

NO FACE-NO ENTRY-NO ATTENDANCE: AN INNOVATIVE SYSTEM

Luthermie Baraquia-Manago

Program Head – College of Engineering;
Faculty of Computer Science and Information Technology
St. Vincent’s College Incorporated,
7100 Dipolog City, Philippines.

luthermiemanago@svc.edu.ph

ABSTRACT: This study aimed at developing an integrated face recognition laboratory access for maximum security and attendance system to alleviate the currently practiced attendance marking methods which are tedious and time consuming. The developmental research method was utilized in the conduct of the study, which integrated face detection and recognition, fingerprint authentication, and Radio Frequency Identification (RFID) for automatic door lock access entry and attendance log monitoring. It is this sense that the “No Face-No Entry-No Attendance: An Innovative System” was developed. It was evaluated by faculty, staff, and student users --in terms of the level of functionality, reliability, efficiency, usability and security as modeled on the ISO 9126-1 Software Quality characteristics. Research instrument reliability was based on the result obtained out of Cronbach’s Alphas’ acceptable standard equivalent to 0.83. Frequency count and weighted mean were the statistical tools used in treating data. The study revealed that the developed system was very much functional, very much efficient, very much reliable, very much usable and very much secured.

KEYWORDS: *Face Detection and Recognition; Fingerprint Authentication Protocol; Automatic Door Lock Access Entry; Innovative System*

1.0 INTRODUCTION

With the dominance of information technology in the environment, evidently a tide of change is seen sweeping everywhere. People are challenge to change and initiate change especially if it sparks them from tedious process towards solution to their existing problems. In particular, schools have problems about security of and delay in transaction processing due to manual system of operation. Manual systems of

operation put pressure on people to be correct in all details of their work. With manual systems the level of service is dependent on individuals and this requires management to run training continuously for staff to keep them motivated and to ensure they follow correct procedures. It can be all too easy to accidentally switch details and end up with incorrect data entry or in handwritten reports. This has deleterious effect not only in terms of efficient service but also information usability. The manual system, thus, of reporting and checking data and producing reports is according to Joseph et. Al., not only time consuming but also subject to errors and hence lacking in security [1]. But if the system is automated, significant time, money and effort can be saved.

To address the old mindset of doing things, the application of technology cannot be overemphasized. One of the many concepts being developed today is the Internet of Things (IoT), which considers the centrality of, among things, functionality and identity. It is, thus, reasonable to define the IoT as “things having identities and virtual personalities operating in smart spaces using intelligent interfaces to connect and communicate within social, environmental, and user contexts” [2]. Combining different technologies for optimum performance, it is one of the end products of the advancement of technology. It allows people to focus on their jobs without having to track several activities occurring at the same time without impairing the overall productivity. Getting access to relevant information at any time anywhere has become very easy. Furthermore it increases human capabilities and simplifies doing things in so many ways as automation is applied to various transactions in day to day living.

Companies, organizations, and institutions of higher learning adopt technological advancement as part of their daily transactions, because of the advantages that it offers in terms of security and faster transaction processing [3]. Indeed, like any other educational institutions, St. Vincent's College Incorporated, in its pursuit of maintaining excellence and contributing in a globally competitive manner to the total development of the family and society, keeps abreast with the latest technological advancement in managing its transactions, which, among other things, involve serving students in the best way possible. One of the institutions priorities is making the monitoring of students' attendance reliably and hassle free, as well as securing its laboratories and equipment.

Along the foregoing context, the study was conducted. It was anchored on “Access Control Theory” [4], that is, the theory that selective restriction of access to a place or other resource is applicable in the fields of physical security and information security.

The researcher aimed to develop a system by combining the different types of technologies like radio frequency identification (RFID), fingerprint, iris recognition, face recognition, and others. It is a system that integrates access control to record and monitor attendance automatically. The attendance data is important for enhancing tough control with regard to the discipline of individuals, which entails observance of the policy of not entering the laboratory without permission. The system for development in this study used face detection and recognition protocols to facilitate access entry to the computer laboratory, monitor the laboratory entry log, and automatically records attendance of individual.

For security purposes, gaining entry access to the laboratory requires validation and authentication of the students' face based on his or her enrolment status. Supported by Daugmans' [5] study in which a threshold is determined for each match by taking account the number of bits available for comparison. He adopted the "Matching Algorithm Theory". The theory assumed every bit of a sample independently and identically contributing to the entropy of the probability distribution. The matching algorithm theory became part of the face detection and recognition [6]. Focusing on the pattern matching associated with comparison of iris pairs on human faces. Human faces are detected and recognized for authentication through direct camera capturing. This theory is applicable to face recognition. Face detection and recognition schemes were complementary to one another. Each one was a complement to the other since a face needs to be detected first before it undergoes face recognition [7]. This makes it possible the effectiveness of face recognition as part of the developed systems capability. Matched face is the basis for a real time attendance system. Once a student is granted an access entry, recording of his attendance is automatically fed into the system along with details on date and time in. Gaining exit access of the laboratory also means an attendance record with date and time out. Security wise, laboratory entry access is only granted to those students who are allowed to use the laboratory on a specified time and day. For unregistered individuals, the laboratory in-charge has the sole authority to grant entry access by having them undergo a standard protocol. In this case, laboratory usage is securely monitored and the equipment safeguarded. Attendance system for laboratory users is automatically logged. Real – time laboratory user's attendance log are remotely accessed by the laboratory-in-charge via WiFi connectivity [8]. Monitoring the attendance details is hassle free, eliminating the monotonous and time consuming method of manual marking and attendance checking. Cases of missed attendance checking and manual alteration of the attendance record are eradicated.

2.0 METHODOLOGY

The study utilized the developmental research method which is a systematic study of designing, developing, and evaluating computer programs, processes, and products that must meet criteria of internal consistency and effectiveness [9]. Research procedures were adapted in the study particularly with respect to identifying the study's participants, creating the design, and collecting and analyzing the data. This is also the type of research that involves situations in which the product-development process is analyzed and described, and the final product is evaluated as to whether it meets the desired objectives.

2.1 System Development Life Cycle

The development of the study was guided by following the protocol of the system development life cycle namely: data gathering, requirement analysis, designing, coding and testing and evaluation. Each of this stage was accomplished one at a time to achieve maximum output. It helped in establishing a system project plan, giving an overall list of processes and sub-processes required in developing a system [10].

Data gathering involves the process of gathering and measuring information on targeted variables in an established systematic fashion, which enables the researcher to answer relevant questions and evaluate outcomes.

The requirements analysis phase involves a detailed study of the current system, leading to specifications of a new system. This further involves frequent communication with system users to determine specific feature expectations, resolution of conflict or ambiguity in requirements as demanded by the various users, avoidance of feature creep and documentation of all aspects of the project development process from start to finish. Detailed study of various operations performed by a system and their relationships within and outside the system was also done, including working out the pros and cons relative to each new area or feature of the system.

Based on the user requirements and the detailed analysis of a new system, designing was undertaken. It is considered the most crucial phase in the development of a system. Designing entailed creation of a plan or convention for the construction of an object, system or measurable human interaction. Arrays of procedures were performed for the purpose of putting the ideas into an attainable design. Systems were created to solve problems.

Figure 1 presents the over-all proposed system design. Face detection and recognition, Radio Frequency Identification (RFID) reader and fingerprint scanner were embedded within the system. Mechanism is applied so as to control that only one individual at a time can gain entry access to the main door. Once an individual's identity is found to be valid, signal is activated setting the device to active on, triggering the automatic opening of the door lock and feeding the data to the attendance monitoring log on the personal computer. Automatic spring is activated so as to close the door returning to its initial lock state at a certain time delay. To ensure system security, authentication protocols are undertaken in order for an individual to gain entry/exit access to the door lock. Validation is based on the information from the database record. The laboratory in-charge has the sole authority for pre-registering valid individuals based on the validated enrolment students' copy.

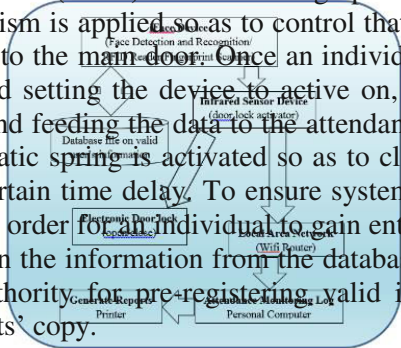


Figure 1: System Design

Coding involves converting the design of the whole system into computer understanding language since the development of the new system prioritizes the use of computer based application system. Object-oriented programming was used as the programming paradigm. This entails the use of objects in enhancing the full functionality of the systems' application.

Testing and evaluation was done before finally operationalizing the new system. This

required removing all the bugs, if there was any. The results were evaluated to assess progress of design and performance. Figure 2 shows the system testing and evaluation information flow.

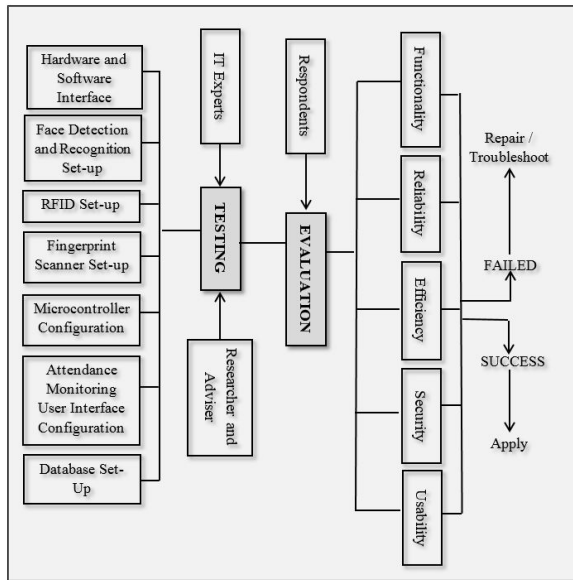


Figure 2: System Testing and Evaluation Flow

3.0 RESULTS AND DISCUSSION

This section presents the data followed by their corresponding analysis and interpretation of the results.

Research instruments were administered by the researcher. Result of the Cronbach's Alpha was used to validate the research instrument used. Nunally [11] cited an acceptable range of alpha to be equal to or greater than 0.7. A highly reliable instrument is always a valid measure of some functions. Since the Cronbach's Alpha internal consistency coefficient yields 0.83, which was above the acceptable range, the research instrument was found to be valid and reliable. A survey was conducted so as to identify what are the present system practiced in laboratory access admission and attendance monitoring and further identifying the problems that arise therein. The data gathered with regards to the problems encountered out of the existing system served as the basis for the development of a new system. Respondents' responses on the

system’s evaluation supports the validity of the newly developed system. The conduct of the research revealed the following findings.

Current computer laboratory practice adopted a purely manual time consuming way of checking of students’ identification in relation to giving them laboratory access. There was no automatic attendance log. All this pointed to the absence of high technology integration. Technological innovation was still not practiced. Majority of the respondents observed that there was no checking and verification undertaken relative to laboratory access. This implies that the problems allows opportunity to place at risks security of the laboratory. The “no-schedule no-entry policy” was not strictly observed in the admission of individuals on the laboratory. This further implies that a new system has to be designed to address the problem.

Several technological features were embedded to come up with the innovated system. Figure 3 shows the hybrid technological features of the newly developed system.

Hybrid Technological Features	
Face Detection and Recognition	
Live Human Face Detection	User Interface Access Level
RFID Tag Authentication	WiFi Based Remote
Fingerprint Scanning and Verification	Monitoring
Automatic Door Lock Opening for Valid Entrants	Network Controlled Devices
Automatic Door Lock Closing After Time Delay	Device LCD Display
Emergency Button for Automatic Door Opening for Emergency Cases	Prevent Unauthorized Entrants
Automatic and Real Time Attendance Log-in	Device Capacity Storage up to 12,000 records
Automatic and Real Time Attendance Log-Out	
Viewing of Attendance Log (Daily, Weekly, Monthly)	
Viewing of Attendance Log by Class Schedule/Time/Date	
Programmable RFID Tag	
Buzzer Alarm for Stolen Device	
Generation of Printed Attendance Log (Daily, Weekly, Monthly)	
One-Time RFID Card/Tag Registration	
Buzzer Alarm and Warning Message Alert (for device malfunction)	
Button for Manual System Override	

Figure 3: Hybrid Technological Features

The respondents evaluated the hybrid technological features of the new system in terms of functionality, reliability, efficiency, usability and security. Criteria was modeled from the ISO 9126-1 Software Quality characteristics [12]. Functionality refers to the overall performance output and running condition of the system in terms of its general objectives. Reliability means the capability of the system to maintain its service provision under defined conditions for defined periods of time. The system’s resources used when providing the required functionality of the system is an attribute

to its efficiency. Usability of the system implies the respondents’ affirmation of the user’s acceptance of the system’s implementation. Security refers to the systems capability to prevent unauthorized access to the laboratory, unauthorized access to modify the attendance log, and unauthorized access to alter the systems code. Results are reflected in Table 1 below.

Table 1: System’s Evaluation Rating

CRITERIA: FUNCTIONALITY		Average Weighted Value	Implication
<i>Functionality</i>	The system is 100% functional.	4.10	MF
<i>Accuracy</i>	The system conducts real time and automatic monitoring of students attendance.	5.00	VMF
<i>Security</i>	The system automatically grants laboratory door lock access entry for authorized individuals.	4.97	VMF
<i>Suitability</i>	The system was able to generate an attendance log upon query.	5.00	VMF
	The systems’ authentication protocols are functional.	4.85	VMF
CRITERIA: RELIABILITY			
<i>Fault Tolerance</i>	The system is able to recover immediately from unexpected interruption.	4.07	MR
	The system handles maximum fault tolerance.	3.87	MR
<i>Recoverability</i>	The system has sufficient power back-up in case of power interruption.	4.10	MR
	The system can withstand into its	5.00	VMR

JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 07, ISSUE 15, 2020

	full operation for a period from 8:00am to 8:30pm.		
<i>Maturity</i>	The system is error free.	4.74	VMR
CRITERIA: EFFICIENCY			
<i>Time Behavior</i>	The system grants automatic access entry to authorized individuals.	4.90	VME
	The systems' ability to capture facial images is fast.	4.87	VME
<i>Resource Utilization</i>	The system has enough memory storage to store the details as to the profiles of valid entrants.	4.84	VME
	The system is capable of providing back-up of the database file.	4.74	VME
	The system provides maximum utilization of its resources.	4.80	VME
CRITERIA: USABILITY			
<i>Understandability</i>	Determines the ease of which the systems functions can be understood, relates to user mental models in Human Computer Interaction methods.	4.87	VMU
<i>Operability</i>	Ability of the system to be easily operated by a given user in a given environment.	4.80	VMU
<i>Acceptability</i>	User's acceptance of the system implementation.	4.90	VMU
CRITERIA: SECURITY			
<i>Compliance</i>	The system only grants access entry to authorized individuals.	4.97	VMS
	The system accurately recognizes individuals facial identity	5.00	VMS
	The system adopts restrictions to user and admin access level in the systems' interface	5.00	VMS
	The source codes are highly encrypted	4.87	VMS

	The system identifies authorized individual using the different authentication protocols	5.00	VMS
--	--	------	-----

4.0 CONCLUSION

Developing a new system of door lock access entry and attendance log monitoring which effectively integrates face detection and recognition, fingerprint authentication, and radio frequency identification (RFID), was achieved in this study. Moreover, the newly developed system guarantees real time and automatic monitoring of laboratory user’s attendance; accuracy in detecting and recognizing human faces, authenticating fingerprint scanning, and Radio Frequency Identification (RFID) authentication; automatic door lock access entry for authorized individuals; secured laboratory access entry; and generation of laboratory usage log report. Hence, the newly developed “No Face-No Entry-No Attendance: An Innovative System” is best for implementation in the computer laboratory of St. Vincent’s College Incorporated, Dipolog City, Philippines as a means of addressing the institutions thrust in securing the laboratory and providing service to its students in the best way possible.

ACKNOWLEDGMENT

The researcher would like to acknowledge the full support and generosity of St. Vincent’s College Incorporated, Dipolog City, Philippines for giving her the opportunity to develop this project and the chance to pursue higher studies. And to valuable persons who provided her extensive personal and professional guidance on research areas and who were very devoted and professional in responding to the researchers’ queries.

REFERENCES

- [1] Jomon Joseph and K. P. Zacharia, “Automatic Attendance Management System Using Face Recognition”, *International Journal of Science and Research (IJSR)* ISSN (Online): 2319-7064, 2013.
- [2] Ohsung Doh Ilkyu Ha, “A Digital Door Lock System for the Internet of Things with Improved Security and Usability”, *Advanced Science and Technology Letters*, Vol. 109 (Security, Reliability and Safety), 2015.
- [3] Rakuten Kobo, *Trends and Effects of Technology Advancement in the Knowledge Society*, IGI Global, 2012.

- [4] Ross J. Anderson, *Security Engineering 2nd Edition*, Wiley and Sons, 2010.
- [5] J. Daugman, "Probing the Uniqueness and Randomness of Iris Codes: Results from 200 Billion Iris Pair Comparisons." *Proceedings of the IEEE*, vol. 94, no. 11, pp. 1927-1935, 2006.
- [6] Asit Kumar Datta, Madhura Datta, and Pradipta Kumar Banerjee, *Face Detection and Recognition: Theory and Practice 1st Edition*, CRC Press, 2016.
- [7] Milan Sonka, Milan, *Image Processing, Analysis and Machine Vision*, 2015.
- [8] Zatin Singhal, Rajneesh Kumar Gujral, "Anytime-Anywhere Remote Monitoring of Attendance System Based on RFID using GSM Network", *International Journal of Computer Applications (0975-8887)* Volume 39. No.3, February 2012.
- [9] Rita C. Richey, James D. Klein, "Developmental Research Method: Creating Knowledge from Industrial Design and Development Practice", *Journal of Computing in Higher Education*, vol. 16, no. 2, pp. 23-38, March 2005.
- [10] Victor M. Font Jr., *The Ultimate Guide to the SDLC*, A FontLife Publication, 2012.
- [11] J. C. Nunally, *Assessment of Reliability in Psychometric Theory 2nd Edition*, New York: Mc Graw-Hill, 1978.
- [12] ISO/IEC JTC1/SC 7/ WG 6, *ISO/IEC 9126-1:2001, Software Engineering – Product Quality – Part 1: Quality Model*, ANSI, 2007.