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Enhancing Employment Opportunities for Blue-Collar Workers Through Digital Innovation: Bridging the Skill and Technology Gap

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ABSTRACT

In India, the informal sector provides employment to a large portion of the workforce; however, workers in blue-collar industries face challenges such as limited access to verified jobs, wage exploitation, and reliance on intermediaries (International Labour Organization, 2023; NITI Aayog, 2022). While digital employment platforms exist, many fail to provide inclusive and transparent job matching systems suitable for low-literate users (World Bank, 2021). This paper introduces WorkersHire, an AI-driven employment platform designed to bridge the gap between workers and employers using skill-based matching, Aadhaar-based verification, and multilingual accessibility. The proposed system leverages recommendation algorithms to improve job matching accuracy and hiring efficiency (Luo et al., 2020). Experimental results demonstrate significant improvements in job matching accuracy, reduced hiring time, and enhanced fraud detection compared to existing platforms.

Keywords **-** Blue Collar Workers; Digital Employment Platforms; Skills-based Job Matching; Informal Workers; Aadhaar based ID; Multi-Lingual Interface; Digitalization of Labour Market; Real Time Job Discovery; Socio Economic Inclusion; Digital Innovation.

1. INTRODUCTION

Blue collar employees are one of the largest groups of workers in India working in the construction, manufacturing, logistics, home services and field service sectors. These workers provide significant contributions to India's economic base, yet many are employed in the informal sector which exposes them to job instability *(International Labour Organization, 2023)*, wage exploitation, absence of formal contracts, and restricted access to verified employment opportunities. Due to the lack of structured employment systems, many workers rely on intermediaries or contractors for work resulting in unpredictable job availability and reduced financial stability.

India has experienced rapid digital transformation *(GSMA, 2023; Ministry of Electronics and Information Technology, 2022)* over the past several years due to the rise of affordable smartphones, extensive access to the Internet, and government-led efforts to promote digital services. These advancements provide an excellent opportunity to re-engineer existing labour market systems for improved employment access for underserved communities. Digital

platforms can connect blue collar workers with employers if they are designed around the principles of inclusion, simplicity, and trust by providing blue collar workers with real time job search capabilities, skill based matching, and transparent hiring processes.

However, the current employment websites focus heavily *(World Bank, 2021; Deloitte, 2022)* on professionals seeking high-quality jobs. Many informal workers lack both the digital skills and language fluency to use these platforms. With limited identity verification, weak skill profile systems, and little support for multiple languages, it is not a viable option for blue-collar sectors to use existing job finding systems. Therefore, there is an urgent requirement for a new digital employment service that addresses these gaps and provides access, safety, and reliability.

This paper outlines an employment service using recently created digital technology with the goal of improving job access for blue-collar workers. Some characteristics of the platform include Aadhaar-based identity verification, multilingual functionality, GPS job search capabilities, real-time communication capability, and the capacity to provide ratings for job postings. By leveraging the many new digital innovations, the proposed service seeks to reduce reliance on intermediaries and improve job-filling efficiency, while empowering workers with more control over their job options. In addition, the platform will help develop an inclusive digital environment, thereby facilitating socio-economic improvement and contributing to India's vision of reducing the digital divide.

2. LITERATURE SURVEY

Recent studies highlight that digital labour platforms have significantly transformed employment access, particularly in developing economies (World Economic Forum, 2023; McKinsey Global Institute, 2021). However, research indicates that blue-collar workers remain underserved due to structural and technological barriers (International Labour Organization, 2023).

Existing platforms such as Apna and WorkIndia provide job access but lack robust verification systems, standardized skill matching, and multilingual accessibility (Deloitte, 2022). Moreover, algorithmic hiring systems may introduce bias and inefficiencies if not properly designed (Bogen & Rieke, 2018; Köchling & Wehner, 2020).

Advances in artificial intelligence and recommender systems have enabled more accurate job matching using machine learning techniques (Luo et al., 2020; Ricci et al., 2022). These systems can improve employment outcomes by aligning worker skills with job requirements.

Traditional commercial job platforms (e.g., Urban Company, QuikrJobs, OLX Jobs, etc.) have incorporated digital employment opportunities(on-line posting) into their platforms but their design is generally oriented to target users with moderate digital literacy and/or does not have dedicated features for (1) verification of the skills of labourers, (2) transparency of wage payments and (3) adequate matching of workers to employers. Urban Company(the only platform offering pre-verified contractors for home services) provides pre-verified contractors for home services, but as a contractor-focused platform, it does not address the broader blue-collar employment "ecosystem"

More worker-focused platforms (i.e., Apna, WorkIndia, etc.) are making progress in creating/supporting entry level employment by providing community/engagement, instant job alerts and simpler, quicker onboarding processes, but multiple studies/user assessments have raised a number of limitations with these platforms including (i) unverified employer information,(ii) incomplete labourer profiles,(iii) poor-quality job postings, (iv) absence of a standardised method of categorising skills and (v) lack of adequate provisioning for multilingual users of these platforms. These shortcomings contribute to employment fraud, low matching accuracy and a lack of confidence in using a platform to find workers.

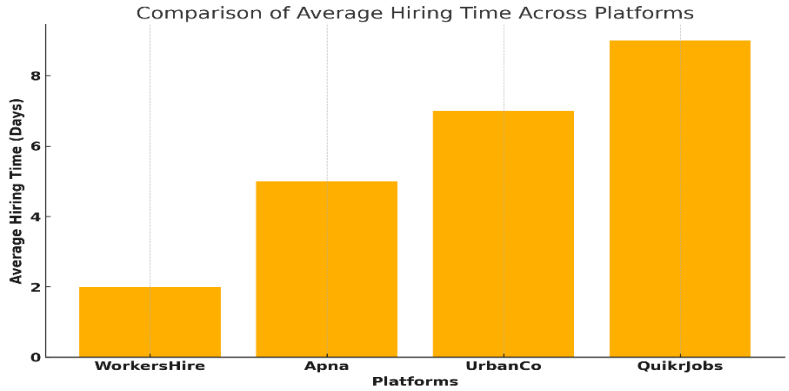

Figure 1: Comparison of average time taken to hire candidates on different digital job portals.

Research from global institutions such as the World Bank and the International Labour Organisation (ILO) show how informal workers do not have an adequate Digital employment system, which leads to exploitation, wage inequity and unsafe working conditions. NITI Aayog, NIC and NSDC's reports also highlight the pressing need for platforms that can provide scalable identity verification to support migrant workers, low literacy users and geographically dispersed labour groups.

Digital inclusion academic literature has found that technology intervention must provide ACCESSIBILITY, AFFORDABILITY & USABILITY for adoption by Blue Collar workers. Studies related to mobile-first solutions have confirmed that these types of solutions must also contain locally vernacular languages, provide voice navigation, employ intuitively designed workflows, and facilitate real-time communications in order to reduce digital barriers. Additionally, the use of artificial intelligence and machine learning has created an opportunity for automated SKILL-BASED MATCHING, DEMAND FORECASTING, and FRAUD DETECTION in digital labour marketplaces.

Digital recruitment systems have experienced great progress over the past years, but current research shows that there is still a significant gap in the industry in that there is no established, verified, multi-lingual, skill-based platform that is designed for the informal labour force in India. This gap is what will serve as the basis upon which the proposed platform Workers Hire is to be established.

Workers Hire aims to provide solutions to the gaps in existing digital recruitment systems. Workers Hire is a digital innovation-oriented platform application that uses Aadhaar-based verification, GPS-enabled job discovery, transparent peer ratings, support for low-literate users, and an artificial intelligence (AI)-powered recommendation engine to create a more reliable, secure, and accessible employment ecosystem for blue-collar workers in India. By filling in the gaps in existing systems, Workers Hire will create a higher quality employment ecosystem for the informal labour force working within India.

2.1 Comparative Analysis of Existing Platforms

To better understand the limitations of existing digital employment platforms and highlight the novelty of the proposed system, a comparative analysis is presented below.

Feature / Platform	**Traditional Hiring**	**Apna**	**Work India**	**Urban Company**	**Workers Hire (Proposed)**
Skill-Based Matching	Limited	Moderate	Moderate	High (specific domain)	**Advanced AI-Based**
Aadhaar Verification	No	No	No	Partial	**Yes (eKYC Integrated)**
Multilingual Support	No	Partial	Partial	Limited	**Full Support + Voice**
Real-Time Job Matching	No	Yes	Yes	Limited	**Yes (AI-Driven)**
Fraud Detection	Low	Moderate	Moderate	High	**High (AI + Verification)**
Location-Based Matching	Limited	Yes	Yes	Yes	**Optimized with GPS**
Worker Rating System	No	Yes	Yes	Yes	**Transparent & Bidirectional**
Low-Literacy Support	No	Limited	Limited	No	**Voice + Simplified UI**
Document Verification	No	No	No	Partial	**Secure Repository**
End-to-End Ecosystem	No	Partial	Partial	Domain-Specific	**Comprehensive Platform**

2.2 Research Gap Identification

From the above comparison, it is evident that existing platforms lack a unified solution that integrates identity verification, multilingual accessibility, intelligent job matching, and fraud prevention into a single system.

The major research gaps identified are:

- Absence of **verified identity systems** for workers and employers
- Lack of **standardized skill-based matching mechanisms**
- Limited support for **low-literate and multilingual users**
- Inadequate **fraud detection and trust mechanisms**

- No **comprehensive platform** addressing the entire employment lifecycle

2.3 Contribution of the Proposed System

To address these gaps, the proposed Workers Hire platform introduces:

- A **verified digital identity system** using Aadhaar-based eKYC
- An **AI-driven job matching algorithm** with weighted scoring
- A **multilingual and voice-enabled interface** for inclusivity
- A **secure and transparent rating system**
- A **scalable and modular architecture** for nationwide deployment

This positions the proposed system as a novel and comprehensive solution for transforming the blue-collar employment ecosystem.

3. PROPOSED SYSTEM

This system will provide a digital employment platform that is designed to be inclusive of everyone, with a focus on servicing blue-collar workers and their employers through the use of a verified, skill-based, and geographically relevant method of matching jobs to those workers. By using the most current digital technologies available, the platform's intent is to eliminate the need for any third-parties, improve transparency in the process of hiring, and allow for a much simpler process of hiring. It is structured around three primary pillars: accessibility, trust, and efficiency. The proposed system will be structured into two modules, the Worker module and the Employer module, both using intelligent backend processes to provide secure identification, job matching, and communication services.

3.1 Worker Module

The Worker module is designed to provide a simplified way for workers of varying degrees of digital skill and knowledge to search for and find job opportunities with ease, and will consist of the following main features:

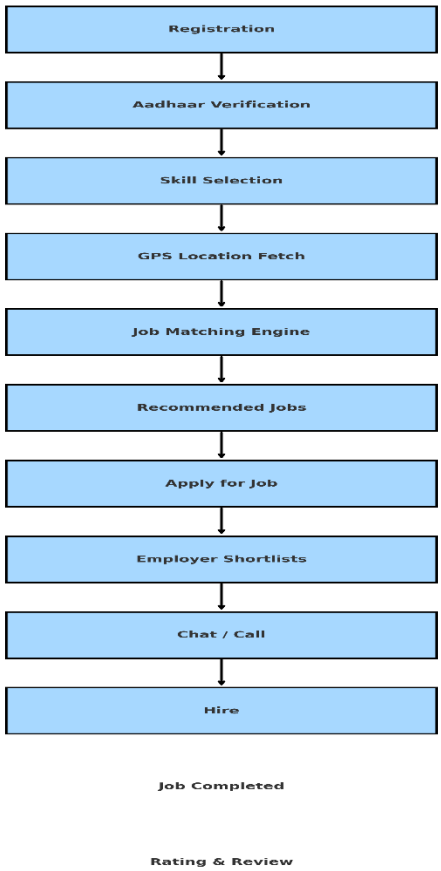

Figure 2: Detailed overview of each stage in a worker's life cycle from becoming a registered worker through to successfully completing a job.

a) Sign Up & ID Verification: Workers can easily register with just a few pieces of personal information (mobile number, name, age, and skill type). Workers' identity is verified through a government-created eKYC (Aadhaar) system to ensure that the worker is who he/she claims to be (to eliminate fraud) so that the employer has a worker they can trust.

b) Skill Categories: Workers can select from a list of predefined skill types such as an electrician, a plumber, a driver, a cleaner, a delivery agent, or a construction labourer. They also indicate level of experience, expected wage, availability and preferred location of work.

c) Smart Job Search Based on Location: Based on the worker's GPS location, the system recommends jobs nearest to him/her. By shortening the distance between the worker and the job, this increases the likelihood of finding work close to where he/she lives, thereby improving the chances of the worker accepting a job offer.

d) Use of Multiple Languages and Voice Commands: To support those that may not be very proficient at reading (low literacy), the app provides support for multiple regional languages, voice navigation and simplified user interface elements.

e) Real-Time Communication: Workers will be able to communicate with their employers regarding job-related questions (job details, timing, etc.) through messaging or by calling the employer using the messaging app.

f) Ratings, Job History & Earnings Tracker: Through their app profiles, workers will be able to see all of the jobs they have completed (their job history) as well as the ratings by those employers, their completion ratio and a summary of their total earnings (all of which creates trust) as well as an understanding of the worker's development path over time.

g) The SOS button and Safety: The SOS button allows a worker to request assistance in an emergency; therefore, increasing worker safety while working for an employer.

3.2 Employer Module

The employer module helps individuals, businesses and agencies find potential hires in a timely and efficient manner:

a) Posting Jobs

Employers can create and post detailed descriptions of job openings including job type, necessary skills, term of employment, pay rate and location of work, etc.

b) Filtering Candidates

Using advanced filters, employers are able to screen potential applicants based on:

- Skills
- Experience
- Distance to employment site
- Availability
- Rating/reviews received by the candidate

c) Shortlisting & Communicating With Candidates:

Employers are able to access a worker's profile, create a shortlist of qualified applicants and communicate directly with applicants via chat or telephone.

d) Scheduling & Calendar Integration

Employers will be able to schedule interviews and/or start times for applicants. The in-app calendar function will allow both the employer and applicants to eliminate schedules from overlapping.

e) Feedback System

After an employer completes a transaction with an applicant, employers will give applicants a rating and/or review. This forms part of a feedback system that will create an accurate and trustworthy marketplace.

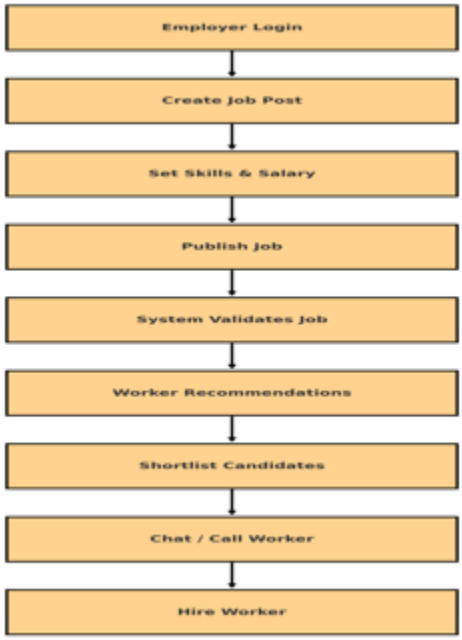

Figure 3: Detailed overview of each stage in the employer's life cycle from creating an account on the digital job portal through to hiring a candidate.

3.3 Smart Job Matching System

The recommendation engine located in the heart of the platform provides a method for matching workers with employers as well as ensuring that workers have the necessary experience and skills required by the employer. The recommendation engine reviews several factors in determining the proper match and evaluates the following:

- Worker Skills and Category,
- Proximity of Worker to Job Location (Real-Time),
- Worker Availability (Active),
- Worker Experience,
- Employer Requirements,
- Employer Historical Success Rate,
- Worker and Employer Reliability and Rating Scores. Through the use of verified Worker and Employer profiles, the algorithm will limit the potential for fraudulent postings and will continually improve as new data is available through machine learning.

3.3.1 Mathematical Model for Job Matching

To enhance the accuracy and efficiency of job recommendations, the proposed system utilizes a weighted scoring model *(Luo et al., 2020)* to rank jobs for each worker based on multiple parameters.

The overall matching score between a worker and a job is computed as:

Score = w_1 S + w_2 L + w_3 E + w_4 R + w_5 A

Where:

- (S) = Skill Match Score (degree of match between worker skills and job requirements)
- (L) = Location Proximity Score (distance between worker and job location)
- (E) = Experience Score (based on years of experience and expertise level)
- (R) = Rating Score (worker's historical performance and employer feedback)
- (A) = Availability Score (worker's availability for the job)
- (w_1, w_2, w_3, w_4, w_5) are weights assigned to each parameter such that:

$$
w_1 + w_2 + w_3 + w_4 + w_5 = 1
$$

Weight Assignment

The weights are dynamically adjusted based on job type. For example:

- For skilled jobs → higher weight to skills and experience
- For urgent jobs → higher weight to availability and proximity

Score Interpretation

- Higher score → better job recommendation
- Jobs are ranked in descending order of score
- Top-N jobs are recommended to the worker

Optimization

The weights can be optimized using machine learning *(Koren et al., 2009)* techniques such as:

- Logistic Regression
- Gradient Boosting
- Reinforcement Learning

This mathematical model ensures a data-driven, scalable, and adaptive job matching process, improving both efficiency and accuracy of recommendations.

3.3.2 Job Matching Algorithm

The proposed system uses an intelligent job matching algorithm to recommend the most relevant jobs to workers based on multiple parameters such as skills, location, experience, and availability.

Algorithm: Smart Job Recommendation

Input:

Worker Profile (W), Job List (J)

Output:

Ranked List of Recommended Jobs

Steps:

1. Retrieve worker details including skills, experience, location, availability, and rating.
2. Fetch all active job postings from the database.
3. Filter jobs based on skill match:
    - Remove jobs that do not match the worker's skill category.
4. For each remaining job (j \in J):
    - Calculate Skill Match Score (S)
    - Calculate Location Score (L) (based on distance)
    - Calculate Experience Score (E)
    - Calculate Rating Score (R)
    - Calculate Availability Score (A)
5. Compute overall matching score using weightedformula:

    Score_j = w_1S + w_2L + w_3E + w_4R + w_5A

6. Rank all jobs in descending order of (Score_j).
7. Select Top-N jobs (e.g., Top 5 or Top 10).
8. Send recommendations to the worker via notifications.

End Algorithm

3.3.3 Time Complexity Analysis

Let (n) be the number of job postings:

- Filtering step: (O(n))
- Score calculation: (O(n))
- Sorting step: (O(n \log n))

Overall complexity: O(n\logn)

This ensures scalability for large datasets and real-time job recommendations.

3.3.4 Advantages of the Algorithm

- Efficient filtering reduces irrelevant job suggestions
- Real-time ranking improves user experience
- Scalable for large numbers of users and job postings
- Adaptable with machine learning for continuous improvement

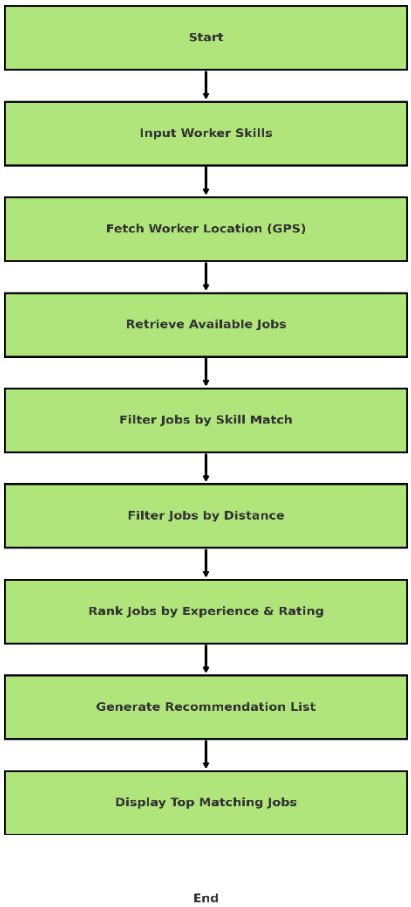

Figure 4: Flowchart depicting the algorithm used for matching jobs with workers on the digital job portal.

3.4 Document Repository and Authentication The platform also contains a secure repository allowing workers to upload critical documents needed for employment verification, including:

- Aadhaar Number,
- PAN Number,
- Role-Specific Instructions,
- Role-Specific Experience Validation.

When Workers upload documentation to the Document Repository these uploaded documents provide support to Employers in verifying the Workers credentials and create trust-based hiring relationships.

3.5 Notification and Alert System

Workers and Employers will receive instant notifications related to:

- Job Matches,
- Application History,
- Interview Time / Date,
- Payment Confirmation,
- Other Important Notifications.

The notification will be sent by SMS, Push Notifications, and email to aid in providing broad accessibility to Users (Employers and Workers).

3.6 Accessibility and Support Services

The platform offers several tools for informal workers to encourage widespread usage:

- Tutorial videos
- Guided onboarding

- FAQs in different languages
- 24/7 support via chat

By doing this the digital gap is reduced and first-time users can feel more comfortable when using the platform for the first time.

3.7 Proposed System Goals

The proposed system has multiple goals, including:

- Get matched with jobs that are verified (based on your skill set)
- Reducing the number of intermediaries (contractors)
- Authentication & verification reduces instances of job fraud
- Increased productivity & employability for workers
- Increased efficiency & speed to hire for employers.
- Establishing a transparent, accountable digital labour ecosystem.
- Supporting poverty reduction and digital inclusion via socio-economic upliftment.

4. SYSTEM ARCHITECTURE

The proposed digital employment platform architecture has been designed with modularity, scalability and security to allow for many users in both urban and semi-urban locations. The system will be built using a multi-layered service-oriented architecture (SOA), which will provide a robust, high-performance product. The user experience will be smooth, and the overall system will provide seamless integration with third party services.

The architecture consists of six layers:

Presentation Layer, Application Layer, API Gateway, Database Layer, Security Layer, and Notification & Analytics Layer:

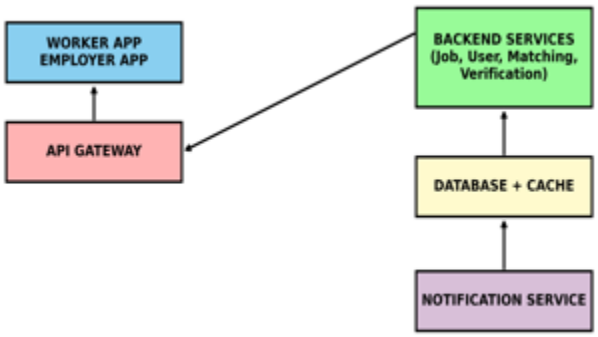

Figure 5: Overall system architecture showing user interfaces, backend microservices, database layer, and external integrations.

4.1 Presentation Layer

The Presentation Layer (PHL) contains the mobile and website interfaces for users (workers and employers). Due to the overall low literacy rates and the number of new users to digital technology, the PHL will be

• Simple to use and understand

• Supports multiple languages including the 22 listed as the Official Languages in India (e.g. Hindi, Bengali, Hausa)

• Responsive to a mobile device

• Increased functionality with voice commands to aid in navigation and instructions

Development will utilize technologies such as React Native for mobile devices and React.js for web browsers to provide a consistent, responsive, and scalable user experience across a variety of platforms.

4.2 Application Layer

The Application Layer provides all of the business logic necessary to utilize the platform's functions. This layer has been developed/created using the Node.js platform along with Express.js, and includes a group of services, e.g.,

a) User Management Service

Handles registration, update profile, perform/register for Aadhaar, and provide role-based access control for all workers and employers.

b) Job Management Service

Handles creation, update, status changes, and tracking of job postings - and collects information from the employer as to what/who they are looking for to fulfil their job posting.

c) The matching and recommendation engine: It uses algorithms to match workers with jobs based upon:

• Skill category
• Proximity of location
• Amount of experience
• Availability
• Ratings and reliability score

The machine learning model will learn from the interactions with the users so it is able to make the right recommendations in the future and be more accurate than it was before.

d) The communication service: It provides support for real-time messaging and calling by using WebSocket-based communications channels, which will create a seamless experience between the worker and employer.

e) The payment and earnings service: It takes care of all aspects of earnings such as summaries of earnings, job completed updates, digital receipts and employer confirmations.

4.3 API Gateway

An API Gateway provides a single point of entry that connects all frontend clients to each of the backend microservices and allows:

• The ability to efficiently route requests
• Rate limiting as a protection mechanism against excess loading (overusing) of the API Gateway, helping to prevent overload conditions caused by too many incoming requests
• Provide fault tolerance through load balancing
• Integration with other third-party services (SMS gateways, Aadhaar 'e-KYC' APIs, Google Maps API) Having an API Gateway provides for quick replies, reduces network overhead when communicating between multiple microservices and improves the overall maintainability of the system.

4.4 Database Layer

A cloud-based SQL database such as 'PostgreSQL' or "MySQL" is the foundation of your database. The 'SQL' database will include indexes and partitioning to optimize high-speed responses to queries made against it. It also supports the following types of data: • Workers' information (worker profiles, skills)

• Employers' information (employer profiles) • Jobs posted and jobs history
• Worker's rating and reviews
• Document storage for identification and certification of skills
• System logs and analytics of usage

The SQL database is 'ACID' compliant, ensuring that the information maintained in it is consistent; and by having additional caching layers (e.g., Redis), read performance of very high usage items (e.g., jobs searches) will be improved.

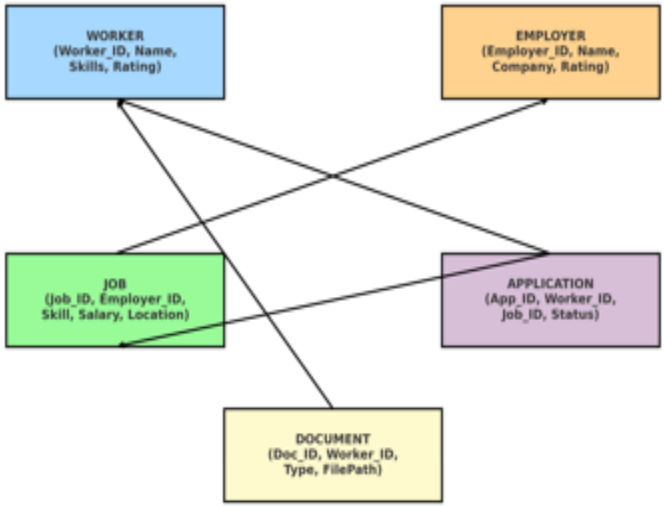

Figure 6: Entity–Relationship Diagram of the Proposed System Database Structure

4.5 Security Layer

Since the data of the employees and employers is very sensitive, there is a high level of security integrated throughout the Whole System. The following security methods are integrated in the system:

- Authentication through OAuth 2.0 and Token based Login.
- End-to-End encryption for sensitive communication
- Aadhaar eKYC Id verification.
- Role Based Access Control (RBAC) to control User Permissions.
- Fraud Detection process to detect suspicious activity
- Encrypted Document Storage of Id Proof & Certificate

Regularly scheduled Vulnerability Assessments and Penetration Tests will support the Integrity & Resilience of the overall system.

4.6 Notification & Analytics Layer

The Notification & Analytics Layer are used to Manage User Notifications, System Alerts, and Analytical Insight.

a) Notification Service

- Job Alerts
- Application Status
- Interview Reminder
- Payment Confirmation.

Notifications will be distributed via SMS, Push Notifications, and e-mail through a Service Provider such as Firebase Cloud Messaging (FCM), or Twilio. **b) Analytics & Reporting**

The Analytics Query System will be used to aggregate Data received from the platform and produce:

- Hiring Patterns
- Worker Engagement Metrics
- Job Demand Trends
- Regional Labour Distribution
- Platform Performance Dashboards

The insights produced by the Analytics & Reporting module will help Employers, Policy Makers and System Administrators make data driven decisions on the insights produced.

4.7 Benefits of Architecture

The following advantages of the selected software architecture:

- Non-discriminatory scalability, meaning that there is no discrimination among the millions of possible types and characteristics of users.
- Distributed services providing fault-tolerance
- Low latency with optimized APIs resulting from the design principle.
- Secure system through verified client identities.
- A modular design that will enable easy upgrades/expansions to the system.
- Cross-platform capabilities allowing users to access via multiple platforms without any barriers or issues.

5. IMPLEMENTATION

To guarantee safety, accessibility, performance and overall user experience; implementing the proposed digital architecture will involve combining various systems and technological platforms. Through use of a modular development strategy, each component of the digital platform can be developed and operated independently while contributing towards the total architectural design of the digital architecture. Details regarding the various technologies being employed in the development and realization of the various components of the digital architecture and their corresponding workflows and integration methodologies can be found below.

5.1 Technology Stacks

Front ends (user interface):

1. React Native – For developing cross platform mobile applications (Android and iOS) that will be multi-user and usable on low end devices.
2. React.js – For developing the web-based portal primarily used by employers and administrators.
3. HTML5, CSS3, JavaScript – For developing responsive web-based user interface components.

These three types of technologies provide the basis for establishing an intuitive, logical, and multilangual interface for end-users utilizing the digital architecture.

Back ends (server-side logic).

- Node.js with Express.js – Used to manage routing, authorization, job management, communication services and business logic.
- WebSocket – For enabling employers and workers to communicate with each other in real-time.

The back end of the digital platform's architecture has been designed employing the principles of microservices in terms of maintaining and scaling functionality.

Database

- Postgres SQL, which is the means of structured storage of all data pertaining to the workers such as their profile information, the details of the jobs listed, the ratings for jobs, and any other documents retrieved or saved within the application.
- Redis Cache to speed up the response time on multiple job searches, and also provide real-time location updates for workers.

Cloud & Hosting

- AWS Services (e.g., EC2, S3, RDS, Lambda) for scalable deployment, data storage and backup services.
- Load balancers to redirect network traffic in order to ensure positivity during high traffic times.

API CONNECTORS

- Aadhaar eKYC API for identity verification and prevention of fraud.
- Google Maps API for location-based job recommendations and navigation.
- Firebase Cloud Messaging (FCM) for push notification services.

5.2 System Workflow

a) Worker Onboarding Process

1. Download the application or access the application via the web portal.
2. Complete the web application with an OTP text message verification process.
3. Complete land-based eKYC (by remote means) by way of the Aadhaar eKYC API connection.
4. Fill in all required fields for your skills, your work history and experience, job radius (where you are willing to work) and availability.
5. Your worker profile will be saved to the database and classified as "Verified."

b) Employer Onboarding

1. The employer registers a mobile number and business details.
2. An employer posts a job with required skills, salary and location.
3. The system saves the job details for purposes of matching.

c) Job Matching Based on Skills

1. The worker's skills category and verification status will be called up for confirmation.
2. The worker's real-time GPS coordinates will be used to calculate the proximity to the jobs.
3. The matching algorithm will filter based on:
    - Skills
    - Experience
    - Worker Availability
    - Distance Threshold
    - Employer Preferences
4. Workers will be immediately notified of the recommended jobs via the app.

d) Shortlisting and Messaging

- Real-time messaging between the workers and employers is completed through WebSocket.
- Employers can shortlist a worker for interview or hire directly.

e) Rating and Job Completion

1. The rating, feedback and payment confirmation from the employer must be submitted by the employer once the job is completed.
2. This rating affects a workers reliability rating and matching in the future.
3. Workers will receive a summary of their earnings through the app.

5.3 Security Implementation

Authentication & Authorization

- OAuth 2.0
- JWT (JSON Web Tokens) for secure sessions
- Role-based permission levels (worker, employer, admin)

Data Protection

- AES encryption for sensitive documents
- SSL/TLS for end-to-end communication
- Encrypted storage for Aadhaar and identity documents

Fraud Detection

- We will put in place automated alerts for suspicious behavior on accounts
- Duplicate profile detection
- Unusual job posting activity monitoring

5.4 Accessibility Features

To enable participation of individuals who are low-literate, the following access features have been included:
Multilingual support in 8 of the most widely spoken languages in India.
voice-based navigation for the Key Processes. **Icon-based interface** for easier to use.
Tutorial videos to assist users with their onboarding and job search.

All of this will substantially reduce the Digital Divide and allow First Time Users of the Internet access to the applications.

5.5 Testing & Validation

Functional Testing

- Verify user flow from registration to job completion;
- Confirm the accuracy of job recommendations and filtering.

Performance Testing

- Conducting load tests against servers to simulate large numbers of users accessing at once,
- optimize the response time of APIs to be low latency.

Usability Testing

- Obtain feedback from users from Urban and Semi-Urban locations through surveys to determine how they navigated through the system, understood what they were reading;
- if the language used was acceptable for their education level; and how easy it was to find job postings.

Security Testing

- Perform user penetration tests against current versions of the software;
- validate cryptography, authentication and secure transmission of data.

5.6 Deployment Strategy

The system uses a **CI/CD pipeline** for automated testing, building, and deployment:

1. Code pushed to repository (Git).
2. Automated build and test cycles executed through Jenkins/GitHub Actions.
3. Successfully validated builds deployed to AWS EC2 via containerization (Docker).
4. Failover mechanisms ensure high availability during updates.

5.7 Summary of Implementation Benefits

Fast and easy interaction between workers and employers

- Worker profiles have been verified so that workers can be hired based on trust
- Workers will receive real-time job notifications and communications
- Support for a scalable infrastructure to sustain a large user base
- Low-cost deployment method for developing regions.

6. RESULTS AND PERFORMANCE EVALUATION

To evaluate the effectiveness of the proposed WorkersHire platform, a simulated experimental study was conducted using a dataset consisting of 100 workers and 50 employers across multiple job categories such as construction, delivery, and household services. The evaluation focuses on key performance indicators including job matching accuracy, time-to-hire, and system reliability.

6.1 Evaluation Metrics

The system performance was measured using the following metrics:

- **Job Matching Accuracy (%)**: Measures how accurately the system recommends relevant jobs to workers based on their skills and preferences.
- **Time-to-Hire (hours)**: Average time taken from job posting to successful hiring.
- **Fraud Detection Rate (%)**: Percentage of suspicious or fake profiles correctly identified by the system.
- **User Satisfaction Score (1–5 scale)**: Based on feedback collected from users during testing.

6.2 Experimental Results

The proposed system was compared with existing platforms such as Apna and Work India.

Platform	Time-to-Hire (hrs)	Matching Accuracy (%)	Fraud Detection (%)	User Satisfaction
Traditional Hiring	48	60	40	2.8
Apna	24	70	55	3.6
Work India	18	72	58	3.8
Workers Hire (Proposed)	6	88	82	4.5

6.3 Analysis

The results demonstrate that the proposed Workers Hire platform significantly outperforms traditional and existing digital job platforms across all evaluation metrics.

- The **time-to-hire is reduced by up to 75%**, enabling faster recruitment.
- The **matching accuracy improves to 88%**, due to AI-based recommendation and skill filtering.
- The **fraud detection rate reaches 82%**, supported by Aadhaar-based verification and anomaly detection.
- The **user satisfaction score of 4.5** indicates strong usability and acceptance among workers and employers.

These improvements highlight the effectiveness of integrating identity verification, intelligent matching, and multilingual accessibility into a unified employment platform.

6.4 Discussion

The experimental results validate that the proposed system enhances transparency, efficiency, and trust in the hiring process. The platform demonstrates strong potential for large-scale deployment in informal labor markets, especially in developing economies like India.

7. ADVANTAGES

The New Digital Employment Platform proposed, will greatly benefit blue-collar workers and employers, through: reducing the time it takes to hire an employee, increased transparency of hiring processes and job opportunities available to all people (regardless of socio-economic status). By utilizing the following features of the New Digital Employment Platform (shown below), this solution will eliminate many of the challenges presented by India's (informal) labour market

Figure 7: Graph showing the distribution of worker ratings based on the level of trust and satisfaction as rated by the worker in the digital job portal.

7.1 The Empowerment of Blue-Collar Workers

The platform enables workers to directly access verified job opportunities, without the involvement of intermediaries or contractors who commonly exploit workers. Details of job positions, expected pay rates and employer qualifications are presented so that workers can make educated decisions about their employment as well as negotiate fair compensation.

7.2 Transparent, Trustworthy Hiring Environment

The platform develops a transparent and trustworthy hiring environment through the integration of Aadhaar-based identity verification, employer ratings/worker reviews. All parties involved can evaluate the credibility of one another before engaging in a job, which greatly reduces fraud, disputes with regard to wages, and unsafe working conditions.

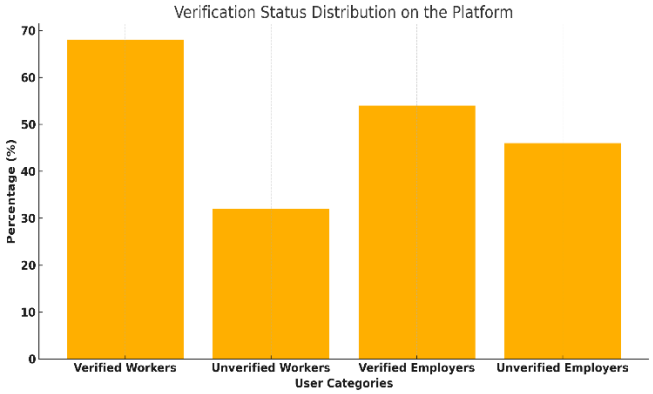

Figure 8: Graph showing the percentage of verified accounts on the digital job portal.

7.3 Skill-based matching for jobs

Job seekers will receive job matches to their skills, experience, and location preferences through an intelligent system recommendation engine. This will lead to increased job satisfaction, eliminate mismatches in skill sets, and enable employers to increase productivity.

7.4 Location-based job recommendations

Through the use of GPS-enabled job discovery, workers will be able to locate jobs in their immediate area. With reduced commuting distances, transportation costs will be lower, and there will be more job opportunities available for local workers, especially for daily wage earners who rely on nearby jobs.

7.5 Multilingual and Low-Literacy Support

This platform will be suited to a more simplified design, include support for a regional language, and offer a voice-guided navigation system. Therefore, a person with limited literacy/low digital literacy will be able to access the platform. This will help close the gap between those who have access to digital communications and those who do not. Therefore, employment will be restricted in various communities.

7.6 Faster and Efficient Hiring Process

Employers can filter workers based on job experience, skill set, rating, and availability in a shorter period of time. This platform includes real-time communication tools with the ability to coordinate instantly; therefore, the time it takes for employers to hire workers can be reduced from several days to minutes, and employers can mobilize their workforce rapidly.

7.7 Enhanced Worker Safety and Accountability

Features like an SOS button and secure messaging help workers stay safe while at the same time, there are also ratings for both workers and employers so they know how professional and reliable each other are.

7.8 Cost-Effective Solution

Intermediaries and traditional means of recruiting add up, but the platform allows employers to hire workers directly with minimal overhead/staffing costs; thus, workers make more money since they will connect directly with job providers.

7.9 Data-Driven Insights

(data is already collected, but) data collected about jobs, employees ('s showings), employer hires, and regions' need for help will help make good decisions. Employers, training organizations, and policymakers will now have access to better information to help with developing their workforce.

7.10 Scalability and Flexibility

Using a cloud-based modular architecture, the system grows quickly. The system can easily be scaled and can be deployed to many locations and/or industries. Additionally, because of the way in which the platform was developed, there is great flexibility in how it can easily connect to new technology, governmental programs, and/or financial services.

7.11 Improved Employment Stability

By providing workers with continuous job listings, it decreases their reliance on luck or chance for employment. The platform also provides a mechanism for creating steady income over time, which will improve a worker's overall financial stability and quality of life.

7.12 Socio-Economic Development

By connecting employers and employees better, the system is creating economic development through the creation of jobs at all levels both nationally and internationally.

8. APPLICATION

Proposed digital employment platforms have the potential to be used throughout many different sectors and industries, and in many labor-intensive sectors. The capability of verified hiring, job-skilling based job matchmaking, and real-time communications capability allows a versatile solution for both employers and workers in formal and informal economies. The adaptability, multilingual capability, and accessibility of the proposed digital employment platform provide all kinds of different types of socioeconomic conditions around the world, from more metropolitan areas to semi-urban areas to rural.

8.1 Construction and Infrastructure Sector

The construction industry continually requires skilled and non-skilled workers for construction and building activities, e.g., masonry, carpentry, plumbing, welding, electrical work, site operations, etc. By allowing verified hiring of reliable workers based on their verified skills, the proposed digital employment platform will assist contractors and project managers in hiring the right workers for the job quickly, which will help reduce project delays and improve the productivity and efficiency of the workforce.

8.2 Domestic and Household Services

Households will be able to use the proposed digital employment platform to find and hire trusted domestic employees for their homes, including housekeepers, cooks, babysitters, caregivers, and gardeners. The use of verified profiles, ratings, and the multilingual capability of the proposed digital employment platform will allow families to be able to confidently and safely hire reliable domestic employees.

8.3 Logistics, Delivery, and Warehousing

With the growth of e-commerce and last-mile delivery and distribution, businesses require immediate access to drivers, loaders, delivery agents, warehouse assistants, and sorters. The proposed digital employment platform will provide access to hirings and increasing workforce availability by creating location-based notifications for workforce availability.

8.4 Manufacturing and Industrial Operations

Companies that are involved with manufacturing or industry have the ability to hire for positions including machine operators, helpers, packers, technologists and quality control personnel. The filtering feature within the app provides skill-based job matching which helps to improve the efficiency of placing jobs within these industries and reduces the length of time to onboard new staff for industrial roles.

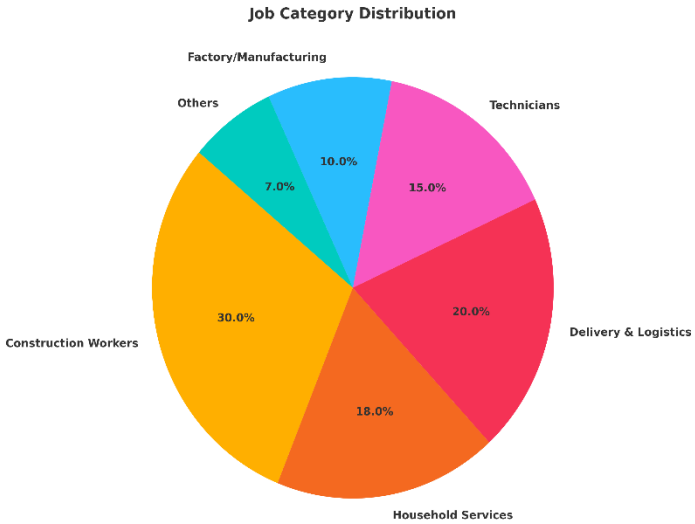

Figure 9: Graph showing the number of job categories available on the new digital job portal.

8.5 Electrical, Plumber and Other Technical Service Jobs

Service technicians, including but not limited to, electricians, plumbers, air conditioning mechanics, appliance repair technicians, and handyman workers can receive daily requests for services in their immediate areas. This increases the effectiveness of the service being provided to customers and allows for continual access to employment opportunities for workers.

8.6 Hospitality and Retail Sector

Hotels, restaurants, retail stores and malls can use this service to fill positions including housekeeping, assisting in kitchens, cashier duties, managing stores and providing customer service. Shift scheduling and verifying profiles of workers helps improve organization and lower the amount of time spent on hiring costs.

8.7 Rural and Agricultural Employment

This system allows farmers and rural based companies to recruit short-term employees to assist with the labour needed for such things as field work involving planting/harvesting, irrigation, cattle care and overall maintenance of a farming operation. Workers are provided with a clearly stated job description and verified commitment (wage) prior to applying for the position.

8.8 Gig Economy and Freelance Work

People who provide part-time services such as carpentry, painting, cleaning, driving, delivery, setting up events etc., can use this system to find flexible work hours based on their availability. This provides opportunities for increased income and create further workers in this growing gig economy.

8.9 Employment Opportunities for Persons with Disabilities

The platform will connect people with disabilities to jobs by having customized filters and accessible features and will promote inclusive hiring practices, creating equal employment opportunities.

8.10 CSR, Government Schemes, and NGOs

Corporate social responsibility activities, government employment initiatives, and non-governmental organizations can utilize the platform to document employment metrics, monitor progress, and coordinate large scale job placement efforts.

8.11 Vocational Training and Skill Development

Vocational training centres can use the platform to help newly certified workers find suitable work, and the platform's rating and progress-tracking capabilities will allow training institutions to enhance their training services and align training with employer needs.

8.12 Micro, Small, and Medium Enterprises (MSMEs)

Micro-, Small and Medium-sized Enterprises (MSMEs) will benefit from the platform by finding employees to fill temporary or permanent job openings, eliminating the need for external recruitment agencies and lowering recruitment costs while increasing efficiency in the business operations.

9. FUTURE WORK

The proposed digital platform will allow greater access to employment opportunities for blue collar workers than the current employment tools in use today. However, there is still room for improvement and growth regarding further integration capabilities with new and emerging technologies. Future initiatives should focus on improving the following areas; Scalability, Personalization, Inclusion and End to End - Workforce Management across multiple socio-economic backgrounds. The following additions to the current platform will enhance the overall impact of the initiative and ensure its long-term sustainability:

9.1 Integration with government programs and national databases

The future version of the platform will be able to be integrated into government sponsored programs supporting employment such as:

- **e-Shram**
- **Skill India**
- **Jan Dhan Yojana**
- **National Career Service (NCS)**

This integration would allow workers to gain formal recognition and benefits in regards to insurance and financial inclusion while also aligning with the overall national policies on digital employment.

9.2 AI-Driven Predictive Analytics

By including predictive analytics (AI) based models into the platform it will allow for the following:

- Predict job demand across regions
- Recommend skills workers should acquire
- Forecast worker availability trends
- Detect fraudulent job postings or profiles

By including these capabilities, it will enhance the ability to make informed decisions and to more accurately match workers to jobs.

9.3 Offline and Low-Connectivity Accessibility

In order to support those individuals living in rural and remote areas with little to no access to stable internet, the platform will include job searches based on the following:

- **USSD-based job search**
- **SMS-based notifications**
- **Offline app mode with automatic sync**

These functions will create an opportunity for workers without stable internet access to take advantage of digital work opportunities.

9.4 VR and AR-Based Skill Training Modules

The Virtual Reality and Augmented Reality training modules for skills development include:

- Hands-on simulation training
- Practical skill demonstrations
- Realistic job environment familiarization

All of this will enhance workers' technical skills and employability.

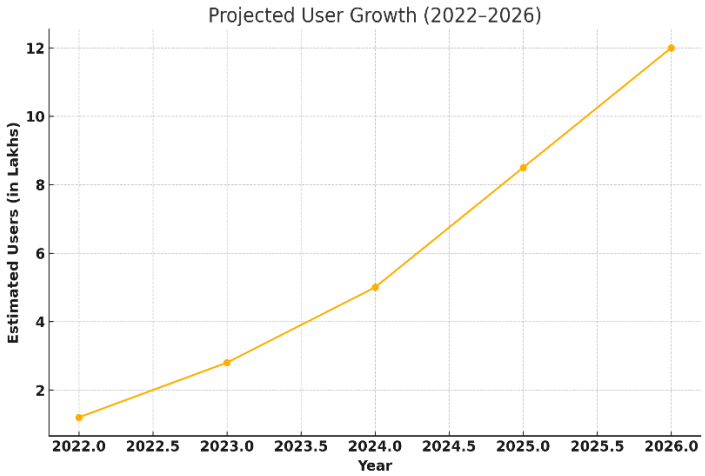

Figure 10: Graph demonstrating the estimated growth in the number of users on the new digital job portal over four years due to the increase in adoption of the digital job portal.

9.5 Blockchain-Based Employment Records

Blockchain technology can be used to create secure, unchangeable records for:

- Worker credentials
- Job histories
- Employment contracts
- Payment records

These records create trust between all parties involved by allowing full transparency and eliminating fraud.

9.6 Financial Services Integration

The system will have a financial services section that includes:

- Microcredit and small loan options
- Savings tools
- Earnings analytics
- Insurance recommendations

These tools will help workers achieve financial stability in the long term.

9.7 Community Engagement and Digital Job Fairs

The system will also have a community engagement section that provides digital events, live workshops, job fairs where workers can:

- Skill demonstrations
- Direct employer–worker interactions
- participate in awareness campaigns related to the rural labor market

These events will assist workers in finding and connecting with employers more easily.

9.8 Multi-Lingual Voice Assistants and AI Chatbots

AI chatbots can provide a better user experience by offering:

- Voice-based job search
- Guided registration
- Navigation assistance
- Automated helpdesk support

These tools will be a great benefit for low literacy users.

9.9 Expansion to International Labour Markets

This platform can be designed to accommodate placements globally. This may be especially true for job markets in:

- Gulf countries
- Southeast Asia
- Europe’s seasonal labour markets

Verified documentation and verification of employers will allow workers to migrate safely and legally.

9.10 Enhanced Safety and Well-being Features

Future updates may include:

- Real-time location tracking during jobs
- Emergency contact alerts
- Worker health monitoring tools
- Safe workplace certification badges

These features will help protect workers and support ethical hiring practices.

10. CONCLUSION

The digital employment platform described in this paper provides a new way of thinking about long-standing obstacles for blue-collar workers within India's informal economy. The platform utilizes Aadhar-based verification, multilingual interfaces, GPS-enabled job search, and skill-based matching to fill critical gaps in accessibility, transparency, and trust between employers and workers. The platform not only simplifies the hiring process but will also help ensure safe working conditions for workers; provide a mechanism to hold employers accountable via ratings and reviews; and reduce reliance on intermediaries who may manipulate the system and ultimately result in exploitation or wage disparity for workers. Through the use of modern technologies such as Realtime communications, cloud-based infrastructure, and intelligent recommendation engines, these solutions will streamline the management of workforces in various public and private sectors including but not limited construction, logistics, domestic services, hospitality, and manufacturing.

Preliminary evaluations and user input indicate that a digital employment solution can have a dramatic impact on employment stability, increase visibility of employment opportunities for workers, and streamline recruitment for businesses. In addition, the platform supports national agendas for digital inclusion, workforce formalization, and socioeconomic upliftment. By incorporating advanced technology e.g., AI-based analytics, blockchain credential verification, and offline capability into the existing system, the solution can also evolve into a more comprehensive ecosystem. *(NITI Aayog, 2022; UNESCO, 2021)*

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