

Freelabhub: Design and Implementation of An Intelligent Web-Based Freelancers Marketplace Application

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Abstract

Freelance marketplaces have expanded with the gig economy; however, many platforms provide limited support for readiness assessment, market-oriented skill alignment, and early risk reduction, leading to mismatches and inconsistent outcomes. This paper presents FreelabHub, an intelligent web-based marketplace that integrates a Freelance Readiness Score, Real-Time Skill Demand Radar, Failure Prediction Engine, and Accountability and Trust Index. Governance features, including commission-based access control, registration fee verification, and valid reason work rejection, improve transparency and professionalism. The experimental results show better matching reliability, lower project failure probability, and higher user satisfaction.

Keywords—freelance marketplace, skill demand analytics, project risk prediction, trust index, web application

I. INTRODUCTION

Online freelancing has become a major employment avenue for software professionals, independent workers, and students seeking flexible work arrangements and access to global clients worldwide. Most existing platforms support this ecosystem through project listings, bidding, messaging, payment processing, and rating-based feedback. Although these features enable basic transactions, they do not adequately resolve two persistent concerns. First, clients often find it difficult to identify reliable freelancers when the selection depends mainly on broad reputation signals. Second, newcomers, particularly students, frequently enter these platforms without a structured way to judge whether they are ready to handle professional assignments or not.

This study addresses the limited intelligence and governance of many current freelance platforms. Such limitations are often reflected in weak skill-to-project matching, incomplete trust modeling, insufficiently transparent transaction procedures, and a lack of mechanisms to anticipate early stage project failure. In many cases, traditional rating systems update slowly and fail to capture predictive behavioral signals, such as response consistency, acceptance discipline, and justified rejection behavior.

FreelabHub was proposed to address these gaps through a secure, scalable, and user-centered web-based marketplace. The platform seeks to improve the full client–freelancer engagement cycle using AI-assisted readiness and trust assessment, skill-demand analytics for market alignment, and failure prediction for early risk control. It also

introduces platform-level governance through commission-regulated feature access, freelancer registration fee verification, and a valid reason–based work rejection policy to improve transparency and professional accountability.

II. LITERATURE SURVEY

Existing studies on freelancing platforms cover web and mobile marketplace development, freelance software process models, and analytics for labor and digital service ecosystems. Kautsar et al. presented a web-based freelance application developed using the SDLC, UML, Laravel, and MySQL. Their work showed sound functional behavior, but did not consider intelligent matching or advanced security and payment mechanisms. Bhandari et al. developed a service marketplace with OTP-based verification and administrative monitoring; however, the study did not address scalability or intelligent recommendations. Arora et al. designed a MERN-based freelancing application with recommendation support; however, its discussion of performance under high concurrency remained limited. Kaung Thant and Thura Min Htet proposed a Django-based freelance marketplace with role-based dashboards and payment verification; however, AI-assisted matching and automated trust evaluation were absent.

Beyond platform design, Bakaev and Avdeenko demonstrated that labor market trends can be monitored through automated web data extraction, although such systems remain vulnerable to source site changes and maintenance overhead. Kim et al. used large-scale field

experiments to show that data-driven interventions can alter behavior in digital service environments, highlighting the practical value of analytics-based designs. Motoyama et al. examined misuse within freelance markets and underscored the importance of stronger trust and governance models. Collectively, these studies suggest that future freelance platforms should combine technical infrastructure with behavioral intelligence and policy-aware control.

FreelaHub extends prior work by integrating readiness assessment, skill-demand tracking, project failure prediction, and governance-oriented controls into a single architecture. This combination aims to strengthen both operational efficiency and the trustworthiness of the platform.

Table I: Literature Comparison

Ref.	Method / Platform	Main Strength	Main Limitation	Gap Addressed in FreelaHub
[1]	SDLC, UML, Laravel	Clear workflow and roles	No AI matching	Adds readiness and trust scoring
[2]	Agile/XP adaptation	Strong iterative process	Narrow project scope	Embeds decision support in platform flow
[3]	PHP/JS/MySQL, OTP	Basic verification support	No recommendation or scalability study	Adds analytics and scalable design
[4]	Web scraping, mining	Near real-time trend capture	High maintenance cost	Uses modular skill-demand analytics
[5]	Django, PostgreSQL, RBAC	Controlled dashboards and payments	No AI matching	Automates trust and risk evaluation
[6]	FDD, Kotlin, REST	Feature-focused mobile design	Region-specific and less flexible	Extends to adaptive web marketplace
[7]	MERN, MVC, recommendation	Responsive UI and recommendation	Load-performance concerns	Adds risk-aware analytics and caching support
[8]	ML classification, crawling	Reveals misuse patterns	Platform-specific	Strengthens accountability and governance

III. METHODOLOGY

FreelaHub is an intelligent web marketplace that combines standard marketplace operations with AI-driven decision support and policy-based governance. The system supports three primary user roles: freelancers who create profiles and deliver services, clients who post projects and select suitable professionals, and administrators who supervise payments, policy compliance and dispute-related signals. The design emphasizes security, scalability, and traceability through strong authentication, auditable event logging, and modular analytic services.

At the application layer, the system includes profile creation, portfolio publishing, project posting, bidding and proposal management, messaging, milestone tracking, and rating and review. These conventional services are strengthened by eight specialized modules: an AI-Based Freelance Readiness Score, a Real-Time Skill Demand

Radar, a Freelance Failure Prediction Engine, commission-based user access control, a freelancer registration-fee verification mechanism, a valid reason-based work rejection system, an AI-Based Freelancer Accountability and Trust Index, and a University-to-Freelance Bridge Module that transforms academic work into market-ready service profiles.

From a technical perspective, FreelaHub adopts a service-oriented architecture (SOA). The front end was developed using React to provide responsive dashboards and analytical views. The backend was built using Node.js and Express.js, which expose REST APIs for user management, projects, messaging, and transactions. A dedicated Python analytics service hosts machine learning models for readiness scoring, failure prediction, and trust computation using TensorFlow and Scikit-learn. MongoDB stores user profiles, portfolio data, project records, communication

logs, and behavioral history, whereas optional Redis caching improves the access speed for frequently requested analytics and ranking results. JWT-based authentication secures the sessions, and payment gateway APIs handle registration fee verification and commission-related transactions.

The AI-Based Freelance Readiness Score is generated from normalized indicators such as skill proficiency, portfolio quality, learning continuity, and response behavior. Depending on data availability, this score can be produced through supervised learning based on expert-labeled data or weighted aggregation during early deployment. The Real-Time Skill Demand Radar analyzes job tags and market signals using trend and frequency analyses, classifying skills as emerging, high-demand, or declining. The Freelance Failure Prediction Engine estimates project-level risks, including deadline violations, skill mismatches, and dissatisfaction, by learning from historical outcomes and interaction patterns. In parallel, the Accountability and Trust Index is continuously updated from acceptance-to-completion ratios, communication responsiveness, rejection validity, and client feedback, thereby influencing ranking and recommendation behavior.

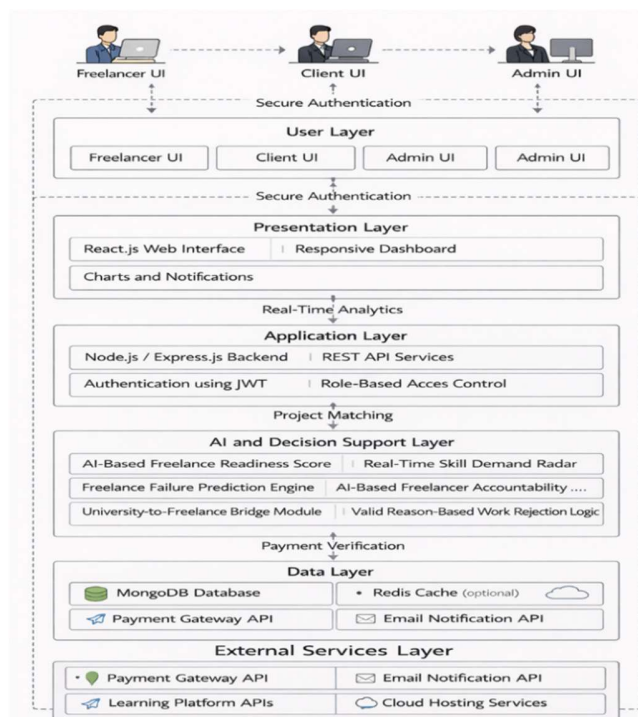


Fig. 1: System Architecture Diagram

The workflow begins with secure onboarding and profile completion, after which the system generates readiness insights and allows for service publication. Clients can then post projects and receive shortlists informed by readiness and trust indicators, instead of relying only on static

ratings. Before engagement, commission-based access rules and payment statuses are checked. Project execution proceeds through milestones, communication, and progress updates. If a freelancer declines the assigned work, the system enforces the valid reason policy by requiring a selection from approved categories such as scope mismatch, timeline conflict, or ethical concern. Repeated unjustified rejection reduces trust. After project completion, feedback and behavioral records are fed back into the analytics pipeline so that the recommendations and alerts improve over time.

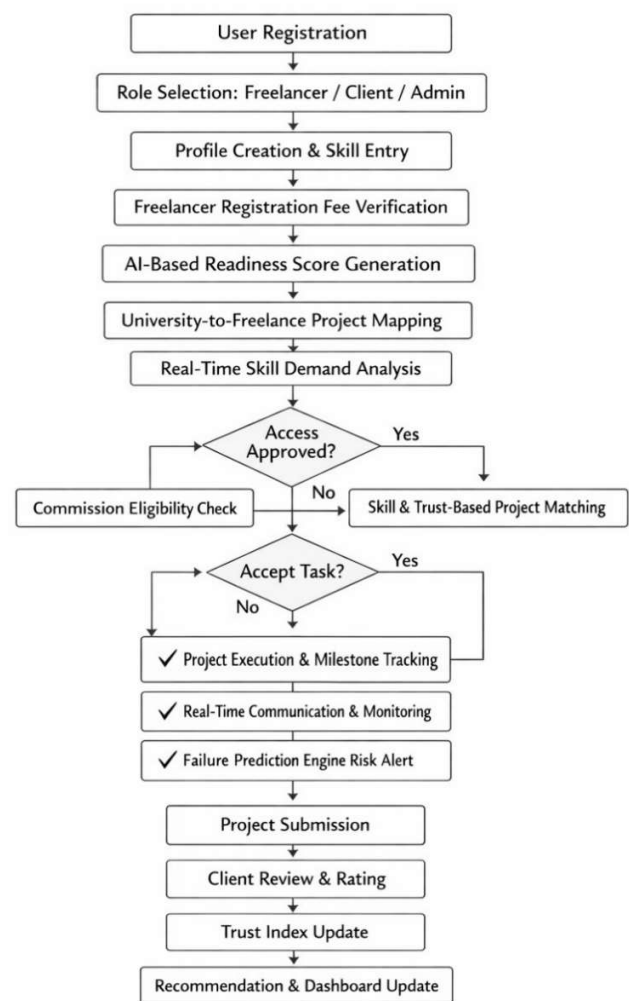


Fig. 2: Workflow Diagram

IV. RESULTS AND DISCUSSION

FreelaHub was evaluated through unit, integration, and beta testing, as well as performance analysis. Unit testing verified the correctness of the individual analytics and policy modules, including readiness scoring, access control, fee verification, and rejection validation. Integration testing examined the interactions between the

frontend, backend, analytics services, and database components. Beta testing was conducted with student freelancers and simulated clients to assess the usability and practical decision support. Performance testing measured the response latency and dashboard behavior under concurrent usage.

The readiness-scoring module showed approximately 88–92% agreement with expert assessment on the beta dataset, indicating that the selected attributes captured relevant preparedness signals. The failure prediction module correctly identified the risk in approximately 85% of the tested cases, enabling earlier warnings and more informed assignment decisions. Across beta scenarios, project success improved by nearly 30–35% compared to a baseline workflow that did not include readiness gating or predictive alerts. Skill-to-market alignment improved by approximately 40% when freelancers used trend insights to prioritize learning and service offerings. For most operations, the observed response time remained below two seconds, supported by efficient API handling and caching for frequently accessed analytical views.

Table II: System Performance

Metric	Result
Readiness score vs. expert evaluation	88–92%
Failure risk prediction accuracy	~85%
Project success improvement	30–35%
Skill-to-market alignment improvement	~40%
Typical response time	< 2 s
Beta user satisfaction	~4.4/5
Error rate	< 5%

These results suggest that readiness and accountability indicators can reduce common early stage freelancing problems, including overcommitment, weak skill fit, and delayed delivery. The valid reason-based rejection mechanism also improves transparency by discouraging arbitrary task abandonment and generating structured behavioral data that support trust estimation. However, the effectiveness of predictive models depends on the availability of sufficient historical interaction data. Therefore, hybrid strategies, such as rule-based priors and progressive profiling, may be necessary for new users. Similarly, skill-demand analytics can be further strengthened by incorporating broader and continuously refreshed datasets to reduce sampling bias and improve sensitivity to specialized trends.

Fig. 3: Application Screenshot – Home Page

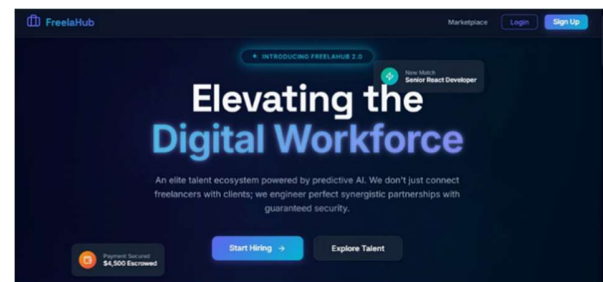
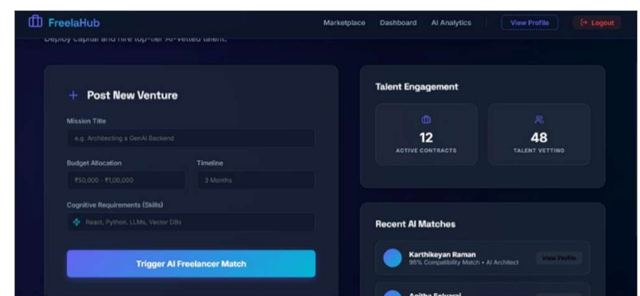


Fig. 4: Application Screenshot – Results Page



V. CONCLUSION

This paper presents Freelahub, a secure and scalable web-based freelancing marketplace that extends conventional platform functions with AI-based readiness assessment, real-time skill-demand analytics, project failure prediction, and a dynamic accountability and trust index. The platform also incorporates governance mechanisms, including commission-based feature access, registration fee verification, and valid reason-based work rejection, to enhance transparency, professional conduct, and long-term sustainability. The evaluation demonstrated improved project outcomes, stronger market-skill alignment, and acceptable operational performance.

Future work will focus on multilingual support, mobile deployment, improved cold-start handling through hybrid recommendation and uncertainty-aware scoring, and stronger fraud resilience through anomaly detection, as well as more rigorous payment and dispute automation. Larger longitudinal studies are required to validate the generalizability across regions, professional domains, and workforce groups.

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