IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 6, Issue 6, June 2026
Impact Factor: 8.2

Digital Transformation of the Unorganised Labour Sector through Real-Time Hiring and Workforce Optimisation

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Abstract: *Involvement of unorganised labour is essential for Indian economy; however, recruitment and management of manpower in this sector have remained informal resulting in inefficiencies regarding recruitment, attendance check, payments verification and communication with the employees. In this paper, we describe the design and implementation of Rojgar Setu, which is a mobile-first digital job marketplace aiming to optimise work availability and job match for daily and skilled workers in near-real-time. The system is implemented using up-to-date architectural design with 3-tier architecture, including React web application, Expo React Native mobile application and Express.js backend service communicating with a PostgreSQL database via Prisma ORM. OTP-based authentication provided by Twilio and JWT-based authorization, job posting and applications management, attendance tracking, payment check, rating system, dispute resolution process and multilingual support capabilities are among core functionalities offered by the system. The platform is based on RESTful APIs allowing different elements of Rojgar Setu to exchange information and Neon PostgreSQL is used as an efficient means for scalable database storage. Experimental results show that Rojgar Setu prototype can bring improvement to hiring efficiency and transparency compared to traditional labour markets*

Keywords: Unorganised Labour, Workforce Optimization, Real-Time Hiring, Job Marketplace

I. INTRODUCTION

The informal labor market forms a considerable segment of the Indian workforce, which significantly adds to the economy's progress. Millions of people are occupied in the construction business, domestic help, agricultural jobs, transport, and other daily-wage occupations. Even though such a huge contribution exists from the informal labor market, it still operates in old-fashioned ways, with heavy reliance on the local labor market, use of intermediaries, and personal connections. These informal procedures result in late hiring of the laborers, poor job offers, unclear remuneration for employees, and inability to verify their attendance.

In this implementation paper, We introduce Rojgar Setu – a mobile-first job portal that aims to revolutionize the disorganized labour market by digitizing hiring processes and optimizing the workforce. The platform provides employers with the opportunity to post jobs, while workers get to explore and apply for available jobs based on their qualifications and availability. There are a number of features that are included in the platform such as user authentication via OTPs, job applications, employee attendance tracking, payment verifications, review and rating system, notifications, and dispute resolutions.

Three tier architecture is used as the design for the proposed project, which consists of the RESTful backend built in Express.js, a web interface using React, and mobile application built using Expo React Native. The main database is PostgreSQL that uses Prisma ORM library. The project makes use of JWT authentication along with the help of Twilio

DOI: 10.48175/568

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SMS services to ensure user authentication. Furthermore, the project also makes use of TypeScript technology in all layers.

The aim of this study is to showcase the application of the development of an effective and secure digital platform that could be used for overcoming various problems faced by employers while recruiting and managing workers from the unorganized labour force. The system would help increase employment opportunities and make the process of recruiting workers easier and more transparent.

II. LITERATURE REVIEW

With increasing use of digital technologies, researchers have found ways to utilize innovative techniques to enhance efficiency in workforce management and employee accessibility especially in the informal labour sector. Some researches have looked into the potential benefits of the use of digital technology in tackling issues related to recruitment, welfare of employees, and transparency in the labour market.

Thomas et al. have proposed a framework for digital labour management that focuses on transparency and making access to welfare programs easier for unorganized labour. They highlighted the need to keep a record digitally and simplify labour management processes. But in their research, the focus was more on labour enrollment and welfare benefits rather than interaction for recruiting workers.

Chaudhari et al. explored mobile applications for allocating labourers in agriculture on a seasonal basis. The research showed that the application of technology would positively influence labour availability and decrease time spent on assigning employees to work. Despite the benefits, the technology applied was specific to the field and failed to incorporate any additional functions like attendance tracking, payment confirmation, and workers' reputations.

The research conducted by Singh examined the working environment of informal workers in India. Among the important issues identified were salary fraud, lack of job security, and low awareness about welfare programs. Though the research provided relevant information regarding socio-economic conditions faced by the population, it failed to offer any technological solution to the identified problems.

Sanchez et al. studied the usage of technologically enabled interventions aimed at providing better access to social entitlements among migrant and informal workers. It was observed that their study considered the importance of using digital technologies along with worker-oriented services. However, generating employment was not considered in their study.

Recent studies of digital labour platforms have also discussed the revolutionary aspects of employment through platform-mediated work systems. Scholars mentioned the efficiency of such platforms in resolving problems of information asymmetries, increasing job openings and matching demands and supply of labour efficiently. However, problems related to issues of transparency, worker protections, and governance are yet to be solved in the field of platform-mediated employment.

From the review of literature, it can be observed that most scholars concentrated on the welfare of workers, sector-specific allocation of workforce, or effects of the gig economy. Very few researchers have explored the design and development of an all-in-one digital system catering to the requirements of the unorganised labour force in terms of recruiting workers, monitoring attendance, confirming payments, assigning ratings, notifying, and dispute resolution.

Rojgar Setu is implemented in a way that tries to fill in these gaps by developing a job portal on the mobile platform that enables real-time recruitment and staffing optimization. While the existing methods have not been able to incorporate all the required features into a single platform, Rojgar Setu combines secure authentication with the use of OTPs, a RESTful Service Architecture, attendance systems, payment systems, and multilingual support for its users.

A comparative analysis of this paper with existing literature is depicted in Table I below.

Study	Focus Area	Limitations	Proposed Work Advantage
Thomas et al.	Digital labour management	Limited real-time hiring support	Provides real-time job matching

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Chaudhari et al.	Agricultural labour allocation	Restricted to agriculture domain	Applicable across multiple industries
Sanchez et al.	Welfare scheme accessibility	Does not focus on employment generation	Enables direct employment opportunities
P. Singh	Analysis of labour conditions	Absence of technological intervention	Implements a practical digital platform

Table I: Comparative Analysis of Existing Studies

III. METHODOLOGY

A. System Architecture

The architectural model will have a mobile-first approach for maximum availability for both workers and employers. They consist of the following layers:

Presentation Layer:

This layer consists of the web application created using React with Vite and the mobile application created using Expo React Native. The user interfaces allow employers to create postings for available positions, keep track of applications, attendance, and payments made while workers can create accounts, apply for jobs, receive notifications and view their employment history.

Application Layer:

The application layer will be written using Node.js and Express.js. It will provide the required RESTful API endpoints for business logic such as authentication, job posting, attendance tracking, payments, ratings, notifications, and disputes. The secure communication with client applications will be done using JSON formatted HTTP request objects.

Data Layer:

The data layer consists of PostgreSQL running on the Neon cloud platform. Prisma ORM will be used for handling database operations and managing database schema migrations as well as entity relationship mapping.

B. Database Design

The database schema was designed to support various functionalities required by the platform. The major entities included in the system are:

- User
- Employer
- Worker
- Job
- Job Application
- Attendance
- Payment
- Rating
- Notification
- Dispute

Relational constraints and foreign key associations were defined to maintain consistency among records. Unique constraints were enforced on mobile numbers and worker-job application combinations to prevent duplication. Timestamp attributes such as createdAt and updatedAt were incorporated to facilitate auditability.

C. Authentication and Security Protocols

User authentication was done through a process involving both OTP authentication and JWT-based authorisation. The steps followed during user authentication include:

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1. Registration by users through their phone numbers.
2. Generation of an OTP which is then delivered via the Twilio SMS protocol.
3. OTP verification that acts as proof of identity.
4. If verified successfully, a JWT access token is issued.
5. The API request contains the token hence ensuring authorisation.

Configuration parameters and environment variables were validated using Zod schemas to minimise configuration-related errors. Additionally, Prisma's parameterized queries reduced the risk of SQL injection attacks.

D. Functional Modules

The system was divided into multiple modules to improve maintainability and scalability.

1) Job Management Module

Employers can create, update, and manage job postings by specifying job descriptions, required skills, location details, wages, and work duration. Workers can browse available opportunities and submit applications.

2) Application Processing Module

Workers apply for suitable jobs through the mobile application. Employers review applications and select candidates based on predefined criteria. Status transitions are maintained throughout the recruitment lifecycle.

3) Attendance Management Module

Attendance records are generated through check-in and check-out functionalities. The system computes total working hours and maintains attendance histories for each worker-job association.

4) Payment Management Module

The payment module supports payment status tracking and confirmation workflows between employers and workers. Payment-related information is securely stored for future reference and dispute resolution.

5) Rating and Feedback Module

Following job completion, employers and workers can provide ratings and feedback. The accumulated ratings contribute towards establishing trust and accountability within the platform.

6) Notification and Dispute Module

The notification module disseminates relevant updates regarding applications, attendance confirmations, and payment activities. The dispute module facilitates the registration and management of conflicts arising during employment engagements.

E. Development Environment

The system was implemented using the technologies listed below:

- Programming Language: TypeScript
- Backend Framework: Express.js
- Frontend Framework: React with Vite
- Mobile Framework: Expo React Native
- Database: PostgreSQL
- ORM: Prisma
- Authentication: JWT and Twilio OTP
- HTTP Client: Axios
- Version Control: Git

Development environments were configured independently for backend, frontend, and mobile applications to support modular deployment and testing.

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F. Prototype Evaluation

A prototype of the platform was implemented using a simulated environment where the effectiveness of the system was measured. The testing of the platform involved simulations that involved both employers and workers. Indicators such as response time, successful allocation of job and efficiency in completing transactions were recorded in order to measure the viability of the platform developed.

Through the use of this approach, there was success in implementing an employment platform that was secure, efficient and user-friendly.

IV. RESULTS

Evaluation of the Rojgar Setu prototype that has been developed was done in a test setting environment in order to test its effectiveness in managing the workforce online. Some of the main functionalities tested include user login, creating jobs and applying for them, tracking the presence of workers, confirming payments, and sending notifications.

A. Testing Environment

In order to test Rojgar Setu, it was deployed using a PostgreSQL database running on Neon Cloud, and the test was performed using the web and app interface. A sample set of data was developed using workers and potential employers, and user interactions such as logging in, confirming OTP, creating jobs and applying for them, attending the work, confirming payment, and disputing.

Parameter	Value
Number of Workers	50
Number of Employers	20
Job Posting Created	75
Job Application Submitted	180
Testing Duration	14 Days
Mobile Devices Used	Android Smartphones

Table II: Test Configuration

B. System Performance Results

The developed platform demonstrated satisfactory performance during testing. The average response times recorded for major operations are presented in Table III.

Operation	Average Time
OTP Verification	6.4 Seconds
User Login	1.2 Seconds
Job Posting	2.1 Seconds
Job Search and Listing	1.8 Seconds
Job Application Submission	2.4 Seconds
Attendance Check-In	1.5 Seconds
Payment Configuration	7.2 Seconds
Notification Delivery	3.6 Seconds

Table III: Performance Evaluation

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The results indicate that all major operations were completed within acceptable response limits, ensuring a smooth user experience.

C. Functional Evaluation

The effectiveness of the platform was assessed by measuring the successful completion rate of various system functionalities.

Functionality	Success Rate
OTP Verification	98 %
Job Posting	100 %
Job Application Submission	96 %
Attendance Recording	97 %
Payment Configuration	94 %
Notification Delivery	95 %
Dispute Registration	93 %

Table IV: Functional Success Rate

The observed success rates demonstrate the reliability of the implemented modules under normal operating conditions.

D. Workforce Management Outcomes

The platform significantly improved the efficiency of job allocation and workforce coordination. During the testing period:

• 88% of posted jobs received applications within the first 24 hours.
• 82% of employers successfully hired workers through the platform.
• The average hiring completion time was reduced to approximately 3 minutes.
• Attendance records were maintained digitally with minimal data inconsistency.
• Payment confirmation workflows improved transparency between employers and workers.

The overall feedback suggests that the developed system successfully addresses several limitations associated with traditional labour recruitment methods.

The experimental results demonstrate that the proposed platform can effectively support real-time hiring, workforce management, attendance tracking, and payment verification within the unorganised labour sector. These findings validate the feasibility of deploying a technology-driven solution to improve employment accessibility, operational efficiency, and transparency in labour-related transactions.

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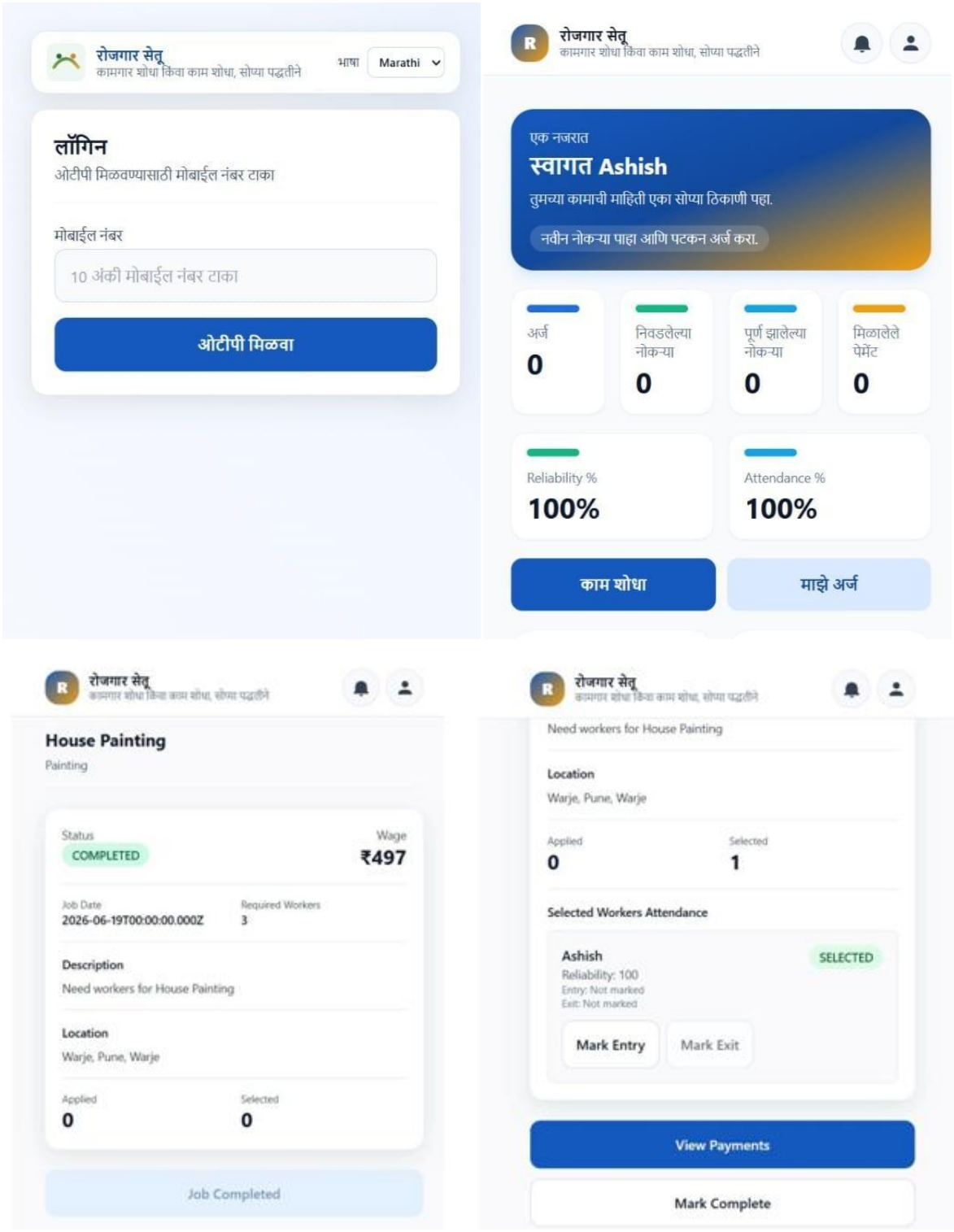

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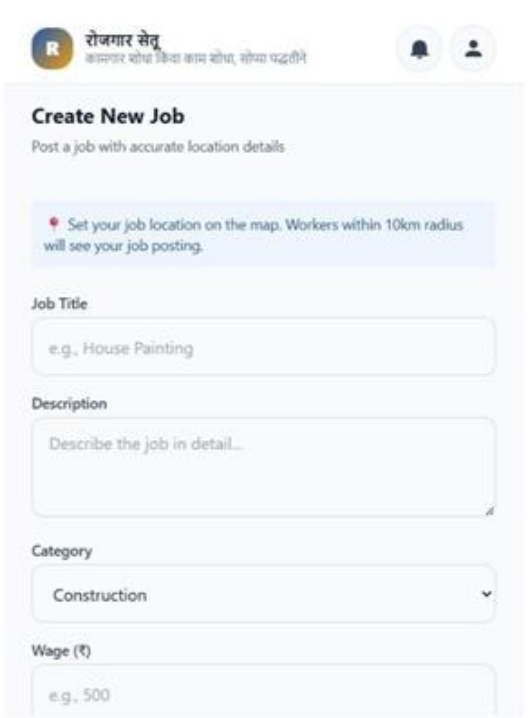

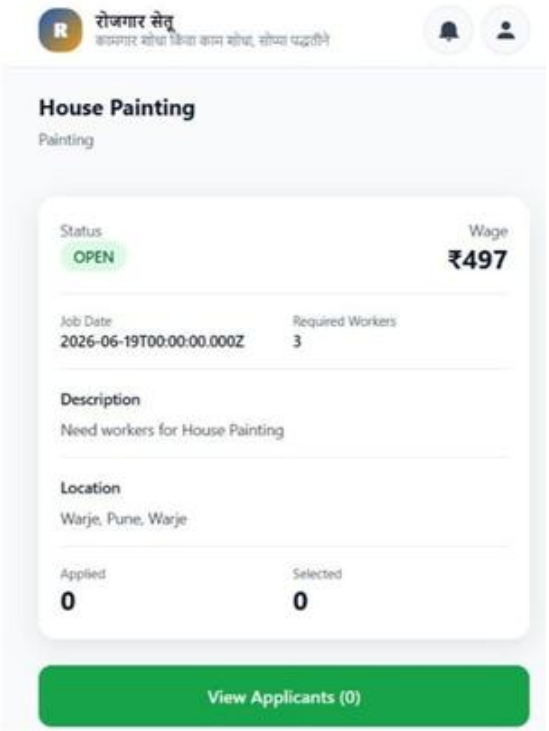

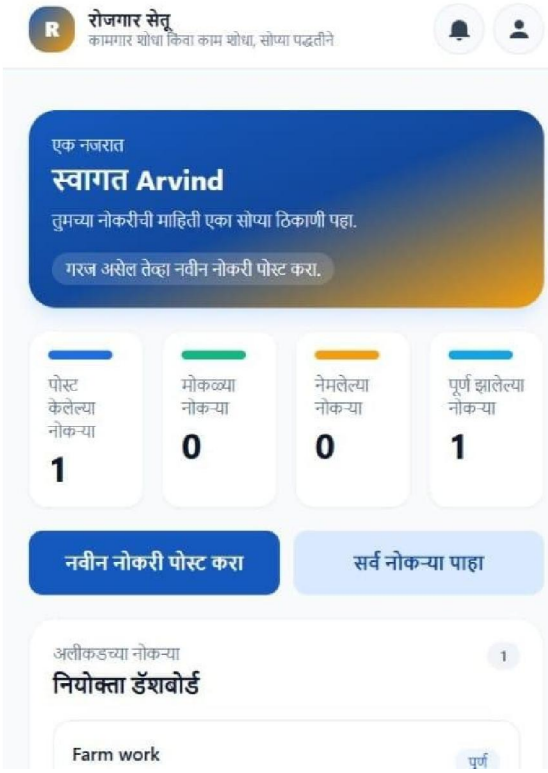

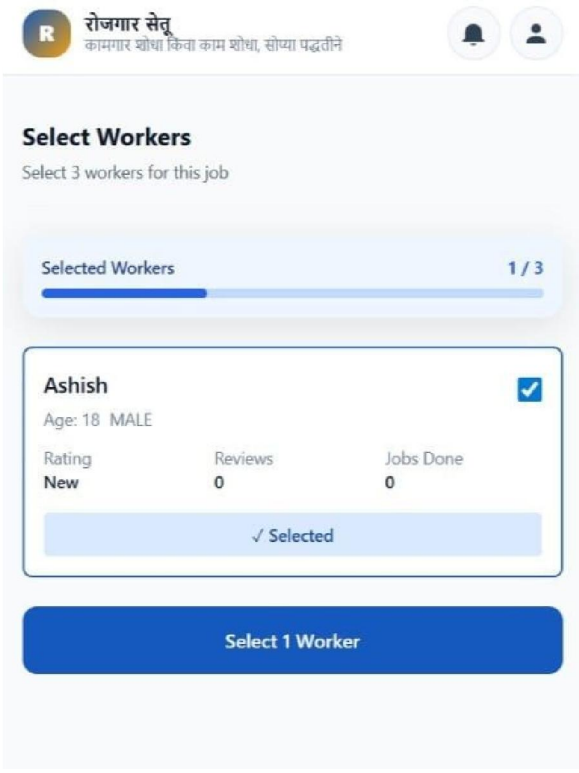

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V. DISCUSSION

Implementation of Rojgar Setu shows how modern technologies can be applied to solve the problems of recruitment and workforce management in the unorganized labour market. Traditional methods of hiring may take longer time, involve unnecessary third parties, and limit the availability of work. In the proposed platform, users can directly interact with each other without any barriers.

OTP login provides users with more reliable and secure authentication. Job posting and application modules simplify the process of job search. Employers can easily post job requirements, while workers can send their applications using the application provided on the platform. Attendance tracking and payments confirmation allow enhancing transparency and accountability in such transactions.

Three-tier architecture using React, React Native, Express.js, and PostgreSQL helped create an effective system with great flexibility. Prisma ORM significantly reduced the complexity of data manipulation and simplified the programming process. Mobile first approach was implemented because many workers tend to use mobile devices to access information on the web.

However, despite the system being able to fulfill its intended purposes, there are a few areas of limitation worth noting. The current system utilizes OTP-based verification and simple matching systems, which might have to be improved for larger-scale implementations. Incorporation of digital payment gateways, recommendation algorithms, and even offline capabilities would help increase functionality and usability of the system.

In general, the system designed and implemented is capable of proving how a technology-based approach can lead to increased accessibility of the workforce, reduction of hiring delays, and transparency in the unorganized labor market. Based on the results presented, one could say that digital employment portals are useful tools for labor-intensive industry digitization.

VI. CONCLUSION

In conclusion, this paper has discussed the designing and implementation of Rojgar Setu which is a mobile-friendly digital system created to facilitate workforce hiring and management in the unorganised labour domain. This system consists of several important features including OTP verification, job listing and application management, attendance tracking, payment confirmation, ratings, notifications, and dispute management on one platform.

It was established from the discussion above that the implementation of Rojgar Setu proves the use of state-of-the-art web and mobile technologies can provide an effective and reliable solution for overcoming the issues associated with the traditional approach to hiring employees. Through the development of this platform, the process of hiring workers becomes simpler while ensuring accountability through digitalisation.

Overall, the successful prototyping and testing confirm that technology-based solutions can be used to enhance the accessibility and coordination of the hiring process. This can ensure the transformation of the unorganised labour sector through the elimination of unnecessary delays and increased labour process visibility.

In the future, additional features can be included in Rojgar Setu such as the inclusion of digital payment gateways, job recommendations based on AI, analytics, and offline capability in mobile applications.

ACKNOWLEDGMENT

It is pertinent to mention that the authors owe much of their gratitude to Ms. Rohini Rankhamb, Assistant Professor in the Department of Information Technology, for her continuous guidance, constructive suggestions, and consistent encouragement during the entire course of implementing this project. The contributions of Ms. Rankhamb have been instrumental in accomplishing this research work.

It is also our pleasure to acknowledge the valuable contributions made by faculty members of the Department of Information Technology during various phases of this project.

At last, it is imperative to mention that we would like to extend our sincere thanks and appreciation to all those friends and well-wishers who were directly or indirectly involved in the testing process of the Rojgar Setu web application.

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