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Block-Chain Based Work Place Management System Using Face-Recognition and Geo-Location

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ABSTRACT

This research paper introduces a cutting-edge solution for Work Place Management systems by integrating face recognition, Geo-fencing, and block-chain technologies. The research paper presents a cross-platform mobile application using Flutter, providing accessibility across diverse user bases. The study addresses the limitations of traditional Work place tracking methods and aims to enhance accuracy, security, and transparency. Emphasizing the synergistic benefits of the Block-Chain, Face-Recognition, Geo-Fence technologies. The paper concludes with a summary of key contributions and suggestions for future research, highlighting the significance of this innovative approach to Work place management.

I. INTRODUCTION

In contemporary educational and organizational landscapes, Work place management remains a critical facet for ensuring accountability, efficiency, and transparency. Conventional methods of Work place tracking have, however, proven to be susceptible to inaccuracies, proxy attendances, and inefficient record-keeping. In response to these challenges, this research explores an innovative paradigm by integrating advanced technologies—face recognition, Geo-fencing, and block-chain—into the development of an Work place management system. The system is implemented as a cross-platform mobile application using Flutter, aiming to enhance accuracy, security, and accessibility.

The motivation for this research stems from the pressing need to address the limitations of traditional Work place systems, which often rely on manual processes or outdated technologies. The integration of face recognition technology serves to bolster identity verification, mitigating risks associated with impersonation or proxy attendance. Geo-fencing, a location-based technology, adds a contextual layer to Work place tracking by tethering it to specific geographical locations, thereby ensuring a more accurate and context-aware recording of attendance.

Furthermore, the incorporation of block-chain technology into the system addresses concerns related to data integrity and tampering. Block-chain, with its decentralized and immutable ledger, provides a transparent and secure mechanism for recording attendance, mitigating the risk of unauthorized alterations or fraudulent activities. The combination of these technologies is poised to redefine the landscape of Work place management, offering a comprehensive solution that goes beyond traditional methods.

The choice of Flutter as the development framework for the mobile application is rooted in its capability to create a seamless and uniform experience across different platforms. By adopting a cross-platform approach, the mobile application ensures accessibility to a wider user base, accommodating the diverse technological preferences of users.

This research aims to contribute to the evolving field of Work place management systems by presenting a holistic solution that addresses the shortcomings of existing methods. Through an in-depth exploration of the integration process, the subsequent sections of this paper delve into a detailed literature review, methodology, results, and discussion, ultimately providing a comprehensive understanding of the synergistic benefits of the proposed system.

II. MOTIVATION

The motivation behind the development of a Block-chain-based mobile application for attendance, integrating face recognition and Geo-location within the Flutter framework, originates from a proactive response to prevalent challenges in traditional Work place systems. Issues like slow biometric systems, extended waiting times, and instances of premature departure after Work place punch-ins compromise both efficiency and data security. A crucial motivation for this initiative is the pursuit of enhanced security through immutability, making the system resistant to Work place data tampering. By discouraging undesirable practices and ensuring the integrity of records, the project strives to contribute to the establishment of a secure, transparent, and technologically sophisticated Work place tracking system applicable in educational and professional settings, particularly serving as a viable technology for worker management facilities.

III. RELATED WORKS

Mohammad Azahari, Afiqah & Ahmad, Arniyati & Rahayu, Syarifah et al. [1] discusses the development of a contact less attendance system using face recognition, body temperature measurement, and GPS technology, implemented on block chain. It addresses the limitations of existing attendance systems that require physical interaction, which are not suitable during the COVID-19 pandemic. The paper emphasizes the significance of employee attendance for the economy and society, and proposes a secure and efficient method for recording attendance.

S. R. Dasi, E. S. Gujar, A. S. M. I. Ansari and Y. Patil, [2] propose an innovative system designed for accurate and secure attendance monitoring in real-time. By incorporating facial recognition technology, the system identifies employees with precision, and attendance records are securely stored on a block chain platform, ensuring immutability, transparency, and resistance to tampering. The primary objective is to furnish organizations with a secure and efficient mechanism for attendance recording, mitigating the potential for errors and manipulation while enhancing transparency and accountability. The detailed methodology outlined in the paper covers requirement analysis, data collection, study and analysis, system implementation, testing, and validation processes. The findings affirm the system's effectiveness, emphasizing its ability to eliminate errors, manipulation, and enhance overall transparency and accountability in attendance management.

Pujah Balasubramaniam and Gokilavani Sagadevan [3] research focuses on exploring the intricate synergies among block chain, artificial intelligence (AI), and face detection technologies to forge an innovative automated and decentralized trust management system. Their investigation delves into the profound integration of these cutting-edge technologies with the objective of tackling multifaceted challenges prevalent in trust-related processes. The core emphasis of their work lies in addressing critical issues such as security vulnerabilities, lack of transparency, and inefficiencies within conventional trust systems. By leveraging block chain's immutable and decentralized ledger, AI's cognitive capabilities, and face detection's biometric authentication, their proposed system aims to revolutionize trust management paradigms by ensuring heightened security, bolstered transparency, and streamlined efficiency across diverse domains and applications. This research holds promise for significantly advancing trust mechanisms by harnessing the combined potential of these emergent technologies, paving the way for novel solutions in ensuring robust, reliable, and decentralized trust frameworks for various sectors.

Hongrong Gao [4] endeavors to illuminate the intricate convergence of online ideological education with the rapid advancements in new media, face recognition, and block chain technologies. By comprehensively exploring this intersection, the study seeks to offer a nuanced understanding of the multifaceted challenges and promising opportunities that arise from the integration of these innovative technologies within the educational sphere. Gao's research delves into the evolving landscape of online ideological education, examining how new media platforms, with their expansive reach and immersive capabilities, intersect with the functionalities of face recognition technology and the security frameworks offered by block chain. This investigation aims to shed light on the transformative potential of these technologies in reshaping educational paradigms, addressing challenges related to ideological education delivery, content authentication, data security, and student privacy. Through a holistic examination of these technological integrations, Gao's research intends to provide valuable insights and guidance for educators, policymakers, and stakeholders to navigate and harness these advancements effectively, thereby leveraging the opportunities presented for enhancing the quality, accessibility, and security of ideological education in the digital era.

Khaled Shuaib, Juhar Abdella, Farag Sallabi, and Mohamed Adel Serhani [5] present a pioneering proposition focused on implementing a blockchain-based system tailored specifically for the secure and decentralized sharing of electronic health records (EHRs). The core objective of their study revolves around harnessing the intrinsic strengths of block chain technology to revolutionize the landscape of health data management. By employing block chain's decentralized and immutable ledger, the proposed system aims to address critical challenges prevalent in the conventional sharing and management of EHRs. Their research delves into the intricacies of this innovative approach, emphasizing the pivotal role block chain plays in fortifying the security, ensuring the privacy of sensitive health-related information, and enhancing the accessibility and interoperability of EHRs across healthcare systems. The proposed framework seeks to empower patients with greater control over their data while facilitating seamless, secure, and efficient sharing among authorized healthcare providers. This exploration holds immense promise in reshaping the paradigm of health data management, offering a robust solution to the longstanding concerns surrounding the security, privacy, and accessibility of electronic health records in modern healthcare ecosystems.

Akinbowale Babatunde, Afeez Oke, Ronke Babatunde, Opeyemi Ibitoye, and E. Jimoh et al. [6] introduces an innovative mobile-based student attendance system that integrates Geo-Fencing, timing, and facial recognition technologies. Recognizing the limitations of traditional attendance tracking methods, the authors propose an Automated attendance System to mitigate errors inherent in manual processes. The Geo-Fencing, implemented through the Winding Number algorithm, ensures precise attendance marking within specified geographical boundaries and predetermined time intervals. Technical details, including the utilization of Android Studio as the integrated development environment (IDE) and Convolutional Neural Networks (CNNs) for facial detection, underscore the technological sophistication of the solution. This research aims to establish a reliable and automated system, reducing errors in attendance management, and providing a seamless and efficient experience for both students and educators within educational institutions.

N. Prathyusha, P. Pooja, and A. Vijay Vasan et al. [7] in 2023 introduces an advanced block chain-based E-Voting system, integrating facial recognition and the Random Forest Algorithm for voter eligibility verification. In

response to the prevalent issues of errors and discrepancies in traditional voting mechanisms, the system strives to enhance trust in electoral processes by deploying cutting-edge technologies. The facial recognition component employs sophisticated algorithms, likely based on Convolutional Neural Networks (CNNs), to ensure accurate voter identification. The Random Forest Algorithm contributes to robust voter eligibility verification through the processing of multiple decision trees, enhancing the overall accuracy of the validation process. Utilizing block chain technology as an immutable and decentralized ledger enhances online voting security and transparency. Beyond fraud prevention, the implementation of such a system carries implications for the broader adoption of secure and transparent technologies in electoral practices, potentially shaping the future landscape of voting systems.

The study by M. Makhtar et al. [8] examines the evolution of attendance tracking systems, tracing their progression from conventional to advanced methods such as RFID and thumbprint technology. Recognizing the growing relevance of mobile attendance tracking, particularly for remote workers with GPS-enabled smartphones, the research focuses on the development and implementation of an Android application utilizing Geo-fencing technology. The study emphasizes the effectiveness of this approach in monitoring employee attendance by analyzing the location and boundaries of GPS-enabled mobile devices. The Android app serves as a user-friendly solution, enabling off-site employees to conveniently clock in and out, thereby improving overall attendance management. In summary, the research highlights the pivotal role of mobile attendance solutions, showcasing the practicality and efficiency of the Android application employing Geo-fencing technology in addressing the evolving needs of contemporary workplaces.

Nazanin Zahed Benisia et al., [9] study introduces a transformative approach to decentralized networking by harnessing the groundbreaking technology of block chain, eliminating the need for a central authority. The invention of block chain in 2008 enables peer-to-peer networks to achieve consensus and establish a chain of approved blocks, particularly relevant in decentralized storage systems. In this application, individuals contribute their idle hardware storage capacity, forming a secure network for file transmission with end-to-end encryption. The study emphasizes the reduction of data failure risks by eliminating centralized controls. Smart contracts play a crucial role in establishing rental agreements, defining the terms of storage usage, and necessitating storage providers to ensure the integrity of stored files over time. The research provides a comprehensive analysis of block chain storage systems, comparing them to traditional cloud storage networks, exploring various consensus algorithms, and evaluating their strengths and limitations. Additionally, the study delves into potential future research directions in this field, offering valuable insights into the evolving landscape of decentralized storage solutions.

Rajeev Ranjan, Ankan Bansal, Jingxiao Zheng, Hongyu Xu, Joshua Gleason, Boyu Lu, Anirudh Nanduri, Jun-Cheng Chen, Carlos D Castillo, and Rama Chellappa et al. [10] present an advanced deep learning pipeline for unconstrained face identification and verification. The system leverages the deep pyramid single shot face detector (DPSSD) and employs deep learning convolutional neural networks (CNNs). Notably, the proposed pipeline demonstrates state-of-the-art performance across various benchmark datasets. The paper contributes to the field by offering a robust and efficient solution for face-related tasks, addressing the challenges associated with unconstrained conditions and achieving remarkable accuracy in face detection, identification, and verification.

Arora, Priyanka and Nagpal, Ritu et al.[11] presents a comprehensive analysis of block chain technology in their 2022 paper, examining its foundational principles, diverse applications, and associated merits and drawbacks. The paper illuminates block chain's pivotal role as a decentralized and distributed ledger system, moving beyond its original association with cryptocurrencies like Bitcoin to explore its varied applications across industries. Noteworthy advantages, including heightened security, increased transparency, and the elimination of intermediaries in transactions, are meticulously outlined. Conversely, the paper addresses potential challenges, such as scalability issues and regulatory hurdles. Through their systematic exploration, the authors contribute significantly to a nuanced understanding of the intricate nature of block chain technology, offering valuable insights that transcend various domains.

IV. PROPOSED METHODOLOGY

Given in Table 4.1 are the Existing methods of recording attendance. After careful consideration of the advantages and disadvantages of all, we decided to go ahead with a method which is a mix of mobile application and online attendance system.

The primary objective is to develop a system capable of recording the attendance of all classroom attendees and ensuring its security using block chain technology. Our solution aims to streamline the process, reducing the time required compared to traditional methods while also enhancing system security. The proposed system is designed to operate securely and efficiently. There are majorly four parts:

1) Face Recognition

One of the key tools for facial detection is ‘face_recognition’, a module of python. Utilizing ‘face_recognition’, an efficient facial detection system can be constructed to gather facial data. The user's facial detection occurs via the front camera within a range of 50-60cm. The process for detecting the face involves:

i) Initially, the frontal camera captures the face and processes the face encodings. The face encodings are a vector of 128 values which represent the measurements of the face.

ii) These encodings are compared with the particular encodings of the user and verified.

2) Geo-Location Verification

This step consists of integrating geolocation services to verify the physical presence of individuals within defined boundaries.

First, a Geo-fence is set up with the given GPS coordinates surrounding the campus. Next, the real-time location data of the user is fetched from their device GPS system. The last step is to compare the fetched location against the Geo-fence boundaries to determine validity.

3) Interacting with Block chain Database

Beneficial from its immutable and distributed nature, block chain technology is promising in eliminating the forged data in attendance systems. Researchers put effort into implementing block chain in Work place systems to boost resistance to insecure data storage. Considering the block chain is a growing ledger, the records are narrowed to address, attendance state, and attendance timestamp for performance.

4) User Interface using Flutter

The User Interface to tie all of this up is provided by Flutter. Flutter is a Mobile Application Development Framework. The major advantages of using Flutter here are Cross-Platform compatibility (One Code base for Android and iOS) , High Performance and Unified App UI and Business Logic in All Platforms. Using the in-built functions for sending HTTP requests, ability to perform form validation and most importantly, allowing us to use device features like camera and location make Flutter an optimal choice.

Table 4.1

Sl. no	Methodology	Advantages	Disadvantages
1	Manual attendance Sheets	1) Simplicity: Easy to use and understand. 2) Low Cost: Minimal equipment and technology required.	1) Error-Prone: Prone to errors in recording and transcription. 2) Time-Consuming: Takes time to manually call out and record attendance.
2	Barcode or QR Code Scanning	1) Efficiency: Quick and efficient for recording attendance. 2) Digital Record: Provides a digital record for easy storage and retrieval.	1) Equipment Cost: Requires barcode scanners or QR code readers. 2) Sharing: Potential for fraud if codes are shared among attendees.
3	Smart Cards or RFID	1) Efficiency: Quick and efficient, reduces the time needed for attendance. 2) Quick and Efficient: Smart cards or RFID systems offer a quick and efficient way to record attendance with a simple tap or swipe.	1) Risk of Loss: Cards can be lost or misplaced, leading to attendance issues. 2) Maintenance and Upkeep: Ongoing maintenance and periodic upgrades may be required to ensure the smooth functioning of the smart card system.
4	Mobile Apps	1) Convenience: Allows for easy and convenient attendance tracking. 2) Real-Time Data: Provides real-time data and updates.	1) Device Dependency: Relies on users having compatible smartphones. 2) Privacy Concerns: Requires careful management of privacy issues associated with mobile devices.
5	Online attendance Systems	Remote access, centralized data management, and integration with other systems.	Relies on internet connectivity and may not account for physical presence.

V. RESULTS

A) The Data Stored in Block chain is as shown in Fig 5.1:

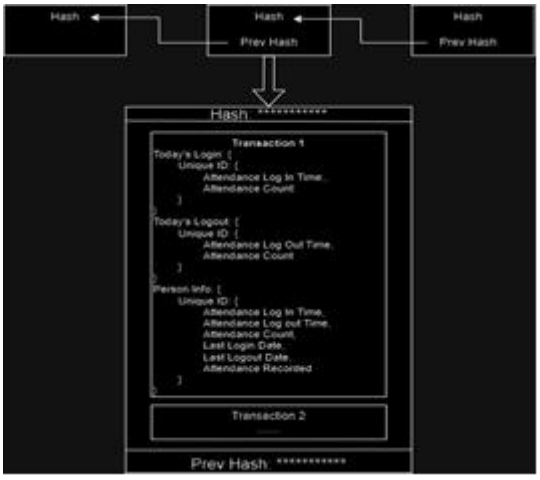

Figure 5.1

The data fields are-

i. Faculty provisioned Ids
ii. Faculty Names
iii. attendance Counts
iv. Log-In Time
v. Log-Out Time
vi. Boolean Attribute for flagging present day's Attendance

B) Face Recognition Module Performance (DLIB)

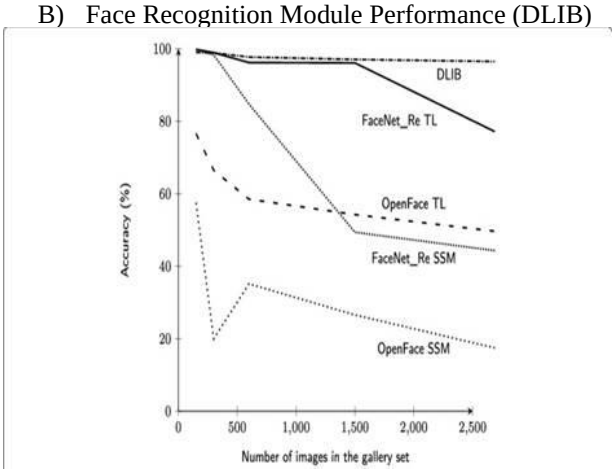

Figure 5.2 Accuracy Comparison

C) The various Flutter UI elements the user will mainly interact with are as follows :

Figure 5.3 Register User Screen

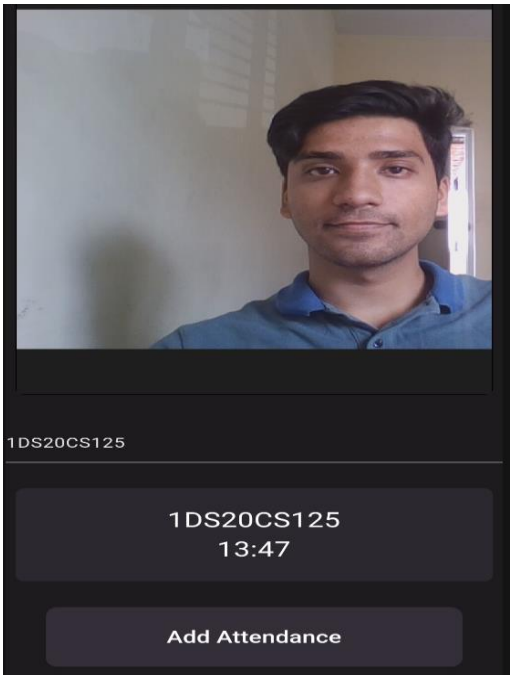

Figure 5.4 Login Screen

CONCLUSION

In conclusion, the development of a Block chain-based mobile application for attendance, seamlessly integrating face recognition and Geo-location through the Flutter framework, addresses critical shortcomings in traditional attendance systems. Motivated by the imperative to enhance efficiency, accuracy, and security in attendance tracking, the project confronts challenges such as slow bio-metrics, prolonged waiting times, and the potential for attendance manipulation.

The incorporation of face recognition technology revolutionizes the user experience, substantially reducing attendance-marking time. Leveraging Flutter ensures a user-friendly interface, while Geo-fencing adds a layer of location-based security, discouraging malpractices. The ultimate objective is to establish a secure and transparent attendance system, setting a benchmark for future advancements. Block-chain adoption ensures data integrity through an immutable ledger. This research project pioneers innovative solutions, aiming to significantly impact attendance tracking processes in educational and professional settings, paving the way for an efficient, secure, and technologically advanced future.

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