Journal of Computing and Intelligent Systems

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Journal of Computing and Intelligent Systems (JCIS)
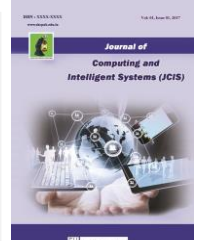
An Implementation of Biometric Fingerprint-based Attendance System for Staff Management(BFASSM)

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Abstract — The workforce is the bedrock of growth, development, and expansion in any establishment. Therefore, there is need to ensure fairness in monitoring staff attendance and creating a workforce that is dedicated and committed in higher Institutions of learning. Although the integration and use of biometric technology are getting simpler, quite a few institutions of learning are taking advantage of this technology in Nigeria. In this study, Biometric Fingerprint-based Attendance System for Staff Management (BFASSM) was developed to monitor the staff of higher institution using the Federal Polytechnic, Ilaro, Nigeria as a case study. The application was developed using C# programming language, Macromedia fireworks and Microsoft Visio. Microsoft SQL Server was used for database management at the back end with Windows 7 as the minimum operating system. The implementation of this system in any other institution of higher learning will eradicate manual attendance taking, curb the problem of infringement and manipulation of staff attendance, create an avenue to make staff resume work punctually and also sign out at the appropriate time. It will also enhance proper documentation of attendance record.

Keywords - Staff Attendance, Higher Institution, Biometric Fingerprint, Management system, Application software*.*

I. INTRODUCTION

Over the years, the manual method of taking attendance in organizations, schools, corporate offices are often infringed [1, 2]. Several approaches have been taken to curb this snag that has become a limitation that is creating a clog in the wheel of efficiency and productivity [3-5]. Many employees resume work anytime they like, because they can easily manipulate the manual attendance register. The attendance of staff in any higher institution of learning is paramount to the progress of such institution because they help to move the institution forward. This is particularly peculiar to government institutions compared to their counterpart private Institutions.

Biometrics identification is used to identify individuals according to their unique anatomical features such as fingerprint, face, iris, hand geometry, and behavioural features such as signature and voice [6-9]. Fingerprints have been the most predominant means of identification over a long period of time, more recently becoming automated [10] due to advancements in computing capabilities.

This study takes the advantage of recent technologies to develop an automated Biometric Fingerprint-based Attendance System for Staff Management (BFASSM) to replace the existing manual attendance registering system using the Federal Polytechnic Ilaro as a case study. This will bypass the manipulations experienced in the manual process and with the expectation of improved service delivery.

II. RELATED WORKS

The use of biometric identification in a person's authentication process enhances the rapid progress of this technology to be implemented in different areas. Person's identification is understood to be a vital part in distinguishing the personality of the specific individual. A person's uniqueness can either be authenticated through the conventional or biometric means [19]. "Fingerprint identification is popular because of the inherent ease in acquisition, the numerous sources (ten fingers) available for collection, and their established use and collections by law enforcement and immigration" [11]. It is basically impossible to share or misplace biometric identifiers because they naturally characterize a person's distinctiveness. They are rapidly becoming vital constituents for efficient identification solutions [12].

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Also, recognition of an individual's by their body and associating the body to an outwardly recognized "identity" forms a potent verification tool [13].

Biometric identification has been successfully utilized to alleviate fraud and increase the convenience of users [14,15]. Fingerprint recognition technique has been outstanding in commercial applications as it provides a good stability when it comes to accuracy, throughput, size and cost and ease of use, hence, making it at the foremost of Biometric identification. [16]. Fingerprint identification offers several advantages that other technologies cannot provide. This includes uniqueness, since the fingerprint of individual are distinct and irreplaceable, no two persons have the same fingerprint feature. It is also convenient because there is no need to keep multiple and complex passwords to login. Also, the method is non-transferable, and its long history of success has been proved compared to other biometric authentication methods [17, 18].

Consequently, there is need to implement reliable attendance monitoring system based on biometric recognition for employees in order to establish a workforce that is dedicated to steering the affairs of institutions of higher learning forward. The following section reviewed some works done on fingerprint biometric identification.

"SwyftTapp: An NFC based attendance system using fingerprint authentication" was carried out by Kommey *et al.* [20]. Here, the study employed NFC technology along fingerprint technology designed with an API and a web-based application to implement an effective approach to manage student's attendance in the school. The study identifies that there is a correlation between students' academic performance and class attendance.

Saidot *et al.* [21], in their study "Biometric Attendance Monitoring System using Raspberry PI PI and Fingerprint" proposed a biometric technology based on Internet-of-things (IoT) with with the encrypted biometric information stored on on the cloud using Raspberry Pi and authentication authentication created through biometric services services as the host on cloud.

Eze and Uzoechi [22], worked on "Design of a Biometric Attendance System with Online Monitoring for a University System". The study developed a system that combines fingerprint Attendance system with remote monitoring for staff and students of institutions of higher learning. The system was also developed to be web-based with real-time remote monitoring interface with the capability to enable the management to view staff as they check-in and out of the system. The study emerged as a result of the absence of staff and students in classes resulting in the poor quality of graduates turned out.

Bhise *et al.* [23] proposed an "Attendance System using NFC technology with an embedded camera on mobile devices". The need to provide a better means of evaluating student's attendance necessitated this study, the developed system was based on NFC technology and run on a mobile application.

Adewole *et al.* [24] worked on the study "Development of Fingerprint Biometric Attendance System for Non-Academic Staff in a Tertiary Institution". The study identified the need to migrate from the manual means of taking attendance to an automated one to improve the productivity of the institution.

Chandrasekar and Natarajan [25], in the study "Fingerprint-based classroom attendance recording device," developed a portable and handheld device to be used in the classroom for recording student's

attendance. The device is meant to be passed among the students in the class and the fingerprint sensor on the device detects the student and update the attendance sheet.

Alsmirat *et al*. [26] observed that "the fingerprint datasets obtained through digital cameras always contain built in degradations resulting from specific lighting, different background, low camera quality, image compression", and other factors. They addressed the problem by creating a "high quality image set that can be used to study the impact of different factors on the accuracy of fingerprint recognition accuracy". They established that image acquisition must be given serious priority, also image quality must not be compromised in b 147 ic authentication systems.

This study however, applied the principle of Biometric Fingerprint system to develop an application specific to the workforce of higher Institutions of learning using the Federal Polytechnic, Ilaro as a case study in order to curb the manipulations of manual attendance system and encourage commitment, hard work and discipline for improve service delivery.

III. SYSTEM DESIGN

The classes of hardware used in the system include, fingerprint scanner/reader which captures the fingerprint image, central server that accommodates the fingerprint templates database which is expected to be controlled by administrators (the server has three workstations connected to it). Two computer stations at different locations to capture the attendance of individual staff (they are responsible for running the comparison algorithm and simulating the application function). The fingerprint scanner is connected to the computer systems via its USB interface. The software consists of Microsoft Server 2008 for an operating system that runs on the server, the application program (front end) and the database (back end). The software tools and technologies used include the following,

Microsoft C# programming language in the Microsoft Visual Studio framework. The framework offers a good user interface for the BFASSM. The merit of Microsoft C# program lies in its speed, scalability, simplicity of programming, exceptional database connectivity. Also, C# runs on both Windows and UNIX operating systems with a large user community that provides online support. Macromedia fireworks and Microsoft Visio were employed for software modelling.

System Architecture

Fig. 1 shows the architecture of the developed System. Enrolment and identification are the major stages in biometric system development. The biometrics of a staff is captured during enrolment with the aid of a fingerprint scanner/reader. For identification, the biometric (fingerprint) of the individual staff is captured again and the features extracted from the fingerprint are compared with the templates in the database. If the fingerprint matches, the staff can then clock in and out with the system. If the fingerprint does not match any template in the fingerprint database, then the staff cannot register. This is the authentication/attendance registering/de-registering stage.
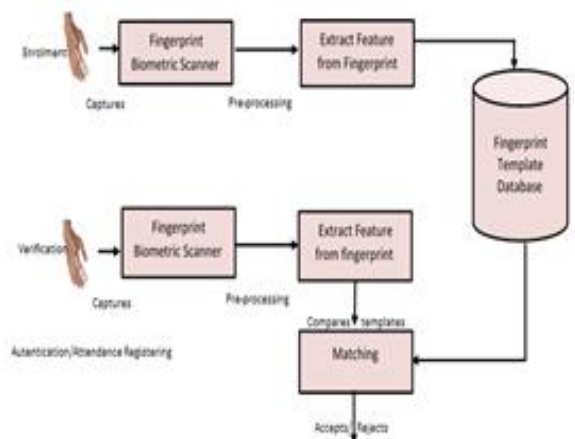

Fig. 1 Architecture of BFASSM authentication system

System Flowchart

Fig. 2 is a system flowchart of the processes involved in the Biometric Fingerprint-based Attendance System for Staff Management (BFASSM). Here, a new staff registers his/her bio-data details and carries
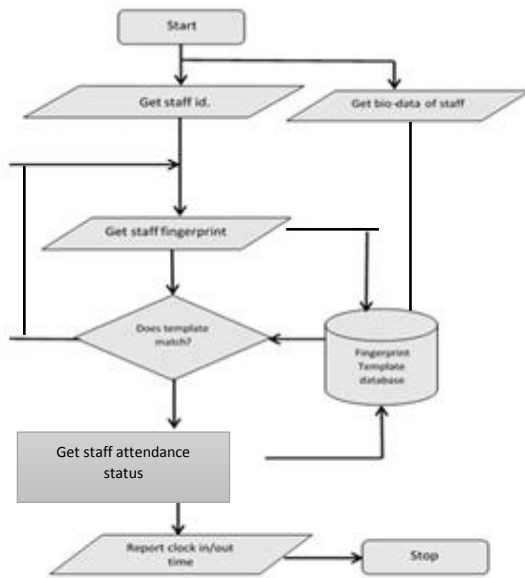

Fig. 2 Flowchart of the biometric fingerprint system

out the fingerprint capturing, and the information is stored in the database. Registered staff gain admission for authentication into the BFASSM by simply entering the fingerprint, the system checks the input fingerprint against those stored in the database and if a match is established, attendance is processed taking both the date and time the staff clocked in/out.

IV. SYSTEM IMPLEMENTATION

The Biometric Fingerprint-based Attendance System for Staff Monitoring (BFASSM) was designed for the staff of The Federal Polytechnic Ilaro, Ogun State. It was implemented by the following logical outline: The administrator is responsible to capture the data of all the staff of the institution to set up the 'take attendance' portal which will be hosted on the server. The Biometric Fingerprint Scanner/Reader was plugged in to the Computer system via the USB port.

The Application (BFASSM) is a two-tier application meaning that it will be installed on two systems, one in the East campus of the Institution and the other in the West campus of the same Institution and the database server will host the data. A Microsoft SQL Server is installed; WAMP is used for the implementation. After which the application will be launched from a shortcut of the BFASSM from the desktop. Fig. 3 to 11 show the login form which is popped up to prompt the administrator to login with Username, Password, IP Address of the Database Server, and the database management system port number. The multiple document interfaces are displayed where an administrator can do the following; Register new staff, Create new administrator, Check attendance record, Update staff record, Search staff record, and Setup the attendance taking portal. Meanwhile, from the staff (non-academic) angle, they just need to supply their unique file number and then input fingerprint. If the match corresponds with the template within the database, the system records the time signed in, otherwise, access is denied. Fig. 3 to 11 show the different interfaces of the developed system.

Fig. 3 The BFASSM system loading

Fig. 4 A form showing the administrative log in page

Fig. 5 A form requesting data input from staff

Fig. 6 An interface for fingerprint enrolment

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7 An interface showing a successfully registered staff

Fig. 8 A touch and go interface for clocking in out for autentication of staff before taking attendance of staff

Fig. 9 A touch and go interface for signing in staff

Fig. 10 A touch and go interface signing in staff

Fig. 11 An interface showing the broadsheet of staff record

V. CONCLUSION

Wrong entry and exit declarations by staff, time wastage and lack of security are some of the problems inherent with the use of the manual attendance systems. Biometric fingerprint authentication for staff attendance becomes the best solution to the problem of staff authentication in institutions of higher learning because human biometric features are difficult to manipulate. Biometric Fingerprint-based Attendance System for Staff Management (BFASSM) is a computer-based program developed to replace the existing manual attendance method used by the staff of the Institution (Federal Polytechnic, Ilaro). The implementation of this system (BFASSM) in other Institutions and sectors of the economy will enhance productivity, curb infringement and attendance manipulations by staff.

REFERENCES

[1] Nwoye CI. Enhancing Attendance Management in Firms and Industries Using Fingerprint Biometric Recognition Technique. IOSR J. Mobile Comput. Appl.,(IOSR-JMCA). e-ISSN. 2016; 2394-0050.

[2] Isinkaye, F, O, Soyemi, J, Arowosegbe, O, I. An Android-based Face Recognition System for Class Attendance and Malpractice Control. International Journal of Computer Science and Information Security (IJCSIS). 2020; 18:78-83.

[3] Kim BG. An Implementation of Auto Attendance Management System based on App using NFC Technique. Journal of the Korea Academia-Industrial cooperation Society. 2016; 17:719-23.

[4] Mothwa L, Tapamo JR, Mapati T. Conceptual Model of the Smart Attendance Monitoring System Using Computer Vision. In 2018 14th International Conference on Signal-Image Technology & Internet-Based Systems (SITIS) 2018 Nov 26 (pp. 229-234). IEEE.

[5] Jang BS, Lee SJ, Kwak HY. A Study of Attendance Management System using Beacon and BLE Advertisement Function. Journal of the Korea Society of Computer and Information. 2018; 23:67-73.

[6] Jain AK, Kumar A. Biometrics of next generation: An overview. Second Generation Biometrics. 2010 Aug; 12:2-3.

[7] Katiran N Wahab HA, and Rahman RA. (2010). Development of Attendance System using Biometric Fingerprint identification. In Proceedings of EnCon2010 3rd Engineering Conference on Advancement in Mechanical and *Manufacturing for Sustainable Environment April 14-16, Sarawak, Malaysia*

[8] Sabhanayagam TP, Venkatesan VP, and Senthamaraikannan K. A comprehensive Survey on various Biometric Systems. International Journal of Applied Engineering Research, 2018; **13**: 2276 – 2297.

[9] Onifade O F, Akinde P, & Isinkaye FO. Circular Gabor wavelet algorithm for fingerprint liveness detection. Journal of Advanced Computer Science & Technology, 2020; **9**, 1-5.

[10] Josphineleela R. and Ramakrishnan M. (2012). An efficient Automatic system using Fingerprint Reconstruction Technique. International Journal of Computer Science and Information Security. 2012; **10**:1-6

[1 150 ni R. and Ruud B. Automatic Fingerprint Recognition Systems New York: Springer, 2004.

[12] Rao S. and Satoa KJ. An Attendance Monitoring System using Biometrics Authentication. International Journal of Advanced Research in Computer Science and Software Engineering. 2013; **3**:379-383

[13] Tistarelli M, & Champod C. (Eds.). (2017). Handbook of biometrics for forensic science. Springer, 2017.

[14] Dargan S, Kumar M. A comprehensive survey on the biometric recognition systems based on physiological and behavioral modalities. Expert Systems with Applications. 2020; **143**, 113114.

[15] Pavithra M, Pavithra S, Priya, RR, Vaishnavee M, Ranjitha M, & Saravanan DS. Fingerprint Based Medical Information System Using IoT. International Journal of Engineering Technology Research & Management. 2020; **4:** 45-51.

[16] Edgar HJ. Federal Bureau of Investigation, Department of Justice, Classification of Fingerprints, US Government, 2007.

[17] Di Nardo, JV. Biometric technologies: Functionality, emerging trends, and vulnerabilities. Journal of Applied Security Research. 2008; **4**: 194-216.

[18] Sajjad M, Khan S, Hussain T, Muhammad K, Sangaiah AK, Castiglione A, & Baik SW. CNN-based anti-spoofing two-tier multi-factor authentication system. Pattern Recognition Letters. 2019; **126**, 123-131.

[19] Hoo SC, Ibrahim H. Biometric-Based Attendance Tracking System for Education Sectors: A Literature Survey on Hardware Requirements. Journal of Sensors, 2019; 1-25

[20] Kommey B, Anyane-Lak O, and Amuzu WE. SwyftTapp: An NFC based attendance system using fingerprint authentication, International Journal of Engineering, Science and Technology. 2018; **10**: 23-39

[21] Saidot HS, Kavitkar OR, and Bajaj K. (2018). Biometric Attendance Monitoring System using Raspberry PI and Fingerprint, International Journal for Research Trends and Innovation IJRTI. 2018; **3**: 1-7.

[22] Eze PU, and Uzoechi LO. Design of a Biometric attendance System with Online Monitoring for a University System, Futo Journal Series. 2016; **2**:107-117

[23] Bhise, A, Khichi R, Korde A, and Lokare, PD. Attendance system using NFC technology with embedded camera on mobile device. International Journal of Advanced Research in Computer and Communication Engineering. 2015; **4**: 350-353

[24] Adewole KS, Abdulsalam SO, Babatunde RS, Shittu TM, and Oloyede MO. Development of Fingerprint Biometric Attendance System for Non-Academic Staff in a Tertiary Institution, Computer Engineering Intelligent Systems. 2014; **5**: 62-70

[25] Chandrasekar V, & Natarajan TS. Fingerprint-based classroom attendance recording device. International Journal on Recent and Innovation Trends in Computing and Communication. 2014; **2**:2802 -2805

[26] Alsmirat MA, Al-Alem F, Al-Ayyoub M, Jararweh Y, & Gupta B. Impact of digital fingerprint image quality on the fingerprint recognition accuracy. Multimedia Tools and Applications. 2019; **78:** 3649-3688