https://dx.doi.org/10.4314/dujopas.v9i4b.32
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 9 No. 4b December 2023*

A Multi-Facet Security Framework for Human Resource Management System

Akule, Simon Terlumun[1], Gilbert I.O. Aimufua[1], Muhammad, Umar Abdullahi[2] and Suleiman Abubakar[1]

[1] Department of Computer Science,
Nasarawa State University,
Keffi,
Nigeria

[2] Department of Computer Science,
Federal University of Technology,
Owerri,
Nigeria

Email: simonakule@yahoo.com

Abstract

The management of personnel records via the use of clock-in and clock-out systems, whether done manually or by other methods such as process paper sheets and time cards, presents a range of issues. This phenomenon is evident in operational processes such as the administration of leave of absence, whereby an employee is obligated to complete a documentation process that may need many weeks or even months before approval is obtained. Numerous scholars have developed a human resource management approach in order to address this issue. Nevertheless, the existing technology has the potential to address some key obstacles, such as the acquisition of personnel records, via the establishment of a centralized electronic database for document management. Nevertheless, due to the mostly centralized nature of the system, it is susceptible to unauthorized access and manipulation. The primary objective of this research is to provide a comprehensive framework for human resource management (HRM) systems that incorporates various security measures. Data flow and use case diagrams were constructed in order to illustrate the functionalities of the system. Access is granted within the framework upon successful verification of biometric, user name, and facial recognition. The use of this method will significantly reduce instances of fraudulent operations and unethical acts inside a corporation.

Keywords: Biometric, Management System, Fingerprint, Face Recognition and Multi-facet

INTRODUCTION

Organizations use human resource management systems to efficiently direct, motivate, and supervise their staff, so guaranteeing congruence with the organization's goals while acknowledging the distinct motivations of individual employees. Human resources (HR) include a range of responsibilities, including but not limited to hiring, promotion, and retirement (Gödöllő, 2012).

**Author for Correspondence*

The advent of globalization has given rise to new technologies and processes that need acquisition in order to stay updated with the always changing global environment. Given the current state of the economy, which is characterized by its information-centric nature, it is crucial to recognize the essentiality of acquiring knowledge in order for people to successfully navigate the ever-changing global environment. Within the present economic landscape, it is imperative to recognize the fundamental role that information plays as the underpinning of the economy. Nevertheless, it is essential to acknowledge that knowledge is primarily grounded in persons. While various technology may assist in its acquisition, knowledge ultimately relies on human action (Illés, 2012).

The domain of Human Resource Management Systems (HRMS) has seen notable progressions since its inception (Ming-Hsuan, David, & Narenda, 2020). The present discourse pertains to an online solution that has been especially designed to cater to the needs of human resources enterprises, aiming to enhance the effectiveness of data administration. The system's features include data input, monitoring, and analysis, covering the whole of the employee's professional journey from recruitment to retirement (Wang & Yuxin, 2018). However, in the present day, HRMS (Human Resource Management Systems) mostly rely on the entry of human data, clocking in processes, and other biometric techniques that are vulnerable to potential hacking incidents. According to Tariq (2020), the employee data is recorded in an Excel spreadsheet, but other important elements like as attendance records, pay information, insurance details, and holiday schedules are stored separately in specific parts of the Excel spreadsheet or Microsoft Access. The management and preservation of such data are marked by their arduous nature and limited appeal, further exacerbated by the inherent danger of introducing mistakes throughout the process of updating these records. Furthermore, the deficiency of a coherent and comprehensive organizational framework in the management procedure, along with the failure to fulfill the prerequisites for societal advancement, leads to a dearth of interdepartmental information dissemination inside the enterprise (Omar, 2020). As a result, the use of Human Resource Management Systems (HRMS) enables the incorporation of computer technology to optimize human resource processes, save expenses, and ultimately improve the effectiveness and efficiency of human resource management.

Scholars have devised centralized human resource management systems as a means to partially alleviate manual labor and enhance employee accessibility to their Human Resource Information System (HRIS). This, in turn, streamlines the dissemination of information among various departments within the organization (Tariq, 2020).

Pratik's (2020) study emphasizes the need of improving systems to promote cooperation inside organizations, particularly in the domains of leave management and monitoring staff activities. Simaanya (2020) investigates several techniques to improve staff management, focusing particularly on the elements of the system that influence organizational performance. Taniya et al. (2018) propose the use of an automated system for HR and attendance management that employs face recognition technology. They stress the need of continuous improvements in this domain. In their research, Marcus and Rozario (2018) recommended the use of a computerized personnel database and payroll system, along with recommendations for using facial recognition technology to improve security. The film Nucleus (2018) presents a computerized human resources system that suggests using automation to reduce errors in data input and the possibility of manipulating worker attendance.

Singh (2018) explores the potential of biometrics technology for access control, specifically emphasizing the need of including additional security measures. Arulogun et al. (2018) propose a wireless system that utilizes iris recognition to monitor attendance, acknowledging the potential for supplementary expenses. Dey and Santhi (2017) suggest the implementation of a real-time face recognition Human Resource Management System (HRMS), specifically addressing the challenges encountered in different scenarios. The paradigm developed by Kanchev and Kancho (2016) for small-scale firms emphasizes the possible concerns related to security and dependability. Virani and Muttu (2015) use the Viola-Jones approach to demonstrate the efficacy of certain algorithms in face recognition, while emphasizing the need for further improvements.

However, it is important to acknowledge that a potential improvement to the system could involve the incorporation of additional modules within the framework of the Human Resource Information System (HRIS). These modules would encompass various aspects including recruitment, training and development, compensation, benefits, and payroll administration. In addition, these systems exclusively depend on login identification (IDs) and passwords as the sole means of system security, making them susceptible to unauthorized access by individuals who possess the login credentials or possess the ability to exploit vulnerabilities through methods such as eavesdropping or gathering dump stars. Hence, the security mechanism used inside this specific system demonstrates inefficiency and unreliability.

The primary aim of this work is to provide a complete security architecture for a Human Resource Management System (HRMS). The suggested framework aims to enhance access to resources inside the system by integrating biometric authentication techniques, such as fingerprint and face recognition, with conventional login credentials, such as usernames and passwords. It is essential that all employees undertake comprehensive authentication and verification protocols before being authorized to access any type of information. Hence, this framework may be used to effectively tackle the issue of impersonation and the existence of bogus workers inside an organization's or establishment's payroll system. This idea has the capacity to help enterprises in mitigating significant financial losses.

METHODOLOGY

The methodology used in this research is Iterative and Incremental Development (IID). This paradigm involves a sequential approach to product development, where several cycles are undertaken to achieve the intended output. Each cycle is dedicated to making incremental improvements to a certain task or component, ultimately leading to the desired conclusion. One notable benefit of using this technique is its capacity to enable developers to evaluate and scrutinize every individual component throughout the whole of the process, therefore gaining valuable insights that may potentially improve the overall design of the final system. The breadth of the design is adaptable, allowing for ongoing upgrades and modifications to fit required updates. The use of this specific strategy enables a continuous progression throughout the whole of the development process, hence eliminating the need of delaying revisions until the completion and reducing time wastage. Figure 1 (Iterative and Incremental Development Model) depicts the use of the Iterative and Incremental Development model inside the proposed framework.

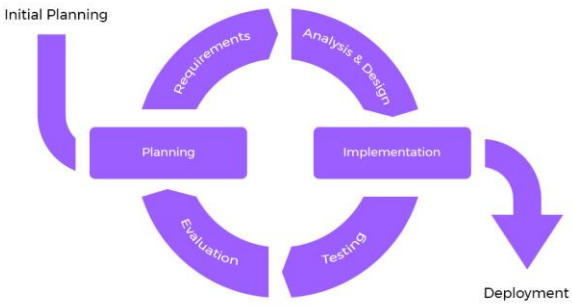


Figure 1: Iterative and Incremental Development Model

1. Planning and Requirements Gathering: During the first phase of the HRMS framework, the primary objectives are determined and the essential requirements are gathered. The requirements of the system may include a range of functionalities, such as biometric identification, payroll administration, and personnel records management, among others (Omar, 2020).

2. Design: Following the gathering of requirements, the Human Resource Management System (HRMS) structure is constructed. The design should include the security considerations of the system, the incorporation of modules, the necessary hardware and software requirements, and the user interface (Omar, 2020; Shukur et al., 2021).

3. Implementation: In this phase, the construction of the Human Resource Management System (HRMS) framework is carried out in accordance with the predefined design requirements. This includes the process of programming the software, deploying the appropriate hardware components, and incorporating any essential third-party software components (Wang, Li & Li, 2021).

4. Testing: In this stage, the development of the Human Resource Management System (HRMS) framework is executed in alignment with the predetermined design specifications (Peng & Wu, 2021). This encompasses the process of developing the software, implementing the suitable hardware components, and integrating any necessary third-party software components.

5. Deployment: After the HRMS framework has passed comprehensive testing and obtained approval, it is deployed in the production environment (Abdulraheem, Zeebaree & Abdulazeez, 2020). The activities included in this procedure involve the migration of data from the existing Human Resource Management System (HRMS) to the recently deployed framework, in addition to delivering training to personnel about the use of the novel system.

6. Maintenance: The maintenance phase includes the ongoing supply of support for the Human Resource Management System (HRMS) framework (Liu, 2023). This includes addressing any found software problems, expanding the system to accommodate additional features, and ensuring the effectiveness and up-to-datedness of the security procedures (Saarikko, Westergren & Blomquist, 2020).

The Human Resource Management System (HRMS) framework may be iteratively built over several cycles utilizing the Incremental and Iterative Development (IID) approach. Throughout each step, the development team is given the chance to evaluate and scrutinize the various components, therefore gaining valuable insights that can be used to improve the overall design of the final system. The use of this technique facilitates ongoing progress within the development process, allowing for prompt revisions as necessary, hence reducing the inefficiency that would otherwise arise from postponing changes until the software development cycle is finished.

Proposed System Framework

The system illustrated in Figure 2 (The Proposed System Framework) comprises four main stages: image acquisition, face detection, feature extraction, and face recognition. These various stages collectively contribute to the establishment of a system that efficiently oversees human resource information, encompassing aspects such as data management, data formats, data storage and retrieval, transaction processing, office automation, information processing, control functions, as well as standard and customized software (Patil, 2019). The proposed system will be implemented by employing three fundamental steps. The first phase entails the identification and extraction of the facial image, which is subsequently followed by the preservation of the aforementioned image (Peng, Portugal, Alencar & Cowan, 2021). The second phase entails the acquisition of knowledge and expertise in the field of facial image analysis, as well as the implementation of training procedures using a designated dataset of facial images. The procedure encompasses the computation of Eigenvalues and Eigenvectors, which play a crucial role in the identification and comparison of facial images with the pre-existing facial image data stored in XML format. The integration of facial recognition technology is becoming more prevalent in various applications, serving as an initial step to assess human actions, intentions, and behaviour (Iqbal, Qureshi, Li & Mahmood, 2023). This technology plays a crucial role in advancing the creation of intelligent environments in the future. The comprehension of diverse actions and behaviours demonstrated by humans frequently necessitates familiarity with the identities of the individuals implicated, as well as the individuals in their proximate environment. This phenomenon is evident in various scenarios, including the identification of esteemed recurring patrons upon their arrival at a retail establishment, the surveillance of conduct within elder care or child care establishments, and the application of command control interfaces in military or industrial contexts (Kawulok, Nalepa, Kawulok & Smolka, 2021). The interpretation of measurement and observation in various applications is facilitated by the pivotal role of identity information in enabling machines to comprehend human actions.

The human resources within an organization are widely regarded as its most valuable and unique assets. The proficient and adaptable administration of human resources within an organization is imperative for its achievement. The escalating intricacy of the human resource function has been further intensified by the limited availability of skilled resources and the heightened demands placed on employees in modern society.

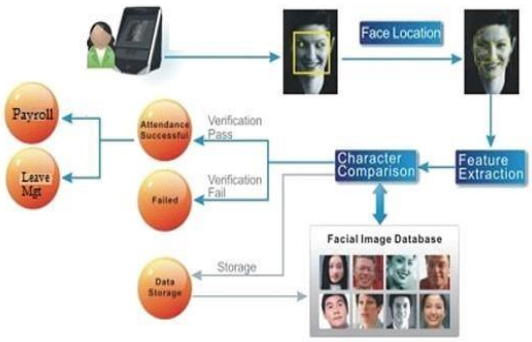


Figure 2: The Proposed System Framework
Source: (Patil, 2019)

Human Resource Architecture

The diagram in Figure 3 (Proposed Human Resource Architecture) illustrates the architectural design of the framework system being examined. Within this particular context, the client initiates communication with the system or server through the utilization of API calls. In order to facilitate the exchange of tokens between the server and the client, every API call must navigate a security layer and employ the use of a JSON Web Token (JWT). The token functions as a mechanism for the client to verify their identity and establish their authorization to access the requested resources to the server. The security layer is tasked with the responsibility of authenticating every request, as there may be certain requests that access the login page without being protected by the security mechanism. As a result, the security layer serves to differentiate between requests that are protected and those that are not. After the successful integration of the security layer, the subsequent element in the system architecture is the request handler. The primary function of this module is to handle and execute user requests by utilizing the support provided by the service. The service component is tasked with encapsulating and managing the business logic. When a transaction is initiated on the server's business side, the service will access the database if the transaction requires database interaction. The service will extract the pertinent data from the database and employ it in a suitable manner. Following this, the system proceeds to initiate a request to the database. The database will now initiate a verification process on the queried elements within the system. The aforementioned process continues until the user triggers a logout from the system. Upon the termination of the user's session, the client computer commences the process of invalidating the token that was transmitted by the server as part of the authentication protocol. This guarantees that in subsequent interactions, the user can initiate a new authentication process.

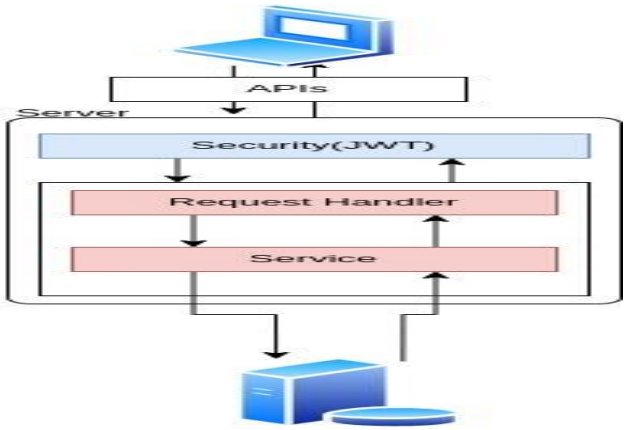


Figure 3: Proposed Human Resource Architecture
Source: Author

Flowchart Diagram of the Proposed Framework

Figure 4 (Flowchart Diagram of the Proposed Framework) depicts the flow diagram of the proposed framework system. The provided flowchart diagram depicts the comprehensive flow pattern within the proposed framework. The document exhibits a deficiency in the examination of the majority of its characteristics. The framework commences the process of user authentication by initiating and subsequently confirming the user's authentication status through the transmission of a request. In the event that the user's authentication status is unverified, the system will redirect the user to the authentication page, also known as the login page, in order to undertake an endeavour to authenticate the user's identity. The user provides their credentials, which encompass personal identification and the requisite biometric data for system entry, encompassing facial recognition or fingerprint authentication. After successfully verifying the user's credentials, the system proceeds to determine whether the individual has administrative privileges or is an employee. The loop will continue to execute and display a login prompt to the user until authentication is successfully completed. At this stage, the system will also conduct a verification process to confirm the user's administrative privileges. If he is not present, he has the opportunity to navigate to his profile page, complete a training application, or lodge a complaint if deemed necessary. If an individual assumes the role of administrator, they are vested with the power to supervise a range of administrative responsibilities, including but not limited to managing payroll, maintaining employee records, facilitating training initiatives, and executing enrolment procedures. The program engages in iterative execution within this loop until the user chooses to terminate the program.

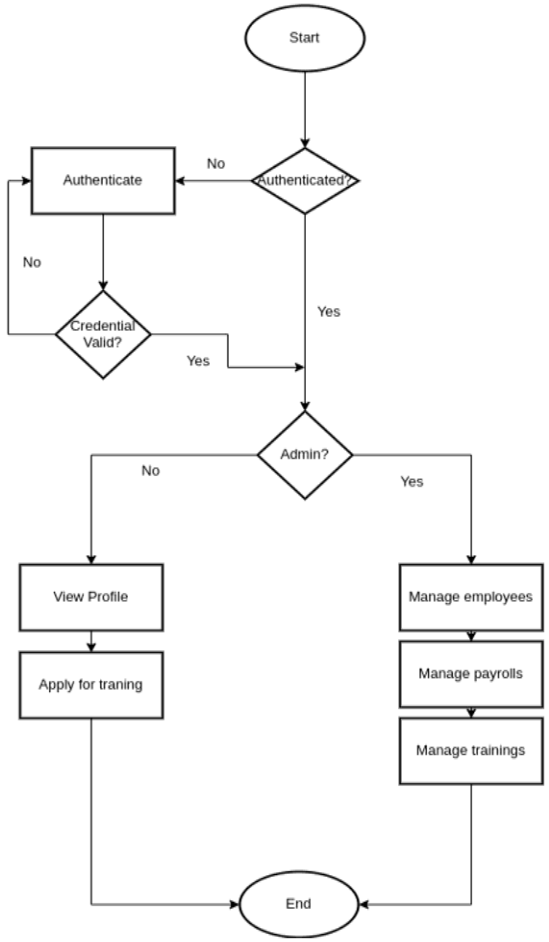
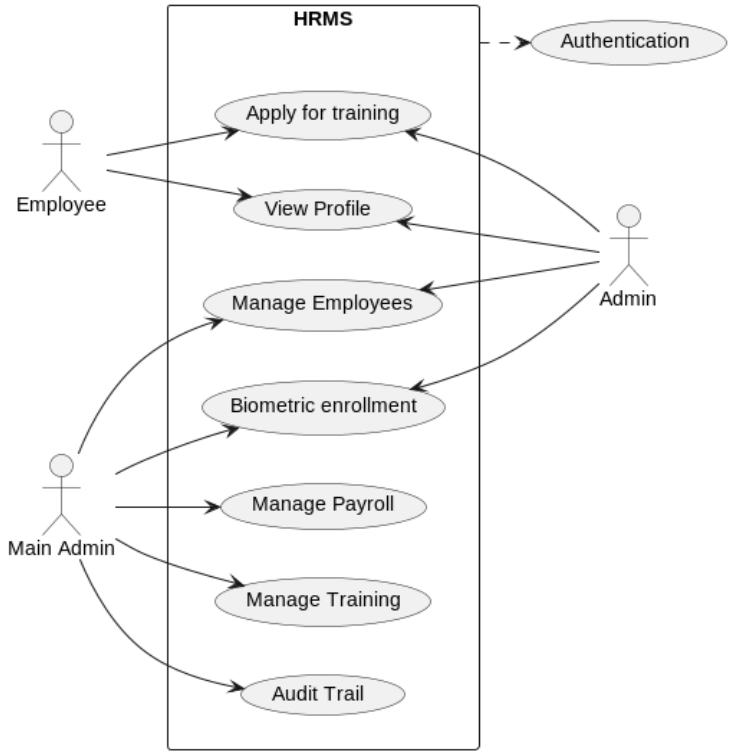


Figure 4: Flowchart Diagram of the Proposed Framework
Source: Author

Use Case Diagram of the Proposed Framework

Figure 5 (Use Case Diagram of the Proposed Framework) depicts the utilization of the proposed framework through a use case diagram. All activities are confined within a rectangular enclosure. Authentication is an essential requirement for any action carried out within the system. The system functions available to a regular employee user are restricted to accessing their profile for potential modifications and reviewing their years of service for training application purposes. The individual fulfilling the role of administrator, while simultaneously functioning as an employee within the system, is assigned the duty of overseeing the management of personnel records across all departments. The individual appointed as the super administrator assumes a comprehensive role within the organization, possessing the requisite authority to oversee and supervise all activities taking place within the system.



.
Figure 5: Use Case Diagram of the Proposed Framework
Source: Author

Entity Relationship Diagram

The subjects can be classified into two distinct categories, whereby the first category encompasses subjects that exhibit interconnections. The database system employs the departmental sequence, also referred to as the one down, to effectively manage and store departmental identification numbers. The audit is not linked to any of the tables. The administrator also does not possess any affiliation with an entity. The topic under consideration is characterized by its autonomy and lack of reliance on external factors. Likewise, the aforementioned principle is applicable to the system settings. The individuals are functioning autonomously. A correlation can be observed between the Fingerprint entity and the employee entity. This statement remains valid in the context of payroll, procedural sequences, organizational units, hierarchical tiers, and employee development programs. The employee training table functions as a database for the purpose of managing and preserving records pertaining to employees who are presently involved in training endeavours. The training table demonstrates a relational association with the employee table. Figure 6 (Entity Relationship Diagram) illustrates the entity relationship diagram (ERD) of the HRMS framework that has been proposed.

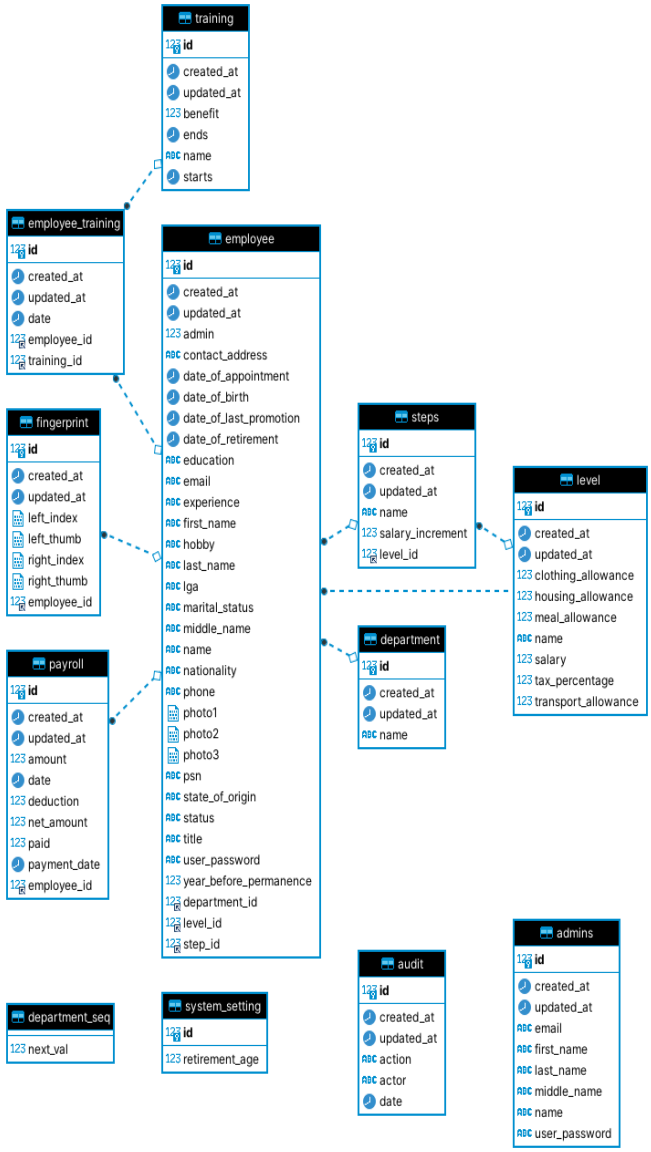


Figure 6: Entity Relationship Diagram
Source: Author

Furthermore, in this study, the emphasis on security is paramount, ensuring that personnel records can only be accessed by users whose biometric credentials are recognized by the system. This stands in contrast to the works of Simaanya (2020) and Pratik (2020), where this crucial security feature was overlooked.

In the research by Arulogun, Olatunbosun, Fakolujo, and Olaniyi (2018), a notable drawback is the high implementation cost of their system. Additionally, the system relies solely on iris recognition, lacking alternative verification methods such as fingerprint recognition to enhance overall security.
Taniya et al.'s (2018) study highlights limitations in their system's ability to accurately identify facial differences beyond 30 degrees. This observation points to a specific challenge in their facial recognition technology, suggesting a potential area for improvement in future system developments.

CONCLUSION

The conventional method of personnel record management, characterized by the utilization of clock-in and clock-out procedures, is susceptible to various challenges, such as potential delays and security vulnerabilities. Academic researchers have devised human resource management systems in order to tackle these concerns; however, current technologies are susceptible to hacking and unauthorized entry. This research paper presents a theoretical framework that delineates the incorporation of diverse security systems, including biometric, username, and facial recognition verification, within the domain of human resource management systems. The proposed framework is anticipated to effectively mitigate occurrences of fraudulent activities and unethical practices within an organization. The data flow and use case diagrams illustrated in this research showcase the functional aspects of the proposed system. Through the implementation of this framework, organizations are afforded the opportunity to optimize the efficacy of their human resource management processes and safeguard sensitive personnel information.

Future research may involve implementing the proposed framework in real life to assess its effectiveness in improving human resource management system security and efficiency. By adding two-factor authentication and data encryption, the framework can be strengthened. To assess the system's usability and suitability for human resources professionals, user testing and feedback would be beneficial. In conclusion, the framework can be customized and applied to sectors like healthcare and finance that prioritize data security and management. A more secure and efficient personnel record management system would result from the proposed adaptation.

REFERENCES

Abdulraheem, A. S., Zeebaree, S. R., & Abdulazeez, A. M. (2020). Design and implementation of electronic human resource management system for duhok polytechnic university. Technology Reports of Kansai University, 62(4), 1407-1420.

Allen, D. (2010). Getting things done: The art of stress-free productivity, New York: Viking ISBN 978-0-670-88906-8

Alonso, G. (2014) Functionality and Limitations of Current Workflow Management Systems. Institute of Information Systems ETH Zentrum (IFW C 47.2) CH-8092 Zurich

Arulogun O., Olatunbosun A., Fakolujo A., and Olaniyi O. (2018, February 2). RFID-Based Students Attendance Management System. Vol. 4. ISSN 2229-5518.

Barney, J. (1991). Firms resources and sustained competitive advantage, Journal of Management, 17, 99-120

Battesse, W. T. (2018). Sustainability: a new and complex challenge for crisis managers. International Journal of Sustainable Strategic Management 2(1), 4-16.

Chavan, R., Phad, B., Sawant, S., Futak, V., & Rawat, A. (2015). Attendance Management system using Face recognition. IJIRST-International Journal for Innovative Research in Science &Technology.

Choudhary, A., Tripathi, A., Bajaj, A., Rathi, M., & Nandini, B. M. (2020). Attendance Generation Using Facial Recognition.

Clerk, M. J. (2016). A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68-73.

Coats, Taneja, S., Pryor, M. G. & Zhang L. (2017). Crisis management: a strategic and tactical leadership imperative for organizational sustainability. International Journal of Sustainable Strategic Management, 2(1), 60-73.

Coopers, D.R & Scindler, P.S. (2006). Business Research Methods, 9th Edition, MacGrowHill, Publishing New Delhi, India.

Creswell, J.W. & Miller, D.L. (2000). Determining validity in qualitative inquiry. Theory into Practice, 39 (3), 124-131.

Crook, T. R, KetchenJr, D. J, Combs, J. G & Todd, S. Y (2008). strategic resources and performance. A Meta-Analysis, Strategic Management Journal, 29, 11411154.

Dey, N., & Santhi, V. (Eds.). (2017). Intelligent techniques in signal processing for multimedia security. Springer International Publishing.
Eason, G., Noble, B., & Sneddon, I. N. (2015). On certain integrals of Lipschitz-Hankel type involving products of Bessel functions. Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences, 247(935), 529-551.
Galbreath, J. (2005). Which resources matter must for firm success? An exploratory study of the resource-based view. Technovation 25, 979-987.
Ghodke, S. S., Kolhe, H., Chaudhari, S., Deshpande, K., & Athavle, S. (2014). ATM transaction security system using biometric palm print recognition and transaction confirmation system. International Journal of Engineering and Computer Science, 3(4), 5332-5335.
Hitt O. D., Ireland V., & Hoskisson K. K. (2013). IT-Enabled Organizational Agility and Sustainable Competitive Advantage, Working Paper Series
Iqbal, S., N. Qureshi, A., Li, J., & Mahmood, T. (2023). On the analyses of medical images using traditional machine learning techniques and convolutional neural networks. Archives of Computational Methods in Engineering, 30(5), 3173-3233.
Kanchev, Kancho D., (2006.) Development and presentation of an information system.
Kaplan, R. S./Norton, D. P. (2015): The Balanced Scorecard: Translating Strategy into Action, Harvard Business School Press, Boston, p. 96-129
Kawulok, M., Nalepa, J., Kawulok, J., & Smolka, B. (2021). Dynamics of facial actions for assessing smile genuineness. PloS one, 16(1), e0244647. https://doi.org/10.1371/journal.pone.0244647
Liu, J. (2023). Design and Application of Human resource management system Based on Data Mining Technology. Procedia Computer Science, 228, 241-252.
Majekodunmi, T. O., & Idachaba, F. E. (2011). A review of the fingerprint, speaker recognition, face recognition and iris recognition-based biometric identification technologies.
Mao, Y., Li, H., & Yin, Z. (2014, July). Who missed the class? -Unifying multi-face detection, tracking and recognition in videos. In 2014 IEEE International Conference on Multimedia and Expo (ICME) (pp. 1-6). IEEE.
Marcus A., D. Rozario. (2018). Designing an employee database and payroll management system.
Mugenda, O. M. & Mugenda, A. G. (2003). Research methods: Quantitative and qualitative approaches, (2nd Ed.). Nairobi: Acts Press.
Muttu, Y., & Virani, H. G. (2015, December). Effective face detection, feature extraction & neural network based approaches for facial expression recognition. In 2015 International Conference on Information Processing (ICIP) (pp. 102-107). IEEE.
Nguyen, T. D., Quang, L. D., Van, N. C., Thanh, L. T., Hoang, T. M., & de Souza-Daw, T. (2012, August). An efficient and reliable human resource management system based on a hybrid of face authentication and RFID technology. In 2012 Fourth International Conference on Communications and Electronics (ICCE) (pp. 333-338). IEEE.
Nucleus. (2008). Automating Time And Attendance: Low Hanging ROI.
Okokpujie, K. O., Olajide, F., John, S. N., & Kennedy, C. G. (2016). Implementation of the Enhanced Fingerprint Authentication in the ATM System Using ATmega128 with GSM Feedback Mechanism.
Okokpujie, K., Etinosa, N.O., John, S. and Joy, E., (2017). Comparative Analysis of Fingerprint Preprocessing Algorithms for Electronic Voting Processes. In International Conference on Information Theoretic Security (pp. 212-219). Springer, Singapore.
Omobogo, R.M. (2015). Contemporary Strategy Analysis, 4th ed., Oxford: Blackwell
Ononiwu G. C. & Okorafor, G. N (2012). Radiofrequency identification based attendance system with automatic door unit. Academic Research International, 2(2), March 2012.
Patil, A. N., Ranavare, R. B., Ballal, D. V., & Kotekar, A. (2019) Raspberry pi based face recognition system for door unlocking. International journal of innovative research in science and engineering vol, (2).
Peng, P., Portugal, I., Alencar, P., & Cowan, D. (2021). A face recognition software framework based on principal component analysis. PloS one, 16(7), e0254965. https://doi.org/10.1371/journal.pone.0254965
Peng, Y., & Wu, I. C. (2021). A cloud-based monitoring system for performance analysis in IoT industry. The Journal of Supercomputing, 77, 9266-9289.
Prasad, P. S., Pathak, R., Gunjan, V. K., & Rao, H. R. (2020). Deep learning-based representation for face recognition. In ICCCE 2019 (pp. 419-424). Springer, Singapore.

Robak, E. (2010) looked at workaholism relating to Human Resource Management System
Ruggles, H.E. (2020). Trade between Zambia and Kenya. An investigation into factors that make the Kenyan edible oil industry competitive, Unpublished Thesis University of Nairobi.
Rumelt, D.P. (1984). Towards a strategic theory of the firm alternative theories of the firm; 2002, 154(2); 286-300 Elgar Reference Collection international library of critical writings in Economics.
Russ, K. (2017). Exploring Corporate Strategy, Text and Case Prentice
Saarikko, T., Westergren, U. H., & Blomquist, T. (2020). Digital transformation: Five recommendations for the digitally conscious firm. Business Horizons, 63(6), 825-839.
Sarvesh, V. A., & Chetana, R. (2016). Face recognition system for unlocking automobiles using gsm and embedded technology. International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 5(7), 6090-6097.
Schneider, G. S. &Price, R. (2015). Assessing advantage: A framework for diagnosing competitive superiority. Journal of Marketing, 52(2), 1-20.
Shukur, H. M., Zeebaree, S. R., Zebari, R. R., Hussan, B. K., Jader, O. H., & Haji, L. M. (2021, February). Design and implementation of electronic enterprise university human resource management system. In Journal of Physics: Conference Series (Vol. 1804, No. 1, p. 012058). IOP Publishing.
Singh, P. K. (2021). Attendance using face recognition.
Sung, K. K., & Poggio, T. (1998). Example-based learning for view-based human face detection. IEEE Transactions on pattern analysis and machine intelligence, 20(1), 39-51.
Swanson, R. A. (2013). Theory building in applied disciplines, San Francisco, CA: Berrett-Koehler Publishers 2013
Swift, J. (2018). Where did time fly: Practical unconventional tips to save and optimize time, CreateSpace Independent Publishing Platform, Amazon USA ISBN 13: 9781452855325
Tao, Q. Q., Zhan, S., Li, X. H., & Kurihara, T. (2016). Robust face detection using local CNN and SVM based on kernel combination. Neurocomputing, 211, 98-105.
Tariq, Omar. (2020). Design and Implementation of Human Resource Information Systems Based on UML. 10.17632/g9hv9chy54.4.
Viola, P., & Jones, M. J. (2014). Robust real-time face detection. International journal of computer vision, 57(2), 137-154.
Wang, T., Li, N., & Li, H. (2021). Design and development of human resource management computer system for enterprise employees. PloS one, 16(12), e0261594. https://doi.org/10.1371/journal.pone.0261594
Woodward, G., Combs, J. G, Galbreath, J. & Scholes, K., (2016). Exploring Corporate Strategy. 6th Edition, Prentice Hall of India, New Delhi.
Yang, H. C., & Wang, X. A. (2015, November). Cascade face detection based on histograms of oriented gradients and support vector machine. In 2015 10th International Conference on P2P, Parallel, Grid, Cloud and Internet Computing (3PGCIC) (pp. 766-770). IEEE.
Yorozu, M. Y., Hirano, K. O., and Tagawa, Y. (2015). "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740-741, [Digests 9th Annual Conf. Magnetics Japan, p. 301,].
Young, M. (1989). The Technical Writer's Handbook". Mill Valley, CA: University Science
Zhang, C., & Zhang, Z. (2015, March). Improving multiview face detection with multi-task deep convolutional neural networks. In IEEE Winter Conference on Applications of Computer Vision (pp. 1036-1041). IEEE.
Zhang, M, A. (2013). The role of intangible assets in sustaining competitive advantage among pharmaceutical manufacturers. Operational Performance Journal 14: 8, 607-618.
Zhao, W., Chellappa, P.J. Phillips, & Rosenfeld, A. (2003). Face recognition: A literature survey". ACM computing surveys (CSUR) 2003, 35(4), pp.399-458.