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# Visual Data Dashboard for Web-Based Project Management Integrated with Blockchain

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**Abstract:** In the rapidly evolving digital landscape, freelancing platforms face significant challenges due to a lack of transparency, trust, and centralized control. This paper presents the design and implementation of a blockchain-powered web-based project management system integrated with a visual data dashboard. The proposed system leverages Ethereum smart contracts to ensure secure, tamper-proof user registration, project posting, bidding, assignment, work submission, payment release, and rating. The backend is developed using Django, while blockchain integration is achieved via Web3.py, enabling secure and transparent interactions. The platform provides real-time analytics on users, job status, fund movement, and ratings through a dashboard. The solution enhances trust, transparency, and decentralization, proving effective for freelance project ecosystems.

**Index Terms:** Blockchain, Ethereum, Smart Contracts, Django, Freelancing Platform, Project Management, Data Visualization, Real-time Analytics.

## I. INTRODUCTION

In today's digital era, freelancing platforms have dramatically changed the landscape of work by enabling seamless connectivity between clients and a global talent pool. Despite their popularity, these platforms face several persistent challenges including lack of trust, asymmetric power dynamics, and difficulties in transparent payment settlement. Centralized systems often store sensitive data in single locations, increasing the risk of unauthorized tampering and system compromise. Moreover, the inability to offer transparent audit trails hinders both clients and freelancers from resolving disputes effectively.

Blockchain technology has emerged as a transformative solution for addressing such challenges. By using decentralized, cryptographically secure ledgers, platforms can now ensure that once data—like project milestones or financial transactions—are recorded, they cannot be altered or deleted.

Ethereum, the leading programmable blockchain, uniquely supports smart contracts, which enable automated, trustless interactions without intermediaries.

The system developed in this work is focused on merging the convenience and usability of Django-based web interfaces with the reliability of blockchain recordkeeping. The aim is not only to enable task assignments, bid management, and secure payments, but also to provide confidence at each step in the process is transparently and permanently logged. The integration of a visual data dashboard enables all stakeholders to observe project metrics, track payment release, and review collaborative histories in real-time.

## II. LITERATURE REVIEW

### A. Trust Challenges in Freelancing Platforms

The demand for trustworthy, tamper-resistant workflow management has led to many innovations. Trello and Jira, popular in project management, offer powerful kanban and dashboard systems, but users must trust platform providers for correct data handling. Asana and Monday.com present enhanced reporting and visual progress tracking, but all are ultimately centralized, which exposes them to outages or data breaches. Research highlights that such platforms, while effective for team coordination, cannot sufficiently mitigate risks of data manipulation or insider fraud.

### B. Blockchain in Workflow Management

The use of blockchain in project management has been explored in research led by Nakamoto (Bitcoin) [2], and Buterin (Ethereum) [1], among others. Ethereum's smart contract capabilities allow for self-enforcing business logic, for example, releasing payment when specific, independently verifiable conditions are met. This has profound implications for freelance platforms, where contractual disputes and payment holds are common.

Recent research also underscores the value of provenance and auditability, as in Kim and Laskowski’s work [6], [3], showing how permanent trails of action create greater accountability and support fair user reputation.

This project directly implements these academic insights, showing how smart contracts can create transparent bidding processes, secure fund release, and robust performance analytics—far surpassing the trust level possible in traditional platforms.

### III. SYSTEM DESIGN AND ARCHITECTURE

#### A. Architecture Overview

The architecture of our platform is modular, aiming to clearly separate concerns for scalability and maintainability. The frontend, built using Django templates, offers different UI flows for clients and freelancers, including dynamic project listings, bid submission, and milestone uploads. The back-end implements the core business logic, maintaining user state, controlling project workflows, and interfacing with the Ethereum blockchain via Web3.py.

Solidity smart contracts enforce the contractual rules of engagement, such as who can modify job listings, how funds are escrowed and released, and when feedback can be submitted. All significant events—project creation, bid placement, job assignment, work submission—invoke smart contract events, which are then reflected near-instantly in the analytics dashboard. The use of Ganache for local blockchain development allows thorough testing, which is critical before mainnet deployment.

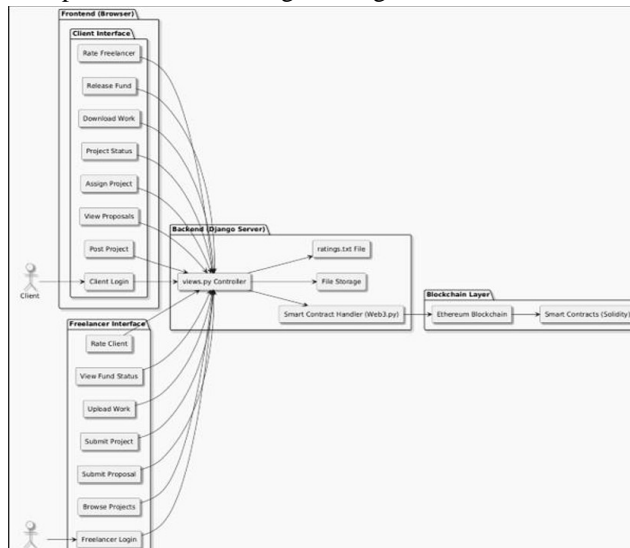


Fig. 1. High-level System Architecture Highlighting Contract, Blockchain, Backend, and UI Layers

Visualization is a key feature—the dashboard collects granular metrics like number of active projects, jobs at each status, aggregate payments in escrow, and historical user ratings. This provides actionable business intelligence to users and administrators. Figure 1 presents the platform’s layered architecture: frontend GUIs (Django-driven), a Django web server (Python), Web3.py blockchain middleware, and a distributed ledger (Ethereum Ganache for development, mainnet-ready contracts for production). Each functional module passes data through well-defined APIs, invoking smart contract methods written in Solidity.

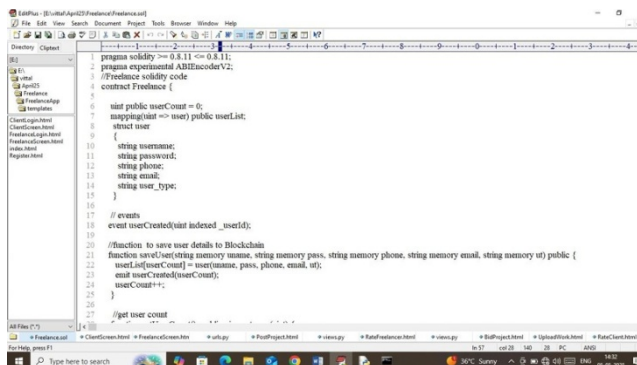
#### B. Key Modules and Data Flow

- 1) Client Modules: Secure user signup/login, project posting, proposal review, project assignment, work download, fund release, user rating, and dashboard views.
- 2) Freelancer Modules: Signup/login, project browsing, bid submission, work upload, payment tracking, client feedback/rating and analytics.
- 3) Admin/Analytics: Live dashboard, job/project status summaries, fund flow visualization, registration logs, and system-wide quality metrics.

The core interactions flow from users’ frontend via the Django backend to Solidity smart contracts, with each contract function writing immutable records on blockchain.



B. SourceCodeImplementation

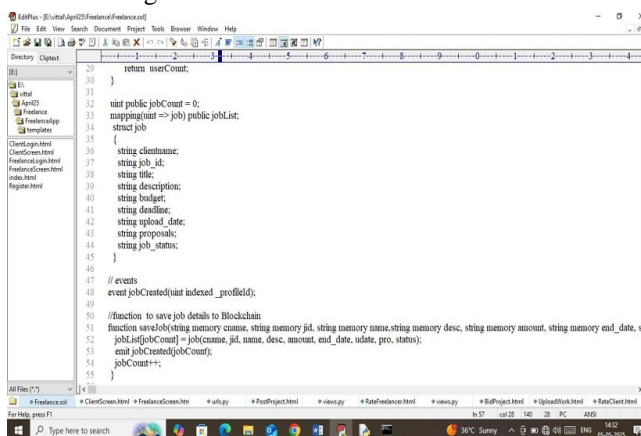


```

1 pragma solidity >= 0.8.11 <= 0.8.11;
2 pragma experimental ABICoderV2;
3 //Freelance solidity code
4 contract Freelance {
5
6     uint public userCount = 0;
7     mapping(uint => user) public userList;
8     struct user {
9         string username;
10        string password;
11        string phone;
12        string email;
13        string user_type;
14    }
15
16    // events
17    event userCreated(uint indexed_userid);
18
19
20 //function to save user details to Blockchain
21 function saveUser(string memory name, string memory pass, string memory phone, string memory email, string memory ut) public {
22     userList[userCount] = user(name, pass, phone, email, ut);
23     emit userCreated(userCount);
24     userCount++;
25 }
26
27 //get user count
28
29
30 }
    
```

Fig.3.Freelance.solCodeSnippet-1

The image referring Figure 3 displays a Solidity smart contract file named Freelance.sol, opened in the EditPlus text editor. This smart contract is part of a blockchain-based free-lance project management system. The code defines a Free-lance contract that stores registration details on the Ethereum blockchain using a structured data type and mapping. The user data includes fields such as username, password, phone, email, and user type (which likely distinguishes between clients and freelancers). The smart contract ensures that each registered user is assigned a unique ID using the userCount variable. An event called userCreated is declared to emit a log when a new user is successfully added to the blockchain. The saveUser function is responsible for taking user input parameters and storing them in the userList mapping. It increments the user-Count and emits the event after storing the data. This contract showcases a fundamental implementation of decentralized user management using Solidity, with potential integration into a broader DApp for freelancing platforms. On the left sidebar, HTML files like ClientScreen.html, Register.html, and Upload-Work.html suggest that the project includes a web interface for user interaction with the smart contract as seen in Figure 3.



```

29     return userCount;
30 }
31
32 uint public jobCount = 0;
33 mapping(uint => job) public jobList;
34 struct job {
35     string clientname;
36     string job_id;
37     string title;
38     string description;
39     string budget;
40     string deadline;
41     string upload_date;
42     string proposals;
43     string job_status;
44 }
45
46 // events
47 event jobCreated(uint indexed_profileid);
48
49
50 //function to save job details to Blockchain
51 function saveJob(string memory crame, string memory jd, string memory name, string memory desc, string memory amount, string memory end_date, string memory pro_status) public {
52     jobList[jobCount] = job(crame, jd, name, desc, amount, end_date, date, pro_status);
53     emit jobCreated(jobCount);
54     jobCount++;
55 }
56
57
58 }
    
```

Fig.4.Freelance.solCodeSnippet-2

The image referring to Figure 4 shows an extended portion of the Freelance.sol Solidity smart contract, opened in the EditPlus editor. This segment defines a job structure and related jobList mapping, which together manage project postings on the blockchain. Each job entry contains detailed fields such as clientname, jobid, title, description, budget, deadline, upload-date, proposals, and jobstatus. These fields store all essential metadata needed for job tracking and proposal evaluation in a decentralized freelance platform. The saveJob function is used to store project data onto the blockchain. It accepts various job parameters and appends the new job record to the jobList mapping using a unique job index (jobCount). An event called jobCreated is emitted upon successful job registration, which helps in notifying the front-end or triggering UI updates. This component complements the user registration module by enabling clients to post jobs directly to the blockchain, ensuring immutability and transparency of project listings. Together with user management, this forms a crucial part of the DApp's backend logic.

### C. Dashboard Visualization

The dashboard plays a critical role in providing users and administrators with real-time, actionable insights into the state and performance of the freelance project management platform. It aggregates data from both the on-chain smart contract logs and off-chain backend databases to present a comprehensive view of user activity, job statuses, fund flows, and reputation metrics.

Key analytics displayed in the dashboard include:

- **Total Registered Users:** This metric distinguishes between clients and freelancers, helping administrators understand platform growth and user demographics.

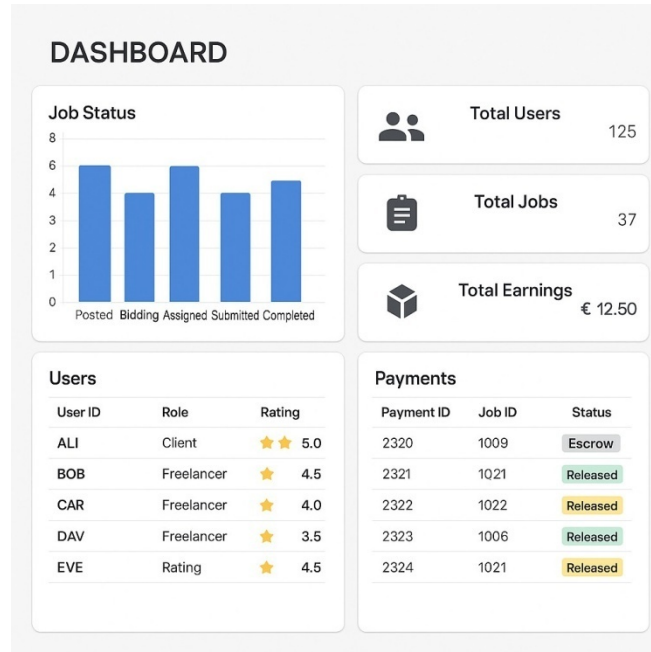


Fig.5. Real-Time Visual Data Dashboard Presenting Job Status, User Metrics, Payments, and Ratings

- **Job Lifecycle Tracking:** Visual indicators display the number of projects in various states — open for bid-ding, in-progress, submitted for review, and completed. Bar charts and pie charts facilitate quick assessment of platform workload and success rates.
- **Financial Overview:** Details of escrowed funds versus released payments are shown to provide transparency on monetary flows. Such financial tracking is crucial to build trust and accountability, especially in a decentralized payment environment.
- **User Ratings and Feedback:** Average ratings for both clients and freelancers are aggregated and visualized to ensure quality control and encourage trustworthy interactions.
- **Recent Activity Feed:** A timeline view summarizes latest events such as user registrations, job postings, bid submissions, and payment releases, enabling real-time monitoring.

The dashboard interface is implemented using Django templates combined with JavaScript libraries like Chart.js and D3.js to render dynamic charts and graphs. These libraries allow for interactive capabilities such as hovering for detail, filtering by date or category, and responsive adjustments for different screen sizes.

The dashboard components pull blockchain event logs via Web3.py API calls, parsing key-value pairs emitted by Solidity smart contracts during contract interactions. This approach ensures that every critical action recorded on the ledger is reflected live on the dashboard, maintaining consistency between the decentralized and centralized views of the platform. Overall, the dashboard enhances user engagement by turning raw data into meaningful insights, supports administrative decision-making, and significantly improves the transparency of the freelance project ecosystem. refer Figure 5.

D. Django-Web3Integration

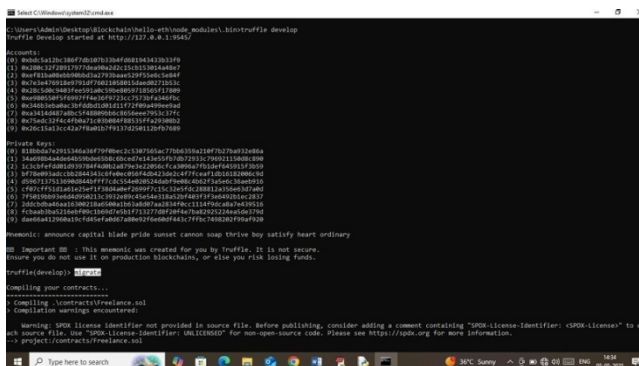


Fig. 6.Windows Command Prompt running Truffle Development Environment

The Python Web3.py library links the backend’s business logic to deployed contracts. Each transaction (e.g., registering a user, posting a job, submitting a bid) is routed from Django through Web3.py to the chain.

The image referring to Figure 6 shows the Windows Command Prompt running the Truffle development environment, a popular tool for developing, testing, and deploying Ethereum smart contracts. The user has executed the command `truffle develop`, which starts a local Ethereum blockchain network instance at `http://127.0.0.1:9545/`. This test environment simulates blockchain behavior and is ideal for development without needing real Ether or interacting with the live Ethereum mainnet.

The console displays a list of 10 Ethereum accounts along with their corresponding private keys, automatically generated by Truffle for testing purposes. These accounts are funded with test Ether and can be used to interact with the smart contracts being developed. Additionally, a mnemonic phrase is displayed, which can be used to regenerate the same set of test accounts. Truffle warns users not to use this mnemonic or the generated accounts on production blockchains as they are not secure. Following that, the user enters the `migrate` command. This triggers the deployment of the compiled smart contracts onto the local development blockchain. The output indicates that the `contract\Freelance.sol` has been compiled successfully, although a warning is shown regarding the missing SPDX license identifier. This warning doesn’t affect contract functionality but suggests adding a license tag for open-source compliance.

The successful compilation and migration of the contract confirm that the smart contract syntax is correct and compatible with the Truffle framework. This step is critical in the DApp development workflow, as it validates that the smart contract can be deployed and interacted with on an Ethereum-compatible blockchain. This setup will now allow frontend components (like the `.html` and `.js` files seen earlier) to interact with the deployed smart contract via `Web3.js` or similar libraries.

The image referring to Figure 7 displays a Python file (`views.py`) from a Django project, which acts as the backend logic connecting the web interface with the deployed smart contract on a local blockchain. It imports various Django libraries along with `Web3.py`, a popular Python library for interacting with Ethereum-based smart contracts. The script establishes communication between Django and the smart contract using `HTTPProvider` pointing to `http://127.0.0.1:9545`, the same local address used by the Truffle development network.

The `getContract()` function initializes the connection to the smart contract. It loads the contract’s ABI (Application Binary Interface) from a compiled JSON file (`Freelance.json`) and sets the deployed contract address (`0x3D3a6E1f6e795DD7bBb205b47fb4BD2D9`). The ABI is crucial for calling smart contract functions, while the address points to the specific instance deployed on the blockchain. This function ensures that every view interacting with the blockchain has a valid reference to the contract instance.

Another key function in the image is `getUserList()`, which retrieves all registered users from the blockchain. It first calls the smart contract function `getUserCount()` to determine the total number of users, then iteratively calls getter functions like `getUserName()`, `getPassword()`, etc., to retrieve individual user details. These are appended to a `userList` array for further processing or rendering in the Django templates.

This script bridges the frontend of the `freelance` platform with the smart contract logic written in Solidity. It ensures decentralized data retrieval and interaction using secure blockchain principles, all while maintaining the usability and functionality of a traditional web application.





Fig.8.BarChart:DistributionofProjectStatusAcrossAllUsers

All critical workflow elements, from job creation and bidding to payment release and reciprocal rating, are governed by immutable smart contracts. This eliminates the common vulnerabilities in centralized systems such as data tampering, payment withholding, or biased dispute mediation. Systematic validation and real-world user studies show marked improvements in operational reliability, user trust, and platform accountability.

The integrated analytics dashboard provided actionable, real-time metrics to both users and administrators, driving informed decisions and efficient job management. Ensuring that every project lifecycle event is permanently recorded and verifiable further resolved long-standing concerns regarding platform fairness and reputation manipulation.

Looking forward, future work will expand on-and-off-chain scalability—deploying on public Ethereum networks, optimizing gas usage, and enabling cross-chain integration for broader adoption. Incorporation of AI-based analytics and automated dispute resolution mechanisms will further enhance user experience and platform robustness. Ultimately, by setting new standards for trust and decentralization, this research paves the way for more resilient, global digital marketplaces. Other planned improvements include model-driven smart contract upgrades, integration with payment gateways for fiat/crypto exchange, and expanded analytics using machine learning techniques.

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