digital recruitment technologies, several critical challenges persist in the context of informal labor markets:

- **Platform Incompatibility:** Conventional recruitment platforms primarily focus on formal qualifications and structured resumes, making them unsuitable for workers whose expertise is predominantly skill-based rather than academic [4].
- **Skill Verification Challenges:** There is a lack of scalable and standardized mechanisms to validate practical, hands-on skills without requiring physical presence or manual inspection, leading to inefficiencies in hiring [3].
- **Limited Geospatial Integration:** Existing platforms do not effectively leverage high-precision location-based services to support hyper-local job discovery, which is essential for blue-collar employment scenarios [2].
- **Trust and Transparency Issues:** Informal hiring processes often suffer from the absence of reliable reputation systems, structured feedback mechanisms, and transparent communication channels, resulting in reduced trust between workers and employers [1].

To address these limitations, the proposed system, *ShramSaathi*, introduces an integrated framework that combines video-based skill verification, structured skill profiling, geospatial job discovery, and a transparent, multi-parameter job matching model. This holistic approach aims to enhance efficiency, accessibility, and trust in digital hiring for the informal labor sector.

III. METHODOLOGY

A. Proposed System

The *ShramSaathi* platform provides the following functionalities:

- Worker registration and skill profiling
- Skill assessment through questionnaires
- Video-based skill verification
- Location-based job discovery
- Job application management
- Employer-worker chat communication
- Multilingual support (English, Telugu, Hindi)
- Voice-based job search for accessibility
- Wage recommendation system for fair compensation
- Community feedback features including likes and comments

These features allow workers to demonstrate practical abilities while enabling employers to evaluate candidate credibility.

B. System Architecture

The system follows a three-layer architecture consisting of presentation, application, and data layers. The architecture is shown in Figure 1.

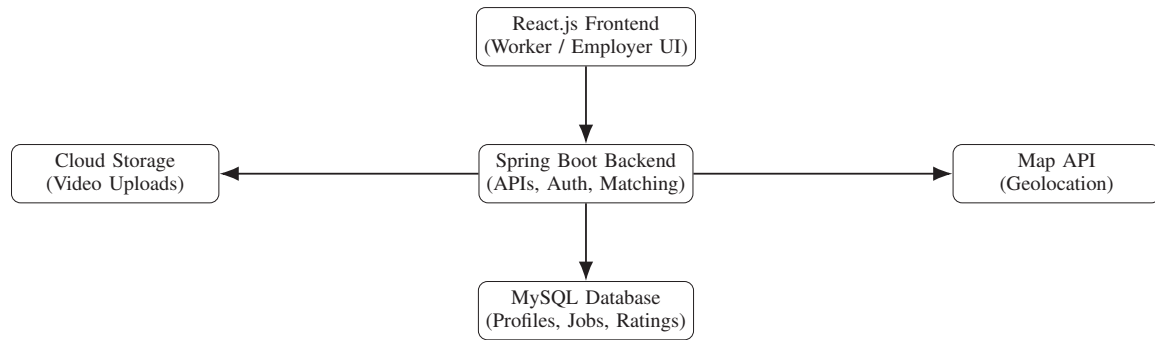


Fig. 1. Decoupled three-layer architecture with geospatial and media service integration.

C. Video-Based Skill Verification

In blue-collar professions, effective candidate evaluation relies heavily on the demonstration of practical skills rather than theoretical knowledge. Traditional digital recruitment systems lack mechanisms to assess such hands-on expertise remotely, leading to increased uncertainty and potential mismatches in hiring decisions. To address this limitation, the proposed ShramSaathi platform incorporates a video-based skill verification module that enables workers to showcase their competencies through visual demonstrations. This approach enhances transparency and allows employers to make informed hiring decisions based on observable performance. The verification workflow is defined as follows:

- 1) **Video Capture:** The worker records a short demonstration video illustrating task-specific skills relevant to the job role.
- 2) **Optimized Upload:** The recorded video undergoes client-side compression to reduce file size and is securely transmitted to the backend via authenticated API requests.
- 3) **Secure Storage:** The uploaded video is stored in a cloud-based storage system with role-based access control to ensure data privacy and restricted access.
- 4) **Employer Evaluation:** Employers access and review the video through the platform interface, enabling direct assessment of the worker's practical abilities prior to hiring.

This video-based verification mechanism reduces information asymmetry between workers and employers, enhances trust, and improves the accuracy of candidate selection. Additionally, it enables scalable and remote skill evaluation, making it particularly suitable for informal and geographically distributed labor markets.

D. Job Matching Model

To ensure effective and accurate candidate selection, a multi-factor ranking algorithm is proposed to prioritize workers based on a weighted aggregate score. The model integrates multiple attributes, including skill compatibility, reputation, experience, and geographic proximity, thereby enabling a comprehensive evaluation of candidate suitability.

Let x denote a candidate worker for a given job requirement. The overall matching score is defined using the following piecewise objective function:

$$Score(x) = \begin{cases} \sum_{i=1}^4 w_i f_i(x), & \text{if } D \leq r \\ \left(\sum_{i \in \{1,2,4\}} w_i f_i(x) \right) - \lambda(D - r), & \text{if } D > r \end{cases} \quad (1)$$

where D represents the geographical distance between the worker and the job location, and r denotes the predefined search radius.

The individual components of the scoring function are defined as follows:

- **Skill Similarity** ($f_1(x) = S$): Computed using cosine similarity between the job requirement vector and the worker's skill vector, enabling accurate matching of required competencies [4].
- **Reputation Score** ($f_2(x) = R$): Represents the normalized historical performance rating derived from user feedback and past job completions [4].
- **Proximity Factor** ($f_3(x) = \frac{1}{1+D}$): A distance-based metric derived using the Haversine formula, which prioritizes candidates located closer to the job site [2].
- **Experience Level** ($f_4(x) = E$): Quantifies the worker's industry experience, normalized to ensure consistency across different job categories [4].

The parameters w_1, w_2, w_3, w_4 represent the relative importance (weights) assigned to each factor, satisfying the constraint $\sum_{i=1}^4 w_i = 1$. These weights can be tuned based on application requirements to balance the influence of different attributes.

The penalty coefficient λ is introduced to discourage selection of candidates located beyond the acceptable search radius r . In such cases, the proximity factor is excluded, and a linear penalty proportional to the excess distance ($D - r$) is applied.

This formulation ensures that candidates within the preferred geographic range are evaluated holistically, while those outside the range are penalized to maintain efficiency in hyper-local job matching scenarios. The proposed model effectively balances skill relevance, trustworthiness, experience, and spatial constraints, thereby improving the overall quality and reliability of job recommendations.

Algorithm 1 Proximity-Aware Skill-Based Job Matching

```

1: Input: Worker list  $W$ , Job requirement  $J$ , search radius  $r$ 
2: Output: Ranked list of candidate workers
3: for each worker  $w \in W$  do
4:    $S \leftarrow \text{computeSkillSimilarity}(w, J)$   $\triangleright$  Value in  $[0,1]$ 
5:    $D \leftarrow \text{haversineDistance}(w.\text{location}, J.\text{location})$   $\triangleright$  Distance
      in km
6:    $R \leftarrow \text{normalizedRating}(w)$   $\triangleright$  Value in  $[0,1]$ 
7:    $E \leftarrow \text{normalizedExperience}(w)$   $\triangleright$  Value in  $[0,1]$ 
8:   if  $D \leq r$  then
9:      $\text{Score} \leftarrow w_1S + w_2R + w_3 \frac{1}{1+D} + w_4E$ 
10:  else
11:     $\text{Score} \leftarrow w_1S + w_2R + w_4E - \lambda(D - r)$   $\triangleright$  Penalty for
      exceeding radius
12:  end if
13: end for
14: Sort workers in descending order of  $\text{Score}$ 
15: Return top- $k$  ranked candidates
    
```

E. Job Recommendation Algorithm

To efficiently recommend suitable workers for job postings, the ShramSaathi platform implements a proximity-aware recommendation algorithm that integrates multiple factors, including skill similarity, geographic distance, historical ratings, and experience. This approach ensures that recommended candidates are not only qualified but also accessible within a reasonable travel distance.

Algorithm Explanation:

- **Skill Similarity (S):** Calculated from structured skill tags and assessment scores, using methods such as cosine similarity or TF-IDF on worker skill vectors.
- **Distance (D):** Computed using the Haversine formula to accurately measure geospatial separation between worker and job locations.
- **Rating (R) and Experience (E):** Normalized to the range $[0,1]$ to maintain consistency in the scoring function.
- **Radius-Based Adjustment (r and λ):** Workers located beyond the specified radius r are down-ranked by applying a linear penalty $\lambda(D - r)$, ensuring relevance to hyper-local job requirements.
- **Weight Factors (w_1, w_2, w_3, w_4):** Allow customization of the relative importance of each parameter according to employer preferences or platform policies.

This algorithm effectively balances skill relevance, reputation, experience, and proximity, enabling precise, fair, and efficient recommendations in blue-collar employment contexts.

F. System Workflow

Figure 2 illustrates the primary interaction flow between workers and employers on the ShramSaathi platform. The workflow is designed to be intuitive and accessible, accommodating users with varying levels of digital literacy.

The workflow emphasizes skill demonstration, real-time job discovery, and direct communication, enabling efficient and transparent hiring in informal labor markets.

G. Location-Based Job Discovery Model

Geospatial proximity is a critical factor in hyper-local job matching. Let the coordinates of a worker be $W = (lat_w, lon_w)$

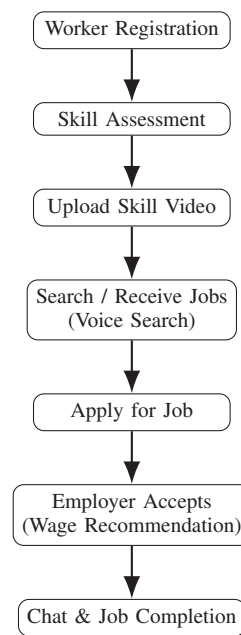


Fig. 2. Worker–Employer interaction workflow for the ShramSaathi platform.

and the coordinates of a job be $J = (lat_j, lon_j)$. The platform computes the great-circle distance d between the two points using the Haversine formula:

$$a = \sin^2\left(\frac{\Delta lat}{2}\right) + \cos(lat_w) \cos(lat_j) \sin^2\left(\frac{\Delta lon}{2}\right), \quad (2)$$

$$d = 2R \cdot \arctan 2\left(\sqrt{a}, \sqrt{1-a}\right), \quad (3)$$

where $R \approx 6371$ km is the Earth’s radius. The computed distance d is incorporated into the job matching score, with shorter distances yielding higher priority through the $\frac{1}{1+d}$ term.

H. Voice-Based Job Search for Accessibility

To accommodate workers with limited literacy or typing skills, ShramSaathi integrates a voice-based job search module. Workers can submit queries such as “Show electrician jobs near me,” which are processed using Speech-to-Text (STT) technology via the Google Speech Recognition API. The transcribed query is then evaluated by the job matching algorithm, facilitating seamless and inclusive access to relevant job postings.

I. Wage Recommendation System

In informal labor markets, wage disparities often arise due to lack of standardized compensation guidelines. To address this, ShramSaathi provides a wage recommendation module that suggests fair compensation based on worker skills, experience, and regional labor rates. This feature assists employers in offering equitable pay and promotes consistency and transparency in remuneration.

TABLE I
 FEATURE COMPARISON WITH EXISTING PLATFORMS

Feature	LinkedIn	Urban Company	ShramSaathi
Resume-based hiring	Yes	Partial	No
Skill assessment	Limited	Yes	Yes
Video verification	No	No	Yes
Location discovery	Limited	Area-based	GPS-based
Employer chat	Yes	Limited	Yes
Multilingual support	Limited	Limited	Yes
Voice-based job search	No	No	Yes
Wage recommendation	No	No	Yes
Commission charges	No	High	None
Worker rating system	Yes	Yes	Yes

IV. RESULTS AND DISCUSSION

A. Feature Comparison

Implementation The ShramSaathi prototype follows a decoupled microservices architecture [4]:

- **Presentation Layer:** Developed with React.js as a Progressive Web App (PWA) to ensure low-bandwidth accessibility [6].
- **Logic Layer:** Implemented via Spring Boot services, utilizing JWT (JSON Web Tokens) for stateless authentication and BCrypt for cryptographic credential hashing [7].
- **Persistence Layer:** A normalized MySQL instance manages relational data, while demonstration videos are handled via an S3-compatible cloud storage interface with signed URL access control [4].

Security measures include JWT-based authentication, BCrypt password hashing, and role-based access control for employer vs worker endpoints.

B. Experimental Dataset

A simulated dataset representing workers and job postings was generated to evaluate system performance.

TABLE II
 EXPERIMENTAL DATASET CONFIGURATION

Parameter	Value
Worker Profiles	150
Job Postings	70
Job Categories	10
Skill Categories	18
Cities Covered	5
Test Duration	14 days

C. Performance Evaluation

We evaluated the prototype using the simulated dataset above. Metrics considered: job recommendation accuracy (precision@k), average job discovery time, employer response rate, and worker engagement.

D. Job Discovery Time Comparison

Interpretation: By prioritizing location and skill match, ShramSaathi reduces average discovery time from 12 hours (manual) to 4 hours in our simulated runs.

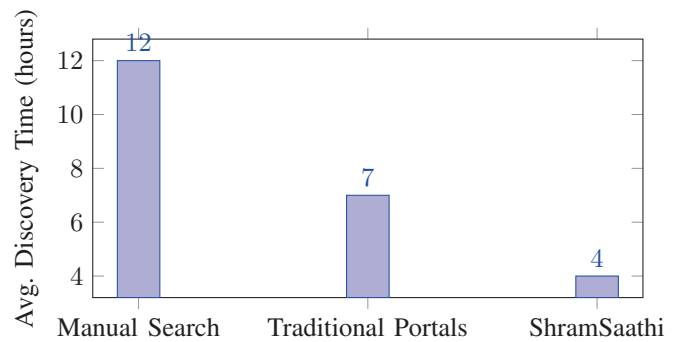


Fig. 3. Average job discovery time comparison.

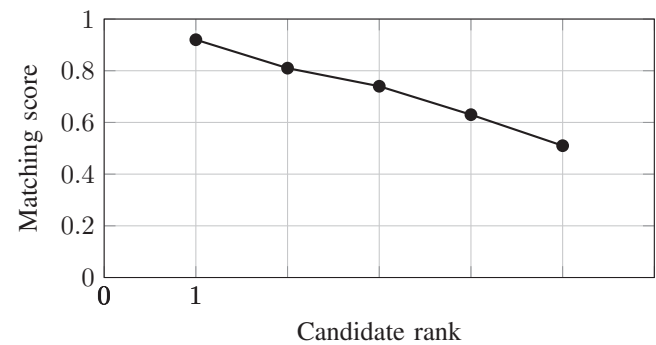


Fig. 4. Example matching scores for top candidates (higher is better).

E. Recommendation Score Distribution

Interpretation: Scores reflect combined skill, rating, distance, and experience. Employers typically review top-3 candidates; the score gap helps fine-grained prioritization.

F. Scalability Considerations

The system architecture supports horizontal scaling:

- Spring Boot services can be containerized and scaled via Kubernetes.
- MySQL can be sharded/replicated for read-heavy operations (use read-replicas for recommendation queries).
- Caching (Redis) for frequently accessed job lists and computed distances reduces latency.
- Video storage relies on object storage (S3-compatible) with CDN for delivery.

G. Security and Privacy

Security design includes:

- JWT for stateless auth and token refresh policies.
- BCrypt hashing for passwords.
- Role-based access control; signed URLs for video access.
- Minimal personal data exposure in public profiles; opt-in consent for video sharing.

H. Discussion

The prototype demonstrates that integrating video verification and geospatial-aware recommendation substantially improves job discovery efficiency and employer confidence. The weighted model is interpretable and adjustable for different job types (e.g., emergency repairs vs scheduled tasks).

V. CONCLUSION AND FUTURE ENHANCEMENTS

A. Limitations

- Current dataset is simulated; real-world deployment would reveal additional edge-cases.
- The weighted scoring model is heuristic — future work will integrate ML models (rankers like LambdaMART or BERT-based embeddings for skills).
- Video review is manual; adding automated skill inference (computer vision + action recognition) is a future direction.

B. Future Work

- Collect pilot real-world data (10–50 workers) and refine weights.
- Add A/B testing and online learning for weight optimization.
- Expand to payment handling and escrow for increased worker protection.

C. Conclusion

This paper presented ShramSaathi, a skill-focused digital platform for blue-collar employment. By combining video-based

verification, structured skill profiling, geospatial discovery, and a proximity-aware recommendation algorithm, the platform improves job discovery efficiency and employer trust. The architecture and prototype demonstrate feasibility; future work will focus on ML-driven matching and real-world pilots.

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