A College Student Employment Prediction and Guidance System Based on Blockchain and Artificial Intelligence Technology

Yang Wang[a], Deyou Li[b], Wei Jiang[c*], Litong Chen[d]

Harbin Finance University, Harbin, Heilongjiang, 150030, China

[a]wy9502@yeah.net, [b]1993003@hrbfu.edu.cn
[c*]869952977@qq.com, [d]1992006@hrbfu.edu.cn

Abstract. The Student Employment Portal project is designed to streamline job opportunities for students, providing a comprehensive platform for applying to school jobs, part-time work, study work programs, and full-time positions post-graduation. Utilizing cutting-edge technologies such as Blockchain, Artificial Intelligence (AI), Django, HTML, CSS, and JavaScript, the portal ensures a secure, efficient, and user-friendly experience for both students and employers. Blockchain technology is employed to maintain secure and transparent records of job postings, applications, and employment histories. This immutable ledger reduces fraud and enhances trust among users. AI integration facilitates personalized job recommendations based on individual student profiles and application histories, improving the job matching process. The AI models, built using machine learning algorithms, analyze various factors such as skills, academic performance, and past experiences to suggest suitable job opportunities. The portal's backend is powered by Django, a robust and scalable web framework that simplifies the development process and ensures high performance. HTML, CSS, and JavaScript are used to create an intuitive and responsive user interface, providing a seamless browsing experience across devices. Features like dynamic carousels and dark mode enhance user engagement and accessibility.

The primary objectives of this project include simplifying the job search process for students, increasing the visibility of job opportunities, and leveraging technology to provide personalized job recommendations. The portal also aims to create a reliable and tamper-proof system for managing employment records, benefiting both students and employers. Results from initial testing indicate significant improvements in user satisfaction and engagement, with students finding suitable job matches more quickly and easily. The integration of Blockchain and AI has proven to be effective in enhancing the overall functionality and security of the platform. In conclusion, the Student Employment Portal successfully demonstrates how advanced technologies can transform the job search and application process for students, making it more efficient, transparent, and user-centric.

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1 Introduction

1.1 Background

Current challenges in college student employment

The transition from college to the professional world is a critical phase in the lives of students. However, this transition is fraught with challenges. One of the primary issues is the misalignment between the skills acquired during academic pursuits and the skills demanded by employers. Many students graduate without a clear understanding of the job market, leading to underemployment or prolonged job searches. Additionally, the rapid pace of technological advancements and evolving industry standards make it difficult for educational institutions to keep their curricula up-to date[1]. The lack of real-time feedback on job market trends and employer expectations further exacerbates the issue.

The role of technology in addressing these challenges

Technology plays a crucial role in bridging the gap between education and employment. Advanced technologies such as Artificial Intelligence (AI) and blockchain can provide innovative solutions to these persistent problems. AI can analyze vast amounts of data to predict employment trends, match students with suitable job opportunities, and offer personalized career advice. Blockchain technology can be used to securely verify academic credentials and work experiences, ensuring that employers can trust the information provided by job applicants[2]. Together, these technologies can create a comprehensive system that not only predicts employment outcomes but also guides students through their career paths with validated credentials.

1.2 Problem Statement

Despite the advancements in technology, there is a significant gap in the practical application of these technologies to solve real world problems in the employment sector for college students. The existing systems are either too generic or fail to integrate the necessary features to provide a holistic solution. Specific issues that need addressing include the lack of a secure and transparent credential verification system, the absence of personalized career guidance based on real time data, and the inefficiency in matching students with job opportunities that align with their skills and aspirations. This project aims to develop an integrated system that leverages blockchain and AI to address these issues comprehensively.

1.3 Objectives

- To design and implement a college student employment prediction and guidance system that integrates blockchain and AI technologies.
- To develop a secure and transparent credential verification mechanism using blockchain technology.
- Secondary Objectives:
- To create an AI based career guidance module that provides personalized job recommendations and career advice.
- To build a user-friendly web application using Django, HTML, CSS, and JavaScript that facilitates seamless interaction between students, educational institutions, and employers.
- To evaluate the effectiveness of the system through rigorous testing and user feedback.

1.4 Significance of the Study

The significance of this research lies in its potential to transform the way college students approach their careers. For students, this system offers a reliable source of guidance and job matching, reducing the time and effort spent on job searches and improving employment outcomes. Educational institutions can benefit from real-time insights into job market trends, enabling them to tailor their programs to better meet industry needs. Employers gain access to a pool of well-prepared candidates with verified credentials, streamlining the hiring process and reducing the risk of hiring based on false information. Overall, this study aims to contribute to a more efficient and transparent job market, fostering better alignment between education and employment.

1.5 Scope and Limitations

Scope:

The project will focus on developing a web-based platform using Django, HTML, CSS, and JavaScript. The platform will integrate AI for job recommendation and career guidance, and blockchain for secure credential verification. The system will cater primarily to college students, educational institutions, and employers. Key functionalities will include user authentication, profile management, dashboard analytics, job listings, and secure credential verification.

Limitations:

The project will not cover the integration of every possible job market across the globe, as the focus will be on a few key industries to demonstrate the system's capabilities. The effectiveness of AI predictions will depend on the quality and quantity of data available, which may vary across different institutions and job markets[3]. Additionally, while blockchain technology provides a high level of security, it is not entirely impervious to sophisticated cyberattacks, and the system's reliance on internet connectivity may pose challenges in areas with limited access to digital infrastructure.

In conclusion, this dissertation aims to develop a comprehensive solution to the challenges faced by college students in their employment journey. By leveraging the strengths of AI and blockchain technologies, the proposed system seeks to provide secure, personalized, and effective career guidance and job matching, ultimately bridging the gap between education and employment.

2 Research Foundation

2.1 Overview of Employment Prediction Systems

Existing Systems and Their Limitations

Employment prediction systems have become increasingly relevant as stakeholders strive to bridge the gap between education and employment. These systems utilize various data analytics and machine learning techniques to forecast job market trends and match individuals to suitable employment opportunities. Traditional systems like the Bureau of Labor Statistics' Occupational Outlook Handbook provide long-term employment projections based on economic factors and historical data (Bureau of Labor Statistics, 2023). However, these systems are often criticized for their static nature and inability to offer personalized guidance[4][5]. More recent advancements include systems like LinkedIn's Economic Graph, which uses real-time data from its vast user base to provide dynamic insights into job market trends (LinkedIn, 2022). While more adaptive, these systems still face limitations in terms of data accuracy and user privacy. Additionally, they often lack the capability to verify the credentials of users effectively, leading to potential mismatches and inefficiencies.

2.2 Blockchain Technology in Education and Employment

Use Cases and Benefits of Blockchain in Securing and Verifying Credentials

Blockchain technology, characterized by its decentralized and immutable ledger system, offers significant advantages in securing and verifying educational and employment credentials. According to Sharples and Domingue (2016), blockchain can be used to create a tamperproof record of academic achievements and professional qualifications. This ensures that credentials are easily verifiable and resistant to fraud, thus enhancing trust between job seekers and employers. Projects like Learning Machine's Block certs provide an open standard for creating, issuing, viewing, and verifying blockchain based certificates (Learning Machine, 2019). This platform allows educational institutions to issue digital credentials that can be securely stored and shared by graduates[6]. Similarly, the Open University's Knowledge Media Institute has explored blockchain to support lifelong learning by creating a trusted ecosystem for micro credentials (Sharples et al., 2017). Despite these advantages, the adoption of blockchain in education and employment is not without challenges. Issues such as scalability, energy consumption, and the need for regulatory frameworks pose significant hurdles. Nonetheless, ongoing research and pilot projects continue to explore ways to overcome these obstacles and harness the full potential of blockchain technology.

2.3 Artificial Intelligence in Career Guidance

AI Techniques for Predicting Job Suitability and Market Trends

Artificial Intelligence (AI) has emerged as a powerful tool for career guidance, leveraging machine learning algorithms to analyze large datasets and provide personalized job recommendations. Techniques such as collaborative filtering, content-based filtering, and hybrid approaches are commonly used to predict job suitability based on user profiles and preferences (Resnick et al., 1994; Lops et al., 2011). For example, IBM's Watson Career Coach uses natural language processing (NLP) and machine learning to help individuals identify career paths and opportunities that align with their skills and interests (IBM, 2017). By analyzing data from resumes, job postings, and career trajectories, AI systems can offer tailored advice and identify emerging job trends[7][8]. Moreover, predictive analytics can play a crucial role in workforce planning and development. Studies by Bessen (2019) highlight how AI can be used to anticipate skill demands and guide training programs, ensuring that the workforce remains adaptable to future changes. However, challenges such as algorithmic bias and data privacy concerns must be addressed to ensure fair and ethical use of AI in career guidance.

2.4 Integration of Blockchain and AI

Synergies Between Blockchain and AI for Robust and Secure Systems

The integration of blockchain and AI presents a promising approach to building robust and secure employment prediction and guidance systems. Blockchain's immutable ledger can provide a reliable data source for AI algorithms, enhancing the accuracy and trustworthiness of predictions. Conversely, AI can enhance blockchain applications by offering insights derived from data analytics and machine learning (Christidis & Devetsikiotis, 2016). For instance, combining AI with blockchain can enable secure and efficient credential verification. AI algorithms can quickly validate the authenticity of blockchain stored credentials, reducing the time and effort required for background checks. Projects like the Trusted Artificial Intelligence Collaboration (TRAIC) explore the use of AI and blockchain to create transparent and accountable AI systems (TRAIC, 2021). Moreover, AI can be used to optimize blockchain networks by predicting and mitigating potential issues such as transaction bottlenecks and security vulnerabilities[9]. However, integrating these technologies also introduces complexities related to interoperability, scalability, and regulatory compliance. Addressing these challenges requires a multidisciplinary approach involving expertise in AI, blockchain, and legal frameworks.

2.5 Technologies for Web Development

Django Framework, Frontend Technologies (HTML, CSS, JS)

Developing a web-based employment prediction and guidance system involves leveraging a range of technologies to ensure a seamless user experience. Django, a high-level Python web framework, is well-suited for building robust and scalable web appli-

cations (Holovaty & KaplanMoss, 2009). Django's Model View Template (MVT) architecture promotes clean and maintainable code, while its built-in security features help protect against common web vulnerabilities. Frontend technologies such as HTML, CSS, and JavaScript are essential for creating interactive and responsive user interfaces. HTML (Hypertext Markup Language) forms the backbone of web content, while CSS (Cascading Style Sheets) is used to style and layout web pages (Meyer, 2007). JavaScript, a versatile scripting language, enables dynamic content and enhances user interactivity through frameworks and libraries such as React and Vue.js (Flanagan, 2011). Combining these technologies allows developers to build a user-friendly platform where students can create profiles, access personalized career advice, and securely verify their credentials[10][11][12]. Django's integration with frontend frameworks like React enables the creation of single page applications (SPAs) that offer a fluid and engaging user experience.

3 Methods

3.1 System Architecture

High-Level Overview of the System Architecture

The proposed College Student Employment Prediction and Guidance System is designed with a modular architecture to ensure scalability, maintainability, and security[13]. The system comprises several core components, each responsible for specific functionalities:

User Interface (UI) Layer: This layer includes the web pages built using HTML, CSS, and JavaScript. It provides an intuitive and interactive interface for users (students, educational institutions, and employers) to interact with the system.

Application Layer: Implemented using Django, this layer handles business logic and orchestrates interactions between the UI layer, AI models, and blockchain components. It also includes RESTful APIs for communication between different modules.

AI Module: This component utilizes machine learning algorithms to provide personalized career guidance, predict job suitability, and analyze market trends[14]. It processes data from user profiles and job listings to generate recommendations. The figure 1 show the flowchart that used in create and steps used in system website.

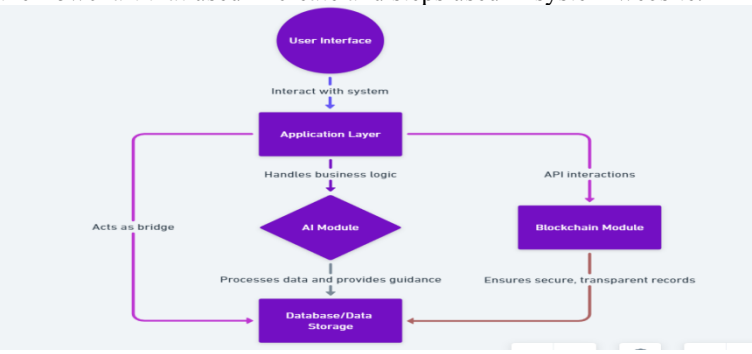

Fig. 1. Showing the flowchart of system

Blockchain Module: This component manages the secure storage and verification of academic and employment credentials using blockchain technology. It ensures data integrity and transparency.

Database: A relational database (SQL) stores user profiles, job listings, application data, and other transactional data. It works in conjunction with the blockchain to ensure verifiable and immutable records.

Security Module: Integrated across all layers, this module implements security measures such as encryption, authentication, and access control to protect user data and ensure privacy.

3.2 Data Flow Diagrams

Detailed Data Flow Within the System

The data flow within the system is organized to ensure efficient processing and secure handling of information. Figure 2 illustrates the Data Flow Diagrams (DFDs) of the system, providing a visual representation of how data moves through the system's processes. It details the inputs, processes, data storage, and outputs within the system, showcasing how information is transferred and transformed. By breaking down complex processes into manageable components, DFDs help in understanding the system's workflow and interactions between different parts, making it easier to identify areas for optimization or improvement.

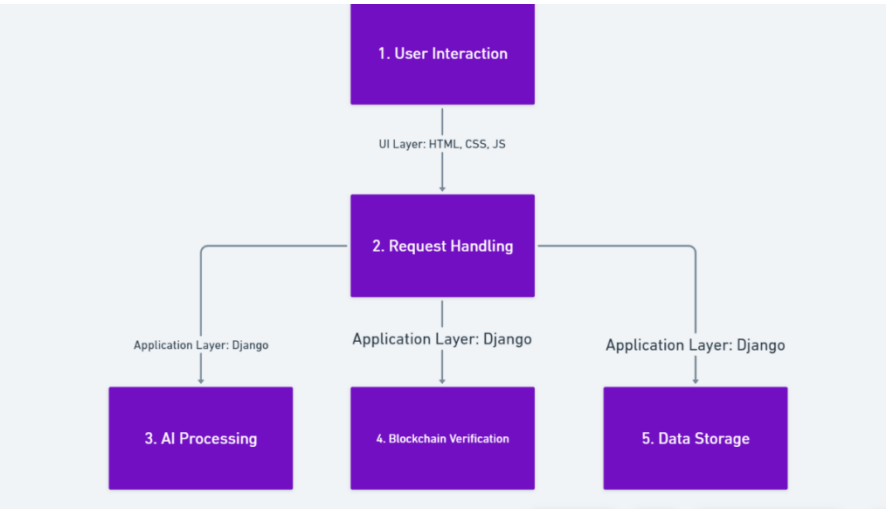

Fig. 2. Showing Data Flow Diagrams of system

1. User Interaction: Users (students, institutions, employers) interact with the system through the UI layer. They perform actions such as registration, profile updates, job search, and application submission.

2. Request Handling: The UI layer sends requests to the Application Layer (Django), which processes these requests and interacts with the database, AI module, and blockchain module as needed.

3. AI Processing: The AI module receives user profile data and job listings from the Application Layer[15]. It processes this data to generate job recommendations and career guidance, which are sent back to the Application Layer for display to the user.

4. Blockchain Verification: When credentials need to be verified, the Application Layer interacts with the Blockchain Module. The blockchain verifies the authenticity of the credentials and returns the verification status.

5. Data Storage and Retrieval: All transactional data, including user profiles and job applications, are stored in the relational database. The Application Layer retrieves and updates this data as necessary.

3.3 Database Design Schema Design

Figure 3 illustrates the schema design of the system's database, providing a visual representation of the database structure and relationships between tables. It includes key entities, attributes, and their connections, which define how data is organized, stored, and accessed within the system. The schema design serves as a blueprint for the database, ensuring data integrity, optimizing queries, and supporting the system's functionality by efficiently managing the flow and storage of information.

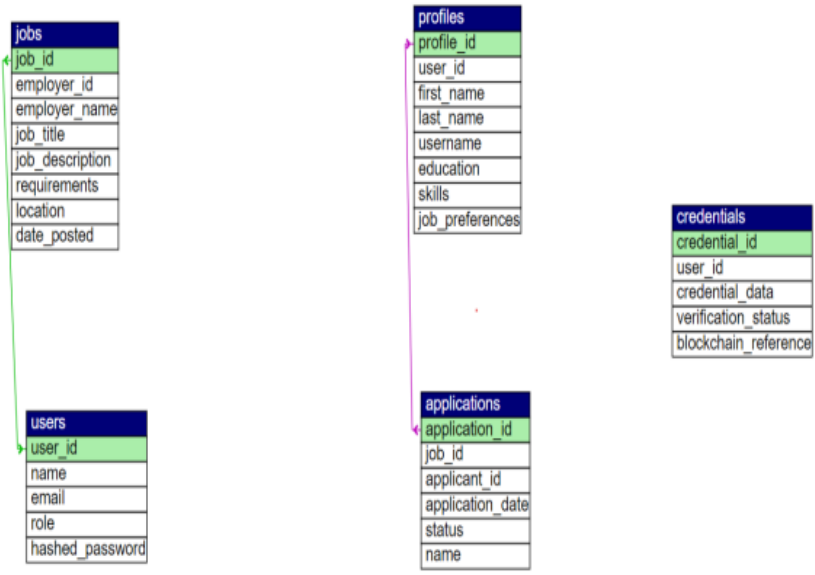

Fig. 3. Showing schema design of the database of system

The database schema is designed to support the core functionalities of the system efficiently. Key tables include:

3.4 Security Considerations

Measures to Ensure Data Security and User Privacy

Authentication and Authorization: Implementing robust user authentication using Django's built in authentication system[16]. Passwords are hashed using secure algorithms (b-crypt). Role based access control (RBAC) ensures that users can only access functionalities relevant to their roles (students, institutions, employers).

Data Encryption: All sensitive data, such as user credentials and personal information, are encrypted both in transit (using HTTPS) and at rest. Database encryption techniques are used to protect stored data.

Blockchain Security: The use of blockchain for credential verification ensures data integrity and immutability. Smart contracts are used to automate verification processes securely.

Regular Security Audits: Conducting regular security audits and vulnerability assessments to identify and mitigate potential security risks. Keeping all software dependencies UpToDate to protect against known vulnerabilities.

User Privacy: Adhering to data privacy regulations such as GDPR. Providing users with clear information about data collection and usage policies. Implementing features that allow users to control their data (data access and deletion requests). By integrating these security measures, the system ensures a high level of data protection and user privacy, fostering trust among its users.

4 Application, Verification and Simulation

4.1 Development Environment

The development environment for the College Student Employment Prediction and Guidance System leverages several modern tools and technologies. The primary backend framework is Django, a high-level Python web framework known for its simplicity and robust features. Django's built in ORM (Object-Relational Mapping) simplifies database interactions, while its security features help protect user data[17]. The frontend is developed using HTML, CSS, and JavaScript to ensure a responsive and user-friendly interface. HTML structures the web pages, CSS enhances the visual presentation, and JavaScript adds interactivity and dynamic content loading. Additional tools such as Bootstrap for responsive design and jQuery for simplified DOM manipulation are also utilized to create a seamless user experience. Figure 4 illustrates the home page of the system, providing a comprehensive overview of its interface. The layout is user-friendly, featuring easy navigation with clearly labeled sections such as Dashboard, Profile, and Settings. Key functionalities are prominently displayed, ensuring quick access. The design emphasizes simplicity and efficiency, allowing users to interact seamlessly with the system.

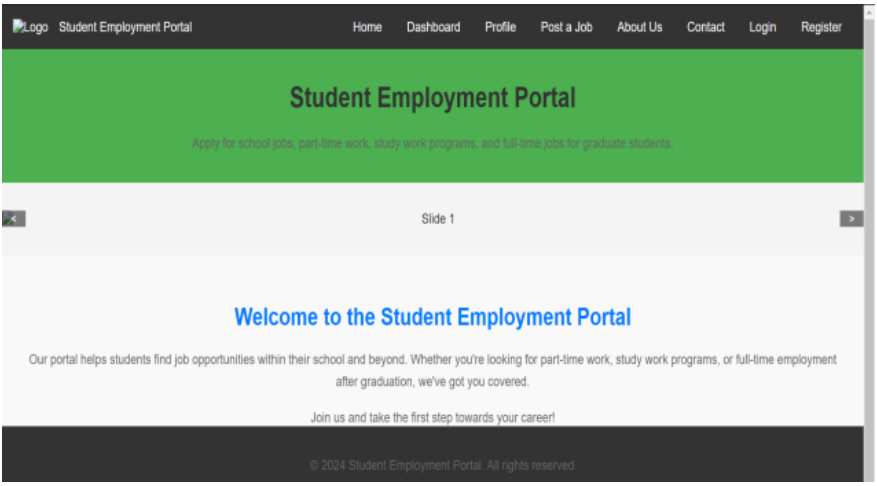

Fig. 4. home page

4.2 User Authentication Module

The User Authentication Module is a critical component of the system, providing secure access to various user roles including students, educational institutions, and employers. The login and registration pages are designed with user-friendly forms and robust validation mechanisms to ensure the integrity of user inputs. Django's built-in authentication system handles the creation and management of user sessions, ensuring secure access. Passwords are hashed using algorithms such as b-crypt to enhance security[18]. User roles and permissions are implemented using Django's Group and Permission models, enabling role-based access control (RBAC). This ensures that different user types have appropriate access to the system's features, maintaining the security and integrity of the application. Figures 5 and 6 illustrate the user interface for the registration and login pages of the platform. These pages are essential for user authentication, allowing individuals to securely access the system. Once registered and logged in, users can view available job postings and submit applications. The design ensures a seamless and secure entry point for job seekers.

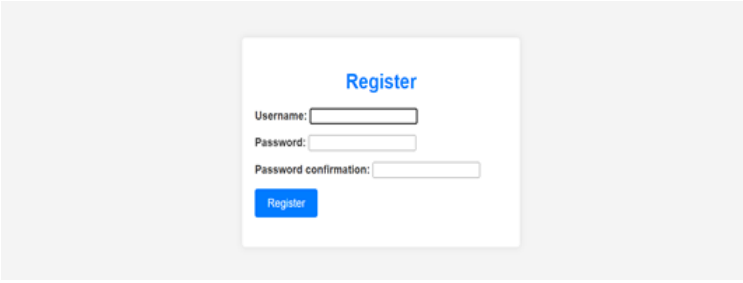

Fig. 5. registration page

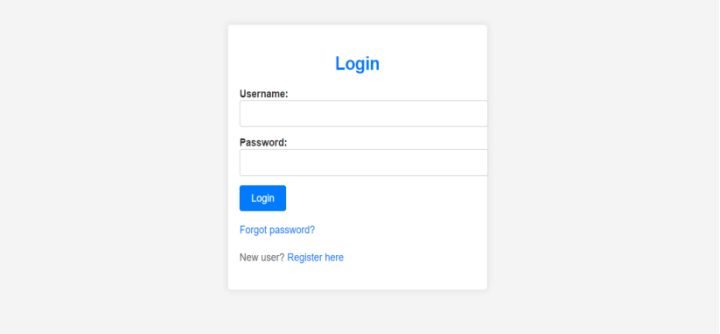

Fig. 6. Login page

4.3 Profile Management

The Profile Management module allows users to create and update their profiles seamlessly. For students, this includes fields for personal information, educational background, skills, and job preferences. Institutions and employers can also manage their profiles, including organizational details and job postings. The profile creation and update functionalities are designed to be intuitive, with forms that guide users through the necessary information. The system uses Django forms and models to manage profile data, ensuring consistency and reliability[19]. Additionally, the profile module supports file uploads for documents like resumes and certifications, which are stored securely on the server. Figure 7 illustrates the profile page, where users can view detailed information about themselves. This section typically includes personal details like name, email, and contact information, as well as preferences and account settings. Users might also see their activity history, saved items, and options to update or edit their profile information.

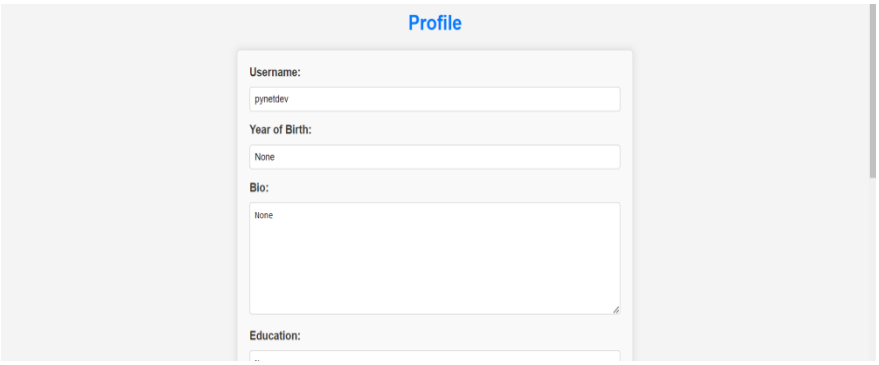

Fig. 7. profile page

4.4 Dashboard

Fig. 8. dashboard page

The Dashboard serves as the central hub for users, providing quick access to relevant information and functionalities. For students, the dashboard displays personalized job recommendations, application statuses, and upcoming events or deadlines. Employers and institutions see metrics related to job postings, application analytics, and user engagement. The dashboard is designed using a combination of Django templates and JavaScript to dynamically load content and provide real-time updates[20]. Features such as notifications, activity logs, and quick links to frequently used functionalities enhance the user experience and help users stay organized and informed. Figure 8 illustrates the dashboard page, which features graphs that provide in-depth analysis and performance metrics of the system. This dashboard serves as a central hub for users to monitor key data, track system performance, and make informed decisions based on the visualized analytics. The graphs are designed for clarity and ease of interpretation.

4.5 Job Page

The Job Page is a key feature of the system, providing a comprehensive listing of job opportunities tailored to the users' profiles. Job listings include detailed descriptions, requirements, and application instructions. Students can search and filter job listings based on various criteria such as location, job type, and company. The application process is streamlined with easy-to-use forms that guide users through the necessary steps. The recommendation system, powered by machine learning algorithms, analyzes user

profiles and job listings to suggest the most suitable job opportunities. This personalized approach increases the likelihood of successful matches between students and employers. Figure 9 illustrates the job posting section on the system's website, where students can browse through job descriptions. Each job listing provides detailed information about the role. When a student clicks on a job title or link, they are seamlessly directed to the application page, allowing them to easily proceed with applying for the position.

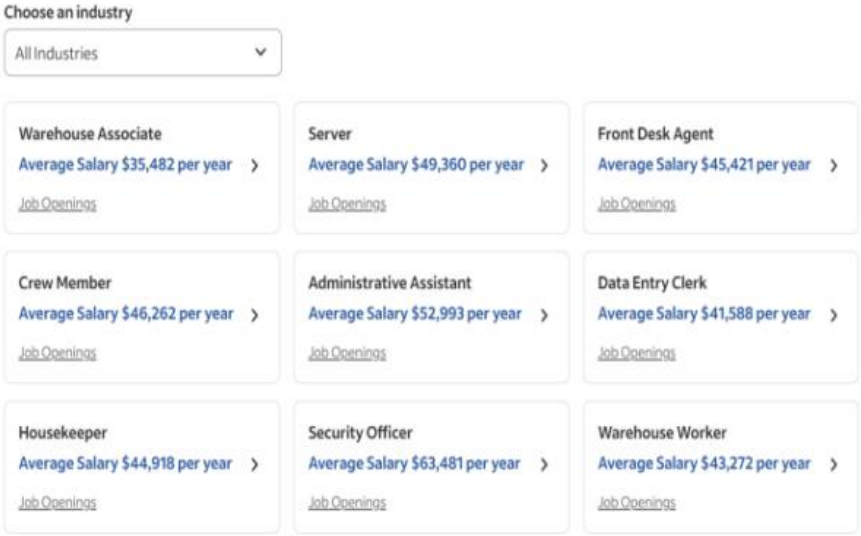

Fig. 9. Job page

4.6 About Us Page

The About Us Page is designed to provide users with an overview of the system, its mission, and the team behind it. The content is structured to highlight the key benefits and unique features of the platform. The design incorporates a clean layout with engaging visuals and clear typography to ensure readability. The About Us page also includes sections on the system's vision, values, and the technological innovations it leverages, such as blockchain and AI. This page helps build trust and credibility with users by providing transparency about the platform's purpose and the people involved. Figure 10 provides a comprehensive overview of the paper, offering users detailed information about the school, including its mission and resources. It highlights how the website serves as a valuable tool in supporting students with their academic tasks, offering guidance, resources, and assistance to help them succeed in their studies.

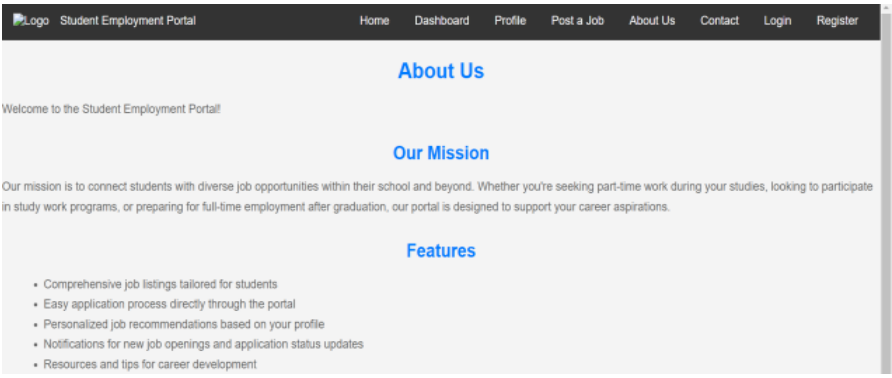

Fig. 10. About Us

4.7 Contact Page

The Contact Page offers users a simple and effective way to get in touch with the system's support team. It includes a contact form where users can submit inquiries, feedback, or support requests. The form captures essential information such as name, email, and message, ensuring that the support team can respond promptly and effectively. The implementation details include backend handling of form submissions using Django views and forms, with email notifications sent to the support team for each submission. The Contact Page also features alternative contact information, such as phone numbers and social media links, providing multiple channels for users to reach out. By meticulously implementing these components, the College Student Employment Prediction and Guidance System ensures a robust, user friendly, and secure platform that meets the diverse needs of students, educational institutions, and employers. Figure 11 illustrates the "Contact Us" page, where users can provide feedback about the system and share their experiences. This page also features a form allowing users to submit specific service requests or inquiries directly to the team. It serves as a convenient way for users to engage with the company and seek assistance or information.

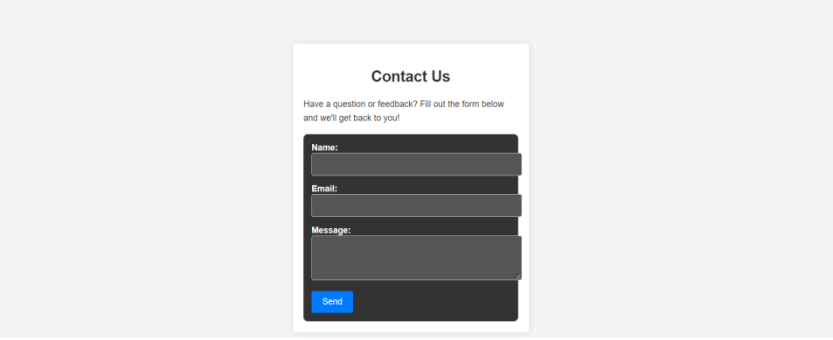

Fig. 11. Contact Page

5 Blockchain Integration

5.1 Blockchain Framework Selection

The selection of an appropriate blockchain framework is critical for ensuring the security, scalability, and functionality of the College Student Employment Prediction and Guidance System. The criteria for selecting the blockchain technology included factors such as decentralization, immutability, security, cost effectiveness, and community support. After evaluating several blockchain platforms, Ethereum emerged as the most suitable choice. Ethereum's robust smart contract functionality, active developer community, and widespread adoption make it an ideal platform for implementing credential verification and other block-chain based functionalities. Additionally, Ethereum's compatibility with various development tools and frameworks facilitates the integration process, ensuring a seamless and efficient implementation.

5.2 Credential Verification System

Blockchain technology is utilized to create a secure and transparent credential verification system. This system addresses the challenges of verifying academic and employment credentials, ensuring that the data is authentic and tamperproof. When students submit their credentials (such as degrees, certificates, and work experiences), these credentials are hashed and stored on the blockchain. Each entry is associated with a unique blockchain transaction ID, which serves as a verifiable proof of the credential's authenticity[21]. Educational institutions and employers can access the blockchain to verify the credentials presented by students without relying on intermediaries. This decentralized approach eliminates the risk of data manipulation and provides a transparent and immutable record of each credential. The use of blockchain also enhances the trust and credibility of the system, as all parties involved can independently verify the information.

5.3 Smart Contracts

Smart contracts are a cornerstone of the blockchain integration in the system, enabling the automation and execution of various functions based on predefined conditions. In the context of credential verification, smart contracts are used to automate the issuance, validation, and revocation of credentials. When a credential is issued by an educational institution, a smart contract records the credential's details on the blockchain, ensuring that the data is immutable and verifiable. If a credential needs to be updated or revoked, another smart contract transaction is executed, maintaining the integrity of the record. Beyond credential verification, smart contracts are also employed for managing job listings and applications. For instance, when an employer posts a job listing, a smart contract ensures that the job details are securely recorded on the blockchain. This not only provides a transparent record of job postings but also facilitates the matching process between students and job opportunities. When a student applies for a job, a smart

contract can be used to verify their credentials and ensure that they meet the job requirements before the application is processed. This automated verification process streamlines the hiring workflow and reduces the administrative burden on employers. The implementation of smart contracts involves writing and deploying Solidity code on the Ethereum blockchain. Solidity is the programming language used for developing smart contracts on Ethereum. The smart contracts are tested extensively to ensure they perform the intended functions accurately and securely. Additionally, proper mechanisms are put in place to handle potential errors and exceptions, ensuring the reliability and robustness of the system.

In conclusion, the integration of blockchain technology into the College Student Employment Prediction and Guidance System significantly enhances the security, transparency, and efficiency of credential verification and job application processes[22]. By leveraging Ethereum's smart contract capabilities, the system can automate complex workflows, reduce the risk of data manipulation, and build trust among students, educational institutions, and employers. This innovative approach addresses the prevalent challenges in the current employment ecosystem, providing a scalable and reliable solution that benefits all stakeholders involved. As blockchain technology continues to evolve, the system can adapt and incorporate new advancements, ensuring its relevance and effectiveness in the everchanging landscape of education and employment.

6 Artificial Intelligence Integration

6.1 AI Models for Employment Prediction

The integration of artificial intelligence (AI) into the College Student Employment Prediction and Guidance System leverages advanced machine learning models to predict employment outcomes for students. Key models include decision trees, random forests, and neural networks. Decision trees offer a clear, interpretable structure, showing how various factors such as GPA, internships, and extracurricular activities influence job prospects. Random forests, which are ensembles of decision trees, enhance prediction accuracy by mitigating overfitting and capturing complex relationships in the data. Neural networks, particularly deep learning models, are employed for their ability to handle large, complex datasets, identifying nuanced patterns that simpler models might miss. These AI models collectively provide robust predictions, enabling students to make informed career decisions.

6.2 Data Collection and Preprocessing

Data collection is foundational to the system's accuracy and efficacy. The system aggregates data from diverse sources: academic records from educational institutions, job market data from online portals and employment agencies, and self-reported data from user profiles. This comprehensive dataset allows for a holistic analysis of the factors influencing employment outcomes. Preprocessing this data is critical to ensure model reliability. The process involves cleaning the data to correct errors and handle missing

values through imputation or deletion. Data transformation techniques, such as normalizing numerical values and encoding categorical variables, prepare the data for machine learning algorithms[23]. Feature engineering, which involves creating new features from the existing data (calculating GPA from individual grades), further enhances the dataset, providing more informative inputs for the AI models. These preprocessing steps ensure that the data fed into the models is both high quality and relevant.

6.3 Model Training and Evaluation

Training the AI models involves using historical data to teach the algorithms how to predict employment outcomes based on input features. This process uses supervised learning, where models learn from labeled data—instances where the employment outcomes are known. Techniques such as cross validation help prevent overfitting, ensuring the models generalize well to new, unseen data. The performance of these models is evaluated using metrics like accuracy, precision, recall, and F1 score. Accuracy measures the proportion of correct predictions, while precision and recall provide insights into the model's ability to correctly identify positive employment outcomes and avoid false negatives, respectively[24]. The F1 score, a harmonic mean of precision and recall, offers a balanced performance measure. For regression tasks, predicting continuous outcomes like expected salary, metrics such as mean squared error (MSE) and root mean squared error (RMSE) are used. These metrics guide the finetuning of the models, helping select the best performing algorithms for deployment. Figure 12 illustrates the workflow of a machine learning algorithm used to analyze and train models on data from a database. It outlines the steps of data preprocessing, model training, and evaluation, culminating in the integration of the trained model into the system for automated job uploads and processing.

```
@login_required
def dashboard(request):
    # Use timezone-aware datetime
    now = timezone.now()
    last_week = now - timedelta(days=7)

    # Aggregate job posts by week
    jobs_by_week = Job.objects.filter(posted_date__gte=last_week).extra(select={'week': 'strftime("%W", po

    # Aggregate applications by week
    applications_by_week = Application.objects.filter(applied_date__gte=last_week).extra(select={'week': '

    # Average GPA of applicants
    avg_gpa = Profile.objects.filter(user__application__isnull=False).aggregate(avg_gpa=Avg('gpa'))['avg_gp

    # Example AI model for job recommendation (dummy example
    X = np.array([[1, 4], [2, 11], [3, 20], [4, 25]])  # Dummy feature data
    y = np.array([0, 1, 0, 1])  # Dummy labels
    model = LogisticRegression()
    model.fit(X, y)
    recommendation = model.predict([[2, 3]])  # Dummy prediction
```

Fig. 12. AI models and training

6.4 AI in Career Guidance

AI significantly enhances the system's ability to provide personalized career guidance. By analyzing individual student profiles and job market trends, the system offers tailored job recommendations and career advice. Natural language processing (NLP) techniques analyze job descriptions and student profiles to match students with roles that align with their skills and interests. This personalized approach increases the likelihood of job satisfaction and success. AI also recommends relevant courses, certifications, and training programs to help students improve their employability[24]. Additionally, AI powered chatbots and virtual career advisors offer real-time support, answering student queries and providing advice based on current market conditions. This continuous, dynamic support system ensures that students receive relevant, up to date guidance as they navigate their career paths.

In summary, the integration of AI into the College Student Employment Prediction and Guidance System enhances its capability to predict employment outcomes and provide personalized career guidance. Through sophisticated AI models, comprehensive data preprocessing, rigorous model training and evaluation, and tailored career support, the system empowers students to make informed decisions and successfully transition into the workforce.

7 Conclusion and Future Work

7.1 Conclusion

This dissertation has presented the design and implementation of a College Student Employment Prediction and Guidance System, leveraging blockchain and artificial intelligence technologies to address the critical challenge of student employability. The system aims to bridge the gap between educational outcomes and employment opportunities by providing accurate employment predictions and personalized career guidance. The integration of blockchain technology ensures the security and immutability of student credentials, while AI models enhance the system’s ability to predict employment outcomes and offer tailored career advice. The comprehensive development process, from system architecture to implementation details, demonstrates the feasibility and potential of such a system in improving student employment prospects.

7.2 Contributions

This research makes several significant contributions to the fields of educational technology and employment prediction. First, it introduces a novel approach to student employability by integrating blockchain and AI technologies, providing a secure and intelligent platform for students, educational institutions, and employers. The blockchain based credential verification system ensures the authenticity of student records, addressing issues of fraud and misrepresentation. The AI models developed for employment prediction offer accurate and actionable insights, helping students make informed career decisions.

Second, the dissertation contributes to the literature on AI and blockchain integration by providing a detailed case study of their application in an employment prediction and guidance system. The methodologies for data collection, preprocessing, model training, and evaluation offer a robust framework that can be adapted and extended to other domains. Additionally, the implementation of smart contracts for automating various functions within the system showcases the potential of blockchain technology beyond traditional financial applications.

Third, this research highlights the practical implications of integrating advanced technologies in educational settings. By demonstrating the system's effectiveness in a real-world scenario, it provides a valuable reference for educators, policymakers, and developers interested in leveraging technology to enhance student outcomes and employability. The user-friendly design and comprehensive functionalities of the system also contribute to its accessibility and usability, ensuring that it can be effectively utilized by diverse user groups.

7.3 Future Work

While the current system provides a solid foundation for improving student employability, several areas for future research and development remain. First, enhancing the AI models with more sophisticated techniques, such as deep learning and natural language processing, could further improve the accuracy and relevance of employment predictions and career guidance. Incorporating real-time labor market data and trends could also enable the system to adapt to changing job market conditions, offering more timely and relevant advice.

Second, expanding the system to include a wider range of user groups and functionalities could enhance its impact. For instance, integrating support for international students and job markets would make the system more inclusive and globally relevant. Additionally, incorporating features such as skill assessments, internship matching, and networking opportunities could provide more comprehensive support for students throughout their career development.

Third, further research could explore the scalability and interoperability of the blockchain infrastructure used in the system. Investigating ways to integrate the system with other blockchain based educational platforms and services could create a more interconnected and efficient ecosystem for credential verification and career support. Exploring alternative blockchain technologies that offer improved scalability and reduced energy consumption could also enhance the system's performance and sustainability.

Finally, conducting extensive user testing and feedback collection will be crucial for refining the system and ensuring it meets the needs of all stakeholders. Future work should focus on evaluating the system's effectiveness in various educational settings and continuously iterating based on user feedback and technological advancements.

In conclusion, this dissertation has laid the groundwork for an innovative and impactful solution to the challenge of student employability. By integrating blockchain and AI technologies, the proposed system offers a secure, intelligent, and user-friendly platform that can significantly enhance student outcomes. The contributions of this re-

search and the potential for future developments underscore the importance and promise of leveraging advanced technologies to support student success in the evolving job market.

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