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Bus Pass Automation Software Using Blockchain Technology

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Abstract:

The Bus Pass Automation Software offers a comprehensive solution to streamline the bus pass issuance process for college students, administrators, and colleges, addressing the challenges encountered with the current manual system. In the ever-evolving landscape of transportation management, the integration of blockchain technology offers a paradigm shift in the administration of bus pass systems. By employing digital identities based on blockchain technology, passenger information is securely stored, ensuring confidentiality and minimizing the potential for identity theft. Students can conveniently submit their information and required documents through the secure online platform. After verification, bus passes are issued electronically, bypassing the need for manual processing and significantly easing the administrative workload. The system eliminates the hassle of dealing with paperwork or visiting administrative offices in person. Effective communication channels between students, colleges, and administrators are facilitated through the system, enhancing efficiency, security, and transparency.

I. INTRODUCTION

The Bus Pass Management System serves as a convenient solution for students facing challenges with the lengthy manual bus pass issuance process. The system's intuitive user interface allows easy navigation and improves user experience with responsive design for accessibility on various devices. Leveraging Optical Character Recognition (OCR) and the Verhoeff algorithm, the system accurately processes and verifies Aadhaar card details to minimize the risk of fake submissions. The system securely stores students' confidential data on a blockchain. Access to this information is granted to respective colleges only upon the student's approval, ensuring data confidentiality and privacy protection. Other data are stored in a cloud database for scalability and efficient management, keeping costs down and operations flexible. This dual-storage approach balances security and accessibility, safeguarding sensitive information while simplifying the management of less critical data. The system enables pass renewal at specified intervals, facilitating a seamless process managed by administrators.

II. LITERATURE SURVEY

The article explores the potential of blockchain technology in revolutionizing Enterprise Resource Planning (ERP) systems. Traditional centralized ERP platforms face challenges in terms of security, transparency, and process integrity. Blockchain, with its decentralized and distributed ledger approach, emerges as a promising solution to address these limitations. The integration of smart contracts into ERP workflows automates cross-organizational processes, presenting opportunities for efficiency gains and improved workflow management while also addressing associated challenges. Distributed consensus mechanisms facilitated by blockchain nodes ensure process integrity and detect tampering, contributing to the reliability of ERP systems. Additionally, blockchain-based shared ledgers promote standardization and transparency, enhancing data interoperability, auditing processes, and regulatory compliance within ERP ecosystems.

Real-time information retrieval from Identity cards, as outlined in the research paper, proposes a set of advanced methods to enhance the process of retrieving real-time information from personal ID cards. It addresses the importance of accuracy and speed in this process, which impacts the efficiency of data exchange. The focus of the proposal lies in optimizing the journey of an ID card from the initial scanning or capture phase to the pre-OCR stage.

The "Online Bus Pass System" is a digital solution designed to streamline and enhance the process of bus pass registration and renewal. The system employs Aadhaar card verification for user authentication by the admin and incorporates GPS tracking for real-time bus pass monitoring. The project aims to reduce manual work, eliminate paperwork, and offer a user-friendly experience through web and application interfaces. It uses the Hadoop Framework to process large datasets to secure data and provides efficient use of the memory.

The Online Bus Pass Generation project is a web application designed to simplify the process of obtaining and managing bus passes in Maharashtra. With separate logins for users and administrators, it offers an efficient platform for pass authentication, application, and renewal, significantly reducing paperwork and time consumption. Users can conveniently refill their accounts and extend pass validity online, while administrators have access to comprehensive user details and balances. The system also includes a search functionality for bus information, enhancing the overall user experience and making bus pass acquisition and journey planning simpler and more accessible for commuters across the state.

The Smart Bus Pass System addresses the inefficiencies of traditional bus ticketing systems by introducing a mobile-friendly solution via an Android app serving as the user interface. Through this technology, passengers receive alerts about impending pass expirations, enhancing convenience and ensuring timely renewals. The system streamlines the boarding process by employing QR codes as digital passes, minimizing the need for manual identification by conductors and eliminating the burden of physically carrying passes for students.

III. PROPOSED METHODOLOGY

The proposed system is intended to come out from the major drawbacks of the currently existing manual system. This system is simple and easy to design or implement. It will work in all the configurations. This application involves transport office admin, college admin, and student.

To mitigate the risk of fraudulent registrations, the system employs OCR technology to extract Aadhaar card details from uploaded documents. These details are then cross-checked with user-entered information, ensuring consistency and authenticity. Additionally, the Verhoeff algorithm is utilized to further validate the accuracy of the data.

MetaMask and Truffle form the backbone of the blockchain infrastructure, facilitating student authentication, wallet address creation, and storage of student details within smart contracts. MetaMask enables the secure creation of student wallet addresses, while Truffle streamlines the development and deployment of smart contracts to store and manage student data. Through this integration, students can grant approval to their college wallet addresses for accessing their data, ensuring transparency, security, and user control over personal information within the blockchain ecosystem.

Firebase Cloud Database serves as a robust solution for storing route details, college information, and other pertinent data, offering several advantages. Its real-time database capabilities ensure instant updates and synchronization across multiple devices. Firebase's scalability accommodates growing datasets, ensuring seamless management of expanding route networks and evolving college information. Moreover, Firebase's serverless architecture reduces maintenance overhead, allowing focus on enhancing route efficiency and college services.

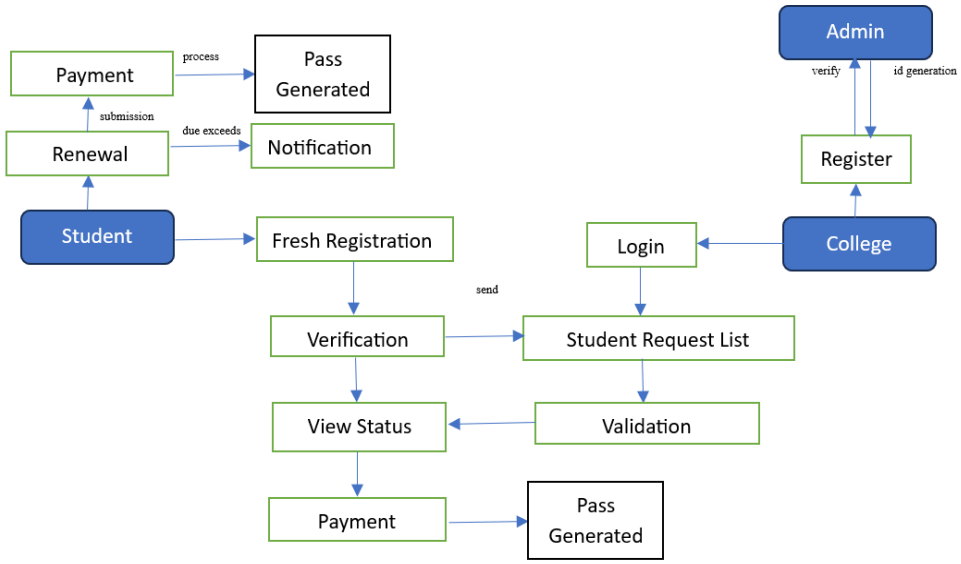

Fig.1 System Architecture

IV. IMPLEMENTATION

Students initiate the process by registering and submitting applications and providing personal details with Aadhaar card images, residential addresses, and educational information. A smart contract is created in Solidity (Ethereum's programming language) to handle important data storage. Following the validation of Aadhaar details, the registration form is forwarded to the college for further verification. This step ensures that the information provided by the student aligns with the records held by the educational institution. Students can log in to their profiles to check the status of their pass applications and renewals (pending/successful). The payment page is activated when the status turns to success. After successful payment, the system generates and issues a digital pass, which is accessible to students via their profiles. A detailed payment history is available for students to track their transactions.

College admin logs in to review fresh pass applications submitted by students affiliated with their institution. They are responsible for verifying student details and either approving or rejecting pass applications. Additionally, college users oversee the verification and approval of renewal requests submitted by students. This approval process ensures that only valid and authenticated pass applications are processed, contributing to the smooth and efficient management of bus passes within the educational institution's framework.

Administrators efficiently manage institution details, define bus routes, fix fares, and review student applications using the system's capabilities, ensuring accuracy and legitimacy. Admin oversees the pass application process and can handle queries posted by the students and college management.

Students benefit from a user-friendly interface, transparent payment history, and automated renewal alerts, ensuring a seamless and secure experience throughout the bus pass lifecycle. Renewal prompts are automatically sent when the pass nears expiration, with the college module managing renewal approval mirroring the fresh application process.

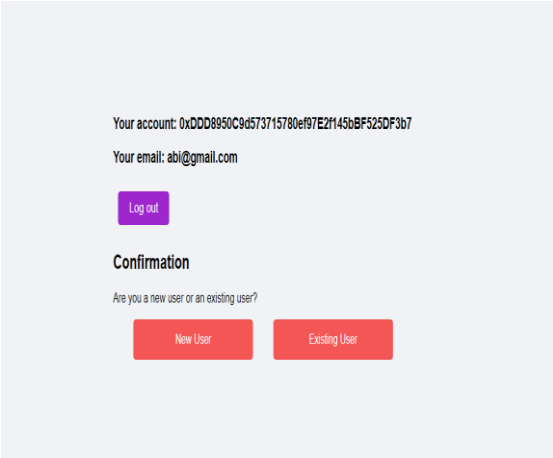

Fig 2. Confirmation Page

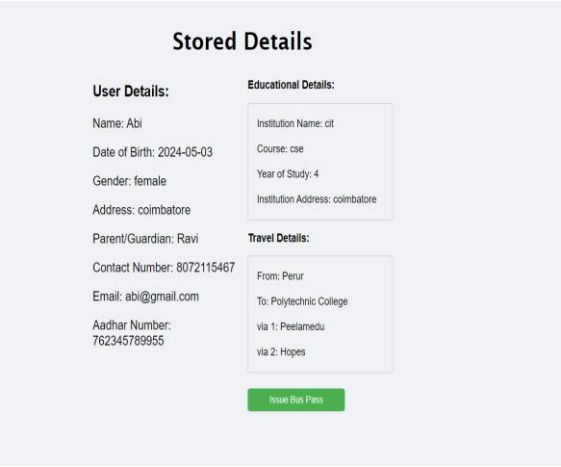

Fig 3. Stored Details

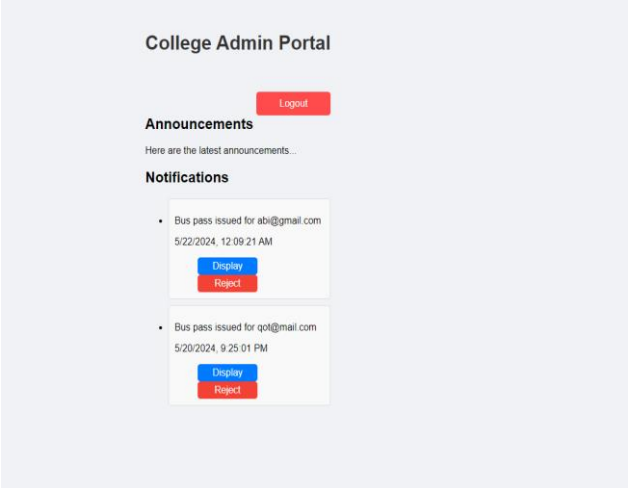

Fig 4. College Admin Portal

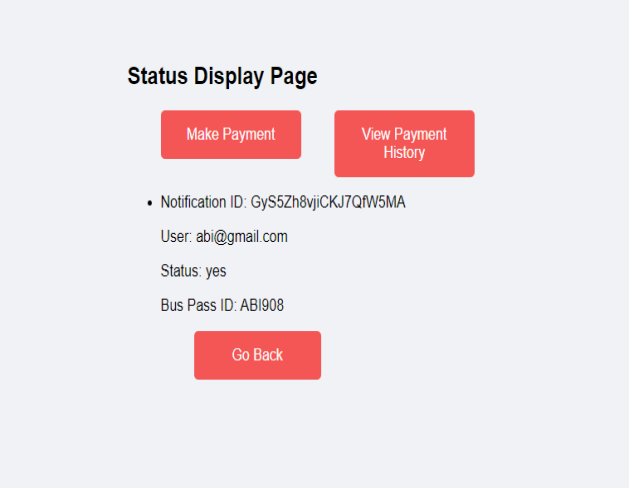

Fig 5. Outcome

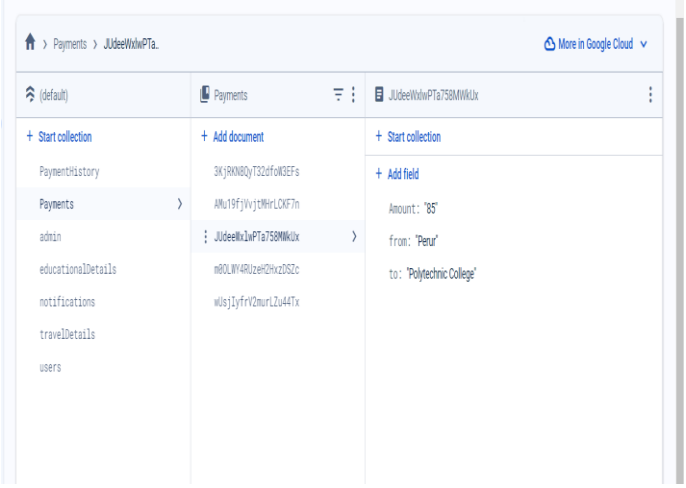

Fig 6. Firebase Data storage

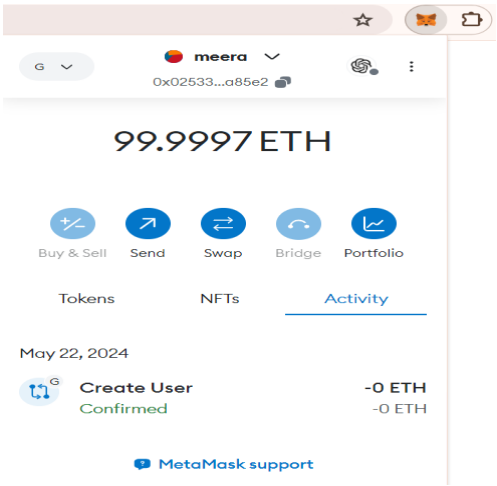

Fig 7. MetaMask Student wallet

V. CONCLUSION

The bus pass automation software revolutionizes the student transportation experience by simplifying the cumbersome pass generation and renewal process. With real-time updates and online payment capabilities, it alleviates the need for constant authorization, reducing administrative hurdles for both students and college staff. Moreover, the integration of cashless payment options enhances convenience and transparency, making transactions seamless. In essence, this system optimizes efficiency, delivering a hassle-free and user-friendly solution that elevates the entire bus pass management process for all stakeholders involved.

VI. FUTURE WORK

Enhance Webpage User Experience:
-The page can be further developed to be more interactive and user-friendly.

Supportive Mobile Application:
- Developing a dedicated mobile application alongside the web application, enhancing convenience across multiple platforms.

Improved Resource Allocation:
- Enabling administrators to efficiently manage new route updates and associated fares, providing users with real-time information on route expansions and corresponding fare adjustments.

Expand to Other Conditions:
-Extend the model's capabilities to other types of passengers, such as the general public, the system becomes more inclusive, promoting broader usage and accessibility.

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