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QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System for Quirino State University Maddela Campus

Winston G. Domingo[1], Zarianne Joy M. Ladia[2]
College of Teachers Education, Quirino State University Maddela Campus, Maddela, Quirino, 3404, Philippines [1]
Admin Office, Quirino State University Maddela Campus, Maddela, Quirino, 3404, Philippines [2]
winston.domingo@qsu.edu.ph

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ABSTRACT

Attendance monitoring is a vital task in any organization. Attendance data helps keep track of the absenteeism of any employee. The QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System is a web-based application that manages the attendance records of the Quirino State University – Maddela employees. At present, a face recognition with biometrics was the device used to get the attendance of the employees through a face recognition program. However, the device only generates an attendance summary of the employee, date, time, and other details which were not suitable for the filing and reporting of the employee attendance. Hence, this research developed a web-based system that will integrate the data produced by the biometrics to generate a report that will be uniform and understandable by the end users. The agile Iterative Model of the Software Development Life Cycle was adapted from the business understanding and requirements elicitation phase to testing the developed face recognition attendance and web-based attendance monitoring system. Based on the findings, the researchers concluded that the developed computerized system helps the processing officer in checking and monitoring attendance, especially during the time-in and the time-out of QSU staff. This can serve as basis for the preparation of the payroll registry for a certain cutoff. The security of the employee

attendance system is important to ensure that employees do not commit fraud in recording attendance and monitoring activities during working hours.

Keywords: *attendance system, biometrics, face recognition, web-based attendance, web applications*

Introduction

Face recognition is a computer application that is capable of detecting, tracking, identifying, or verifying human faces from an image or video captured using a digital camera. Although a lot of progress has been made in the domain of face detection and recognition for security, identification, and attendance purposes, issues are still hindering the progress to reaching or surpassing human-level accuracy. A face recognition system is an application of computer vision and image processing that is capable of performing two major tasks identifying and verifying a person from an image or a video database (Bah & Ming, 2020).

Recently, using biometrics applications for a person's authentication has received more attention from computer vision researchers. Biometrics applications play an important role in reliable person authentication for recording the attendance of employees in large organizations. Face detection is considered an optimal solution for enrolment attendance among all biometrics applications such as fingerprint (Mady & Hilles, 2017). The attendance system is very important in schools and colleges. Manual attendance system has many difficulties; it may be less accurate and critical to maintain. So, the attendance system using the face recognition technique increases the accuracy and also requires less time than other methods (Surve et al., 2020).

Efficient employee attendance management leads organizations to increase overall corporate performance and accomplish specific goals. Accurate employee attendance records are important to control working discipline and increase workers' productivity. Manual attendance-time checking is increasingly time-consuming and adds to the paperwork burden for companies. Human actions (i.e., mistakes at work, and fraudulent timekeeping) are additional hidden expenses that affect the productivity of the organization. Variations in the attendance policies set by different companies complicate the evaluation of employee working hours (Oo et al., 2018). The attendance monitoring system is an essential element in all organizations and is considered an integral part of efficient organizational information systems (Khan et al., 2020). Manually recorded attendance of all the employees has produced some problems such as data accuracy and staff performance efficiency (Maramis & Rompas, 20018). Attendance is one of the major factors for measuring eligibility, punctuality, and commitment to the institution. Keeping and managing attendance records efficiently is very important for employees (Kabir et al., 2021). Employers are concerned about the absenteeism among employees in the workforce and the complexity of monitoring (Garg et al., 2018). The attendance of employees was recently seen as one of the most important elements or issues in paying salaries (Aravindhan et al., 2021).

The QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System is a web-based application that manages the attendance records of the QSU Maddela employees. At present, face recognition with biometrics was the device used to get the attendance of the employees through a face recognition program. The

biometric device has built-in features of a face recognition program; thus, all employees must have registered in the biometric device using its face recognition program. However, the device has no features that will generate a summary of attendances that includes the names of the employees, department/division, date, morning in and out, and afternoon in and out. The device only generates an attendance summary of the employee, date, time, and other details, which are not suitable for the filing, and reporting of the employees' attendance. Hence, this research developed a web-based system that will integrate the data produced by the biometrics to generate a report that will be uniform and understandable by the end users.

Methods

Materials

The materials and/or computer programs/software used in the study are the following:

Software:

- PHP for the Web App Development
- MySQL for Database System
- Relational Database Management System
- Composer and Node.js as a tool for Dependency Management for PHP
- Additional Libraries (ChartJS, PHP Barcode Generator, Mobile Detector, Slim Framework, jQuery, and Laravel for scripting language and framework)
- Bootstrap5, HTML5, SweetAlert2, AdminLTE, Cascading Style Sheet (CSS) for interface design
- Cross-Platform Apache MySQL and Pearl (XAMPP) for the Apache and MySQL Server
- PHP Scripting Generator
- Notepad++/Notepad for text editor
- Browser (Google Chrome, Edge, Safari, Brave, Mozilla Firefox, and Opera)

Hardware:

- Laptop/Desktop for the development
- 1 set computer system unit for implementation
- Biometric device with face recognition

Research Design

This study used a descriptive research design and the Software Development Life Cycle (SDLC) methodology. The descriptive research design method was used to determine the present status and condition of the manual process of attendance checking and reporting. The agile Iterative Model of the Software Development Life Cycle was adapted from the business understanding and requirements elicitation phase to testing the developed QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System (Mallepally, 2016).

Design, Treatments, and Layout

Treatments, and layout the Agile Iterative was adopted to guide the development of the computerized grading system for the Marketing Office. Every iteration in the system development involves the following process:

Requirement Analysis. In this procedure, the researchers conducted a series of interviews with the staff of the Marketing Office, who typically administer and supervise the office's entire process and actions. All the gathered data and information were

studied by the researchers to come up with appropriate inputs in designing and developing the computerized QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System for Quirino State University – Maddela Campus.

Design. The researchers chose the appropriate programming software, database, and hardware with which the developed system could be compatible. The researchers constantly coordinated with the users and production officer on the features that are suitable for their needs. They designed the framework of QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System.

Development. The activities involved in this phase were designing and coding of the user interface. During the development, there was a series of laboratory tests that were conducted in the different modules of the system. Compatibility testing was done and constant coordination with the users was made to align the users' specifications with the developed system.

Testing. In this procedure, parallel testing of the developed system was done. The researchers consolidated all the comments from the testing teams which served as the basis for the modification and redesign of the system. Integration of data produced by the biometrics to the computerized system was done to check the format and compatibility of data and to process the database.

Implementation. The researchers implemented the system in the Admin Office, Quirino State University-Maddela Campus, Quirino. The system was installed and used. During the implementation phase, a series of training was made for the processing officers/staff. Calibration and alignment of expectations of the users with the developed system were also done.

Maintenance. In this process, monitoring of the implementation and documentation of the use of the system were conducted. The problems and challenges encountered by the users were closely recorded and reported. The errors and bugs encountered by the users including suggestions for better features were documented and fixed.

Data Gathering Procedure

The researcher secured approval from Quirino State University. The study also underwent an ethics review to ensure that there would be no violation of the Privacy Act. The researchers gathered data through a series of interviews. Focus Group Discussion (FGD) was also conducted with the staff of the ffice of the administration who check the attendance. The results were the basis of the research in the design and development of the system. The researchers conducted form and report evaluation as part of the data-gathering procedure to have a deeper understanding of the current manual operation of the marketing office. The developed system was tested and used by the users (staff and director for production) of the system and they were also involved in the evaluation of the interface of the system. Their recommendations were considered in the development of computerized QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System.

Statistical Tool

The data collected were tabulated, analyzed, interpreted, and summarized using both descriptive and inferential statistics. The mean score was used to analyze the average rating of the IT experts concerning the compliance of the application that was developed and implemented in this study with regard to the ISO25010 Software Quality Standards. The evaluation of tools is based on the ISO 25010 framework, which

investigates software functionality, reliability, performance efficiency, usability, compatibility, and information quality (Keibach & Shayesteh, 2022).

The ISO 25010 Software Quality Standards was used as an instrument for assessing the developed system. The results gathered were analyzed employing the following 4-point Likert.

Table 1. Likert Scale with Numerical Interpretation

Weight (Likert Scale)	Weighted Mean	Descriptive Interpretations	Interpretations
4	3.50-4.00	Compliant to a very great extent	The measure described in the item is highly accepted.
3	2.50-3.49	Compliant to a great extent	The measure described in the item is accepted.
2	1.50-2.49	Compliant to a low extent	The measure described in the item is not accepted.
1	1.00-1.49	Compliant to a very low extent	The measure described in the item is highly not accepted.

Ethical Considerations

The researchers considered ethical standards in this study to prevent the fabrication or falsification of data. The participants of the study were not subjected to any harm in any way. Full consent was obtained from the participants before the study. The protection of the privacy of research participants and the data provided were secured, ensuring an adequate level of confidentiality.

Furthermore, this study underwent rigorous review by the Ethics Review Committee of Quirino State University to ensure it passed the ethical standards. A language editor also validated, checked, and critiqued the entire manuscript for grammar and technical writing issues.

Results and Discussion

Figure 1 shows the system architecture of QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System. It presents the process of recording attendance from employees to biometrics with face recognition.

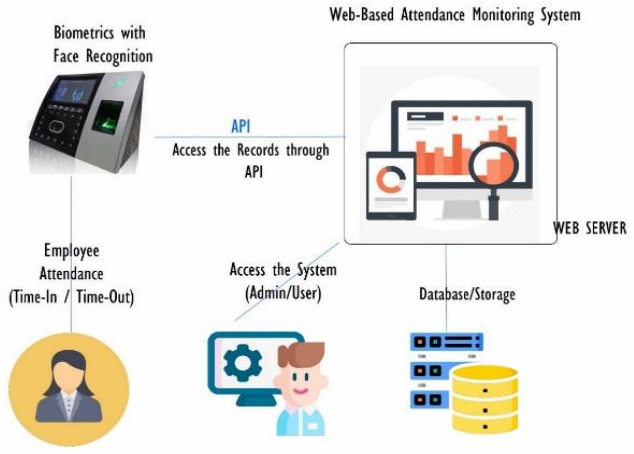

Figure 1. *The System Architecture of QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System.*

The employee must be registered in the biometrics; the biometrics records the daily time-in and time-out of the employee. The web-based attendance monitoring system accesses the records of biometrics using the Application Program Interface (API). The records will be stored in the file/web server, and the data will be processed by the system to synchronize the records and will be stored in the databases. The synchronization of records feature is only accessed by the system administrator; the privilege of the users is to generate the reports and manage employee information.

Figure 2 represents the database design of the developed QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System. It shows the data tables which relate to other tables. The researchers used a combination of normalized and denormalized database design. Normalized tables are designed for limited records only and the denormalized design is for multiple and related records so that the process of the data processing would not affect the data retrieval.

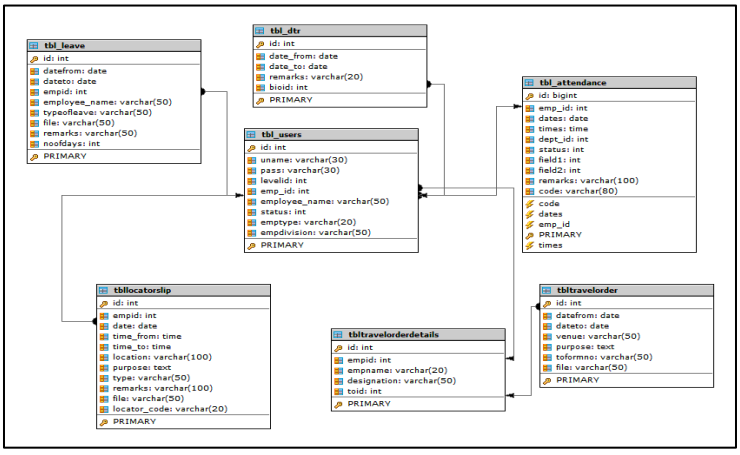

Figure 2. *Entity Relationship Diagram*

Figure 3 shows the hierarchical input process output of the system. Settings, transactions, and reports present the main module of the system. The settings have

three sub-modules (employee list, department, and division). The setting represents the input. The transaction module has four submodules (attendance synchronization from the device attendance monitoring, employee leave, travel order, and locator slip). The transaction represents the process. The report represents the output, and it has three reports (monthly report, employee list, and attendance report).

The HIPO serves as the framework needed to establish collaboration between programmers and operators to automate the continuous delivery of new software and to reduce the development life cycle and produce quality software (Akbar et al., 2022). The analytic hierarchy process method was used to prioritize challenges and their categories based on their relative importance (Shameem et al., 2018).

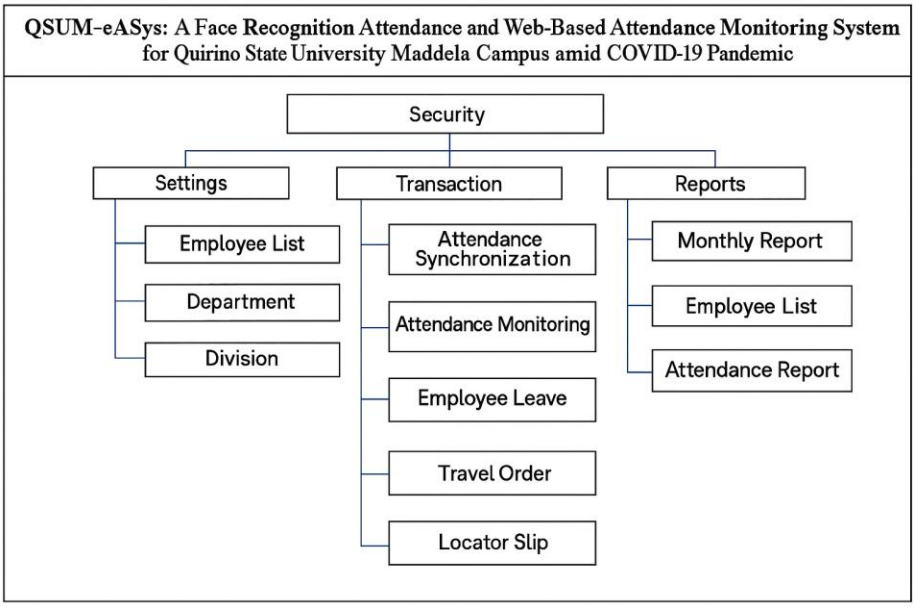

Figure 3. *Hierarchical Input Process Output of the System*

Figure 4 shows the attendance records that were generated from the biometrics. The records include only dates and numbers. The user does not know the details of the data generated from the biometrics. The records generated from the system show the dates, day, AM in, AM out, PM in, PM out, and remarks which display the cutoff dates and the name of the employee. The user can easily understand and check the attendance of the employee.

```
24 2022-05-16 07:46:33  1  0  15  0
33 2022-05-16 07:46:46  1  0  15  0
33 2022-05-16 07:46:48  1  0  15  0
49 2022-05-16 07:50:00  1  0  15  0
49 2022-05-16 07:50:03  1  0  15  0
39 2022-05-16 07:50:10  1  0  15  0
32 2022-05-16 07:50:24  1  0  15  0
67 2022-05-16 07:51:11  1  0  15  0
67 2022-05-16 07:51:14  1  0  15  0
43 2022-05-16 07:51:19  1  0  15  0
43 2022-05-16 07:51:21  1  0  15  0
64 2022-05-16 07:51:27  1  0  15  0
72 2022-05-16 07:51:47  1  0  15  0
88 2022-05-16 07:51:54  1  0  15  0
53 2022-05-16 07:52:06  1  0  15  0
41 2022-05-16 07:52:41  1  0  15  0
41 2022-05-16 07:52:43  1  0  15  0
21 2022-05-16 07:54:32  1  0  15  0
21 2022-05-16 07:54:34  1  0  15  0
70 2022-05-16 07:54:52  1  0  15  0
50 2022-05-16 07:56:57  1  0  15  0
 2 2022-05-16 07:57:41  1  0  15  0
 2 2022-05-16 07:57:43  1  0  15  0
76 2022-05-16 07:59:14  1  0  15  0
82 2022-05-16 07:59:18  1  0  15  0
```

Figure 4. *Attendance Records Generated from Biometrics*

Figure 5 shows the data processed by the computerized system. This report helps the users to understand the data and reports.

From April 01, 2022 to April 21April 30, 2022				BIO ID: 82 - Employee Name: WINSTON DORENGO		
Date	Day	AM IN	AM OUT	PM IN	PM OUT	REMARKS
2022-04-01	Friday	08:01:37 AM				
2022-04-02	Saturday					
2022-04-03	Sunday					
2022-04-04	Monday	08:07:08 AM				
2022-04-05	Tuesday	08:21:38 AM 08:01:40 AM				
2022-04-06	Wednesday	08:19:49 AM				
2022-04-07	Thursday					
2022-04-08	Friday	08:13:09 AM				
2022-04-10	Sunday					
2022-04-12	Monday	08:13:09 AM				
2022-04-13	Tuesday				05:17:09 PM	
2022-04-14	Wednesday	07:54:41 AM			05:26:01 PM	
2022-04-15	Thursday					
2022-04-16	Friday					

Figure 5. *Attendance Records Generated from the System*

Figure 6 shows the attendance report with remarks. This page shows the complete attendance of the employees with the remarks of travel or on leave to easily monitor and help the processing officer for the checking of attendance.

Aff: From April 01, 2023 To April 16, 2023 — BIO ID: 83 - Employee Name: WINSTON DORENGO

Date	Day	AM IN	AM OUT	PM IN	PM OUT	REMARKS
)23-04-01	Friday	08:01:37		-	✓	Trial:
)23-04-02	Satuday	-				2021-00009-000
)23-04-03	Sunday	-				2021-00009-000
)23-04-04	Monday	-	08:07:50 AM	-	✓	
)23-04-05	Tuesday	-	08:10:08 AM	-	✓	
)23-04-06	Wednesday	-	08:01:00 AM	-	✓	
)23-04-06	Thursday	-	07:56:43 AM	-	✓	
)23-04-09	Sunday	-				
)23-04-09	Monday	-				
)23-04-10	Tuesday	-	08:13:09 AM	-	✓	
)23-04-11	Tuesday	-		-	✓	
)23-04-13	Thursday	-	07:54:41 AM	-	✓	
)23-04-14	Friday	-		-	-	
)23-04-15	Sunday	-		-	-	Leave: Sick Leave
)23-04-16	Saturday	-				

Figure 6. *Attendance Report with Remarks*

Figure 7 shows the attendance report per division. The user can generate a report of attendance per division (Instruction Division, ADMIN Division, and COS/JO Division). The system will generate attendance based on specified time frame and selected division. This feature of the system helps the processing officer to generate attendance per division.

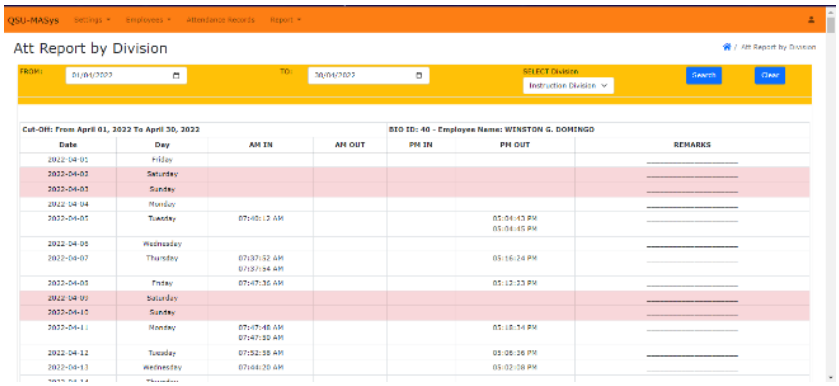

Figure 7. *Attendance Report Per Division*

Results Evaluation of the System

Table 2. Result Evaluations of the System in Compliance with the Developed System Using ISO 25010 Software Quality Standards

ISO 25010 Software Quality Standards	IT Experts	Descriptive Rating
1) Functional Suitability	4.53	Compliant to a very high extent
2) Performance Efficiency	4.47	Compliant to a very high extent
3) Compatibility	4.60	Compliant to a very high extent
4) Usability	4.63	Compliant to a very high extent
5) Reliability	4.55	Compliant to a very high extent
6) Security	4.88	Compliant to a very high extent

7) Maintainability	4.40	Compliant to a very high extent
8) Portability	4.33	Compliant to a very high extent
Grand Mean	**4.45**	**Compliant to a very high extent**

The developed system evaluated the QSUM-eASys: A Face Recognition Attendance and Web-Based Attendance Monitoring System using the ISO 25010 framework to assess its extent of compliance. The evaluation results show that the indicators functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability got a descriptive rating of compliant to a very high extent. The results present a grand mean of 4.45 with an overall descriptive rating of compliant to a very high extent.

Software quality standards that exist today show the importance of achieving software quality. Quality software information can be measured such as the number of functions, complexity, the number of errors, and trials used to support management planning, organizing, implementing, and controlling (Dewi et al., 2020).

Conclusion and Future Works

From the above findings, the researchers concluded that the developed computerized system helps the processing officer in checking the attendance of the employees. The developed computerized system could generate a monthly attendance report and monthly attendance report per division and per type of employee. The staff can also record the filed leave and travel order forms. In the monthly generated attendance report, the filed leave and travel order will be displayed in the remarks, these remarks will be the basis of the staff in monitoring attendance and for the preparation of payroll, as well as for checking and monitoring attendance, especially during time-in and the time-out. This will also be the basis for the preparation of the payroll register for a certain cutoff. Attendance monitoring is a vital task in any organization.

For future work, the addition of features of the developed attendance monitoring system may include the integration of service credits earned for every employee to monitor their attendance and service credits earned, and filing of Travel Orders, leaves, and gate passes through the Human Resource Information System (HRIS) is suggested.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.