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Timekeeping and Immediate Monitoring of Employees by Consistently Advocating Time Consciousness and Honesty Using Enhanced Attendance Monitoring System (TIME CATCH Using EAMS)

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ABSTRACT

Attendance management methods that use QR codes and face recognition technology to identify and verify an individual's features are widely used in many aspects of people's lives nowadays, notably in pandemic situations where contact-less systems are used. In this paper, the development of enhanced attendance monitoring system using was introduced. The Isabela State University Angadanan Campus has implemented a biometric attendance monitoring system. However, it is limited to the number of employees' registrations, leave management and generation of Daily Time Record. The biometric system can only store 60 employees in every device, leave application and credits cannot be catered by the system and the Daily Time Record is not auto-generated and auto-formatted. For this reason, an enhanced attendance monitoring system was developed. The system uses a camera and QR Code reader to take attendance electronically, and the attendance records be saved in a database. It can store multiple number of employees, process leave application, manage remaining leave credits, and provide auto-generated Daily Time Record. This method, on the other hand, reduces the requirement for fixed materials and employees to retain records. From the developed system and the gathered data, it has addressed the problem of the conventional way of checking employee's

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attendance. The general mean of 4.72 shows that the software quality of the system based on ISO 25010 is found to be functional that the users have strongly agreed on the different characteristics of the system as it addresses the issues in the current attendance monitoring system of ISU.

Keywords: Attendance, QR code, face recognition

INTRODUCTION

During the pandemic, government agencies were urged to cease the usage of the Biometric Fingerprint Attendance Monitoring system. As a result, the use of biometrics as a prerequisite for employee attendance is being phased out to stop the spread of the coronavirus disease. Temporarily, employees have to sign in a logbook located in their respective offices. However, logbooks are not a viable way to guarantee employee safety and capture employee logs since human contact with surfaces contaminated with the COVID19 virus is one exposure route in the transmission of infectious diseases (Hale & Song, 2020).

The Isabela State University-Angadanan Campus has also implemented a biometric system as a basis for employees' attendance. Because the system uses biometric fingerprint verification technology, it is not recommended to be used because employees are still prone to contacting the biometric device that other employees use. More specifically, the system is limited to the number of registered employees, requiring them to provide additional sets of biometric devices for casting attendance logs. Occasionally, the biometric system is incapable of capturing/recognizing fingerprints, necessitating the manual entry of time logs on printed sheets of paper. In the case of Daily Time Record rendering, the system can only export attendance logs in the form of excel files, which necessitates the in-charge downloading and reformatting logs at the end of each month, which consumes a significant amount of preparation time. Another issue is leave management; because the biometric system can only capture attendance logs, leave credits must be manually managed and kept by the Human Resource Management Office. Explicitly, there are flaws in the biometric system's efficiency report on matters pertaining to the attendance system.

TIME CATCH using EAMS was developed to enhance the system to address issues in Timekeeping and Immediate Monitoring of Employees' attendance while implementing contactless transactions. EAMS (Enhanced Attendance Monitoring System) is a network-based system that uses Face recognition and QR code technology for employees' contactless transactions. It is also capable of (1) Registration of employees with an auto-generated ID system, (2) Face Recognition and QR Code Casting employees' attendances, (3) Automatic Generation of DTR, (4) Automatic Management of Employees' Leaves and (5) Live Dashboard for Immediate Monitoring. Using the developed system, the Isabela State University-Angadanan Campus can ensure TIME CATCH (Timekeeping and Immediate

Monitoring of Employees logs by Consistent Advocating Time Consciousness and Honesty) even during this time of the pandemic.

MATERIALS AND METHODS

This study's main concern is attaining the objective by following the processes to create a successful project. Therefore, the researcher used the Rapid Application Development Approach, where sequences and various phases were determined, followed, and stated for the accomplishment of the research project, illustrated in Figure 1.

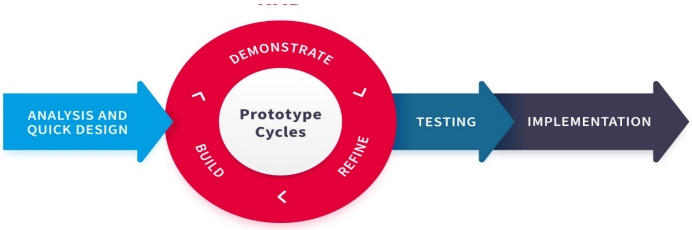


Figure 1. Software development model

Analysis and Quick Design

To determine the essential features that will be added to the study, the researchers contacted the concerned staff or ended users for features and add-ons to be incorporated into the system. Furthermore, as a foundation for report automation, the researchers gathered HR reports such as the leave form and the DTR. After the collection of data, the system design was created.

System Design

Figure 2 explains the system design. Employee attendance is recorded by scanning their QR code and using facial recognition software. After the verification and identification processes, if an employee's QR code and Image model are validated and present in the database, his or her attendance will be updated. The HR is the only user with the sole authority to update employee information and issue auto-generated Daily Time Record (DTR). The campus administrator can monitor the live dashboard of the system, viewing and printing reports links, overall employee matter list, and the employees per department. Meanwhile, the Campus Business Affairs Office (CBAO) is responsible for printing Employees' QR Code cards. Finally, the System Administrator sets the overall system settings and configurations.

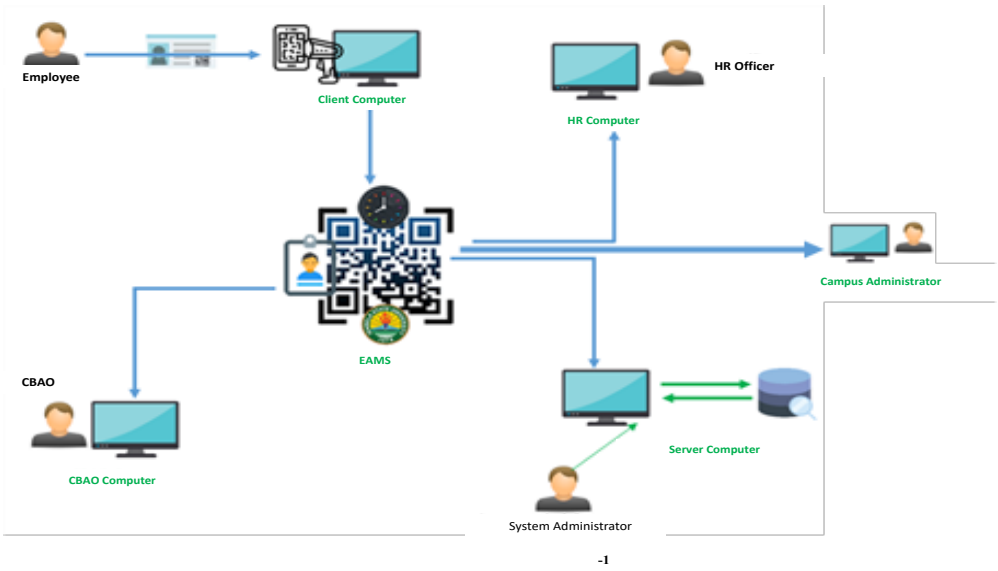


Figure 2. System architecture

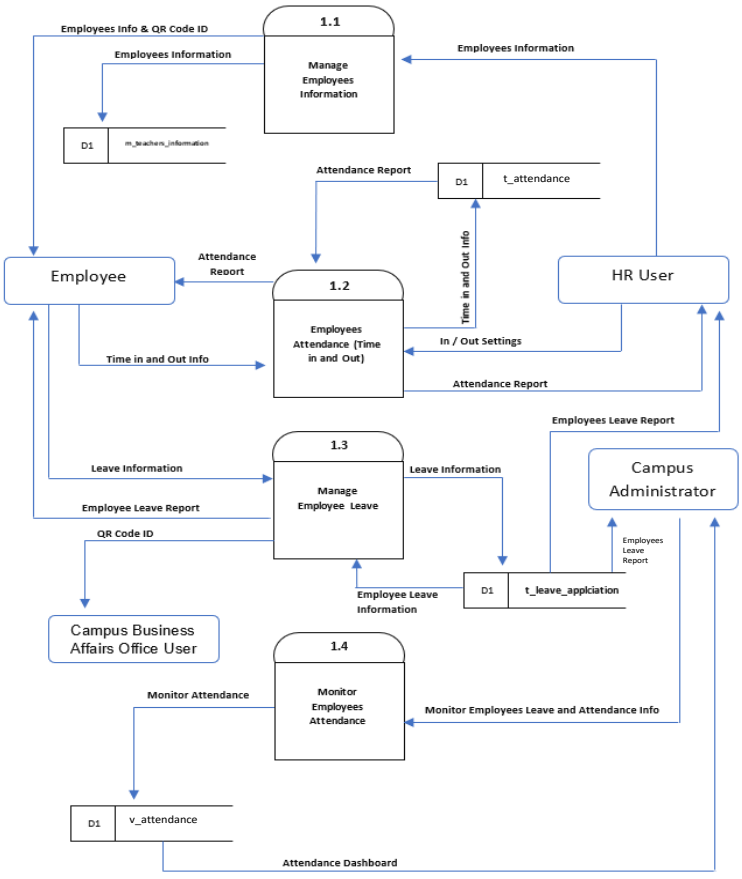


Figure 3. Data flow diagram of the developed system

Figure 3 shows the Data Flow Diagram of the developed TIME CATCH (Timekeeping and Immediate Monitoring of Employees by Consistently Advocating Time Consciousness and Honesty) using EAMS (Enhanced Attendance Monitoring System). The first process begins with the HR User registering each employee's information. Next, a QR code ID printed by the Campus Business Affairs Office user shall be given to each employee. Finally, employees cast their attendance using their QR codes and captured images. Employees can also file their leave application reflected in the live dashboard monitoring of both HR and Campus Administrator Users. The Figure 4 shows the entity relationship of diagram of the developed system it illustrates the connection of every table in the database.

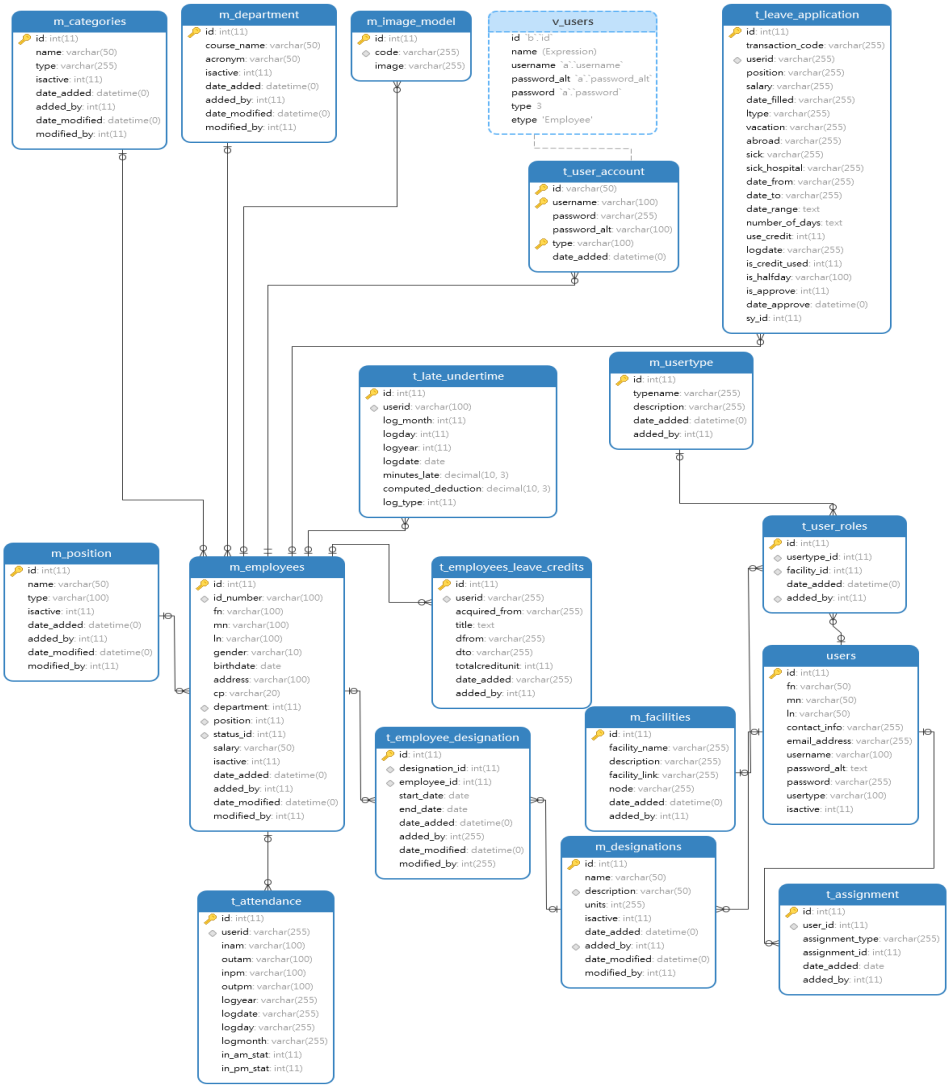


Figure 4. The entity relationship diagram of the developed system

Prototyping. Prototyping and actual programming were used to create the program's working interface. The following software was used during the development phase:

- Visual Studio 2010—The client module/attendance window is a window-based application invoked every time the client's computer runs. Visual Studio 2010 was used to develop the attendance window because of its capability to create compiled window-based applications. Moreover, the class libraries of face recognition and QR Code are supported by VB2010.
- PHP—PHP was used as the programming language in constructing the administrator module, particularly in writing server-side scripting language that communicates the UI (User Interface) elements to the database.
- MySQL—served as the database engine of the system. SQL Queries were also used to transact data from the system user's UI (User Interface) to the Database Tables. SQL was also used to extract and visualize data coming from the database. These data were the employee's information, attendance information and leave information.
- Bootstrap 2.4 AdminLTE—Bootstrap is an HTML, CSS and JS Library used to simplify the development of a responsive website. Bootstrap 2.4 AdminLTE is a bootstrap template used to design the system's UI (User Interface) using cards, panels, grids, form elements, navigation, tables and modals.

Alpha Testing. The researchers used it to test for faults and other technical issues that could emerge during the creation of a system.

Beta Testing. It tested and deployed the system to users (Employees, HR officers and the Systems Administrator).

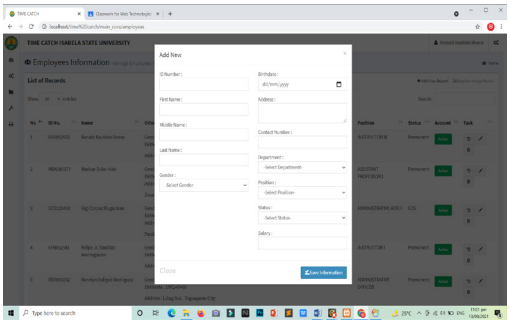
System Implementation. It was done to see how the program complies with the set requirements. The implementation phase is covered by the methods listed below:

Employees Registration

Employee information is entered in the appropriate field by entering the employee's ID number, name, birthdate, contact number, address, department, job status, and salary (Figure 5). The employee information is then registered. The CBAO (Campus Business Affairs Office) prints the QR Code card once registration is complete.

Casting of Attendance Logs

The attendance window is used in casting employee logs, where attendance is taken by scanning the employee's QR code and capturing their face through facial recognition for verification purposes (Figure 6). Employee attendance is automatically recorded in the database once an account has been verified.



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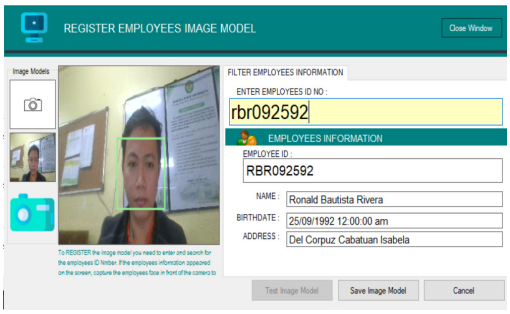

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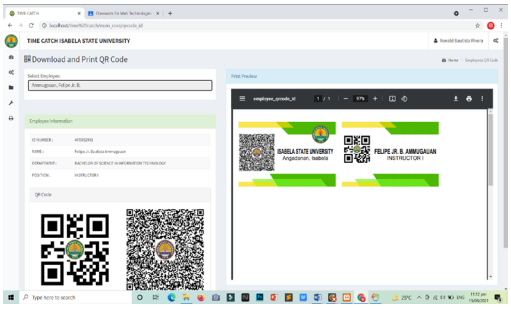

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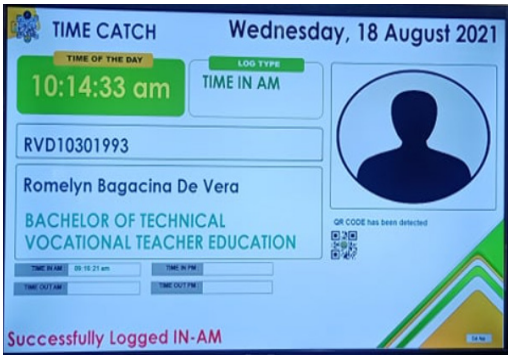
Figure 5. Employees registration



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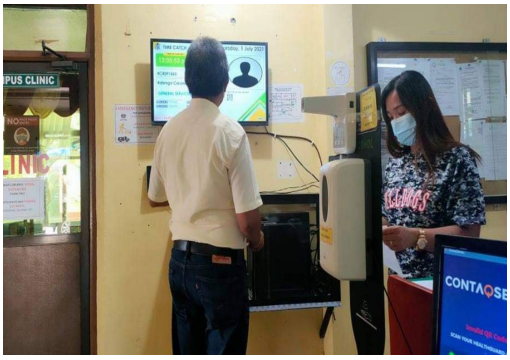


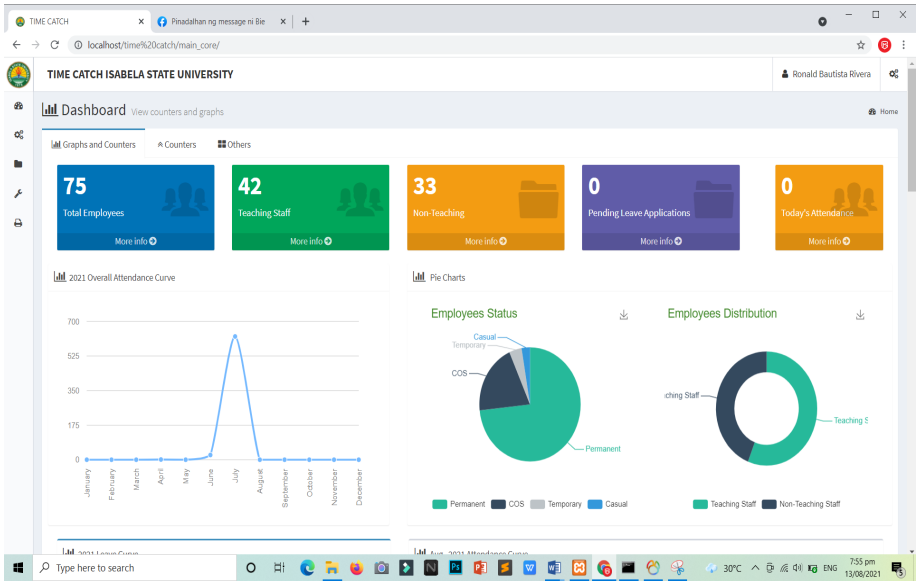
(b)

Figure 6. Casting of attendance logs

The Monitoring Dashboard

The Monitoring and Dashboard module (Figure 7) lets users view the system's live dashboard. The module includes counters which can view the number of teaching and non-teaching staff, the total number of employees, pending leave applications and the number of attendances on the current date. The module also includes graphs for attendance, employees' status pie chart, leave and attendance curve, and employees distribution graph.

The monitoring dashboard module can be viewed by the campus administrator, the Human Resource Officer and the Program Chairs or Deans of Isabela State University.



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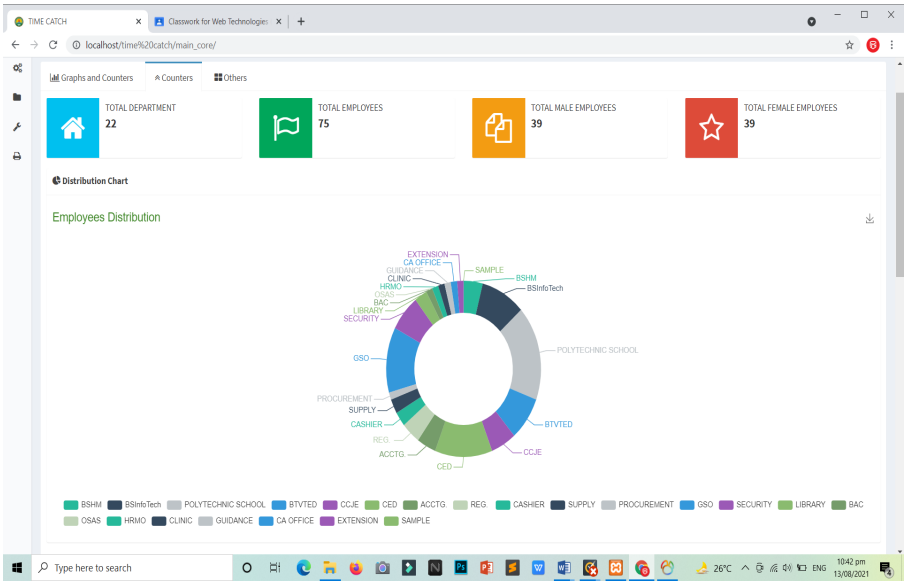

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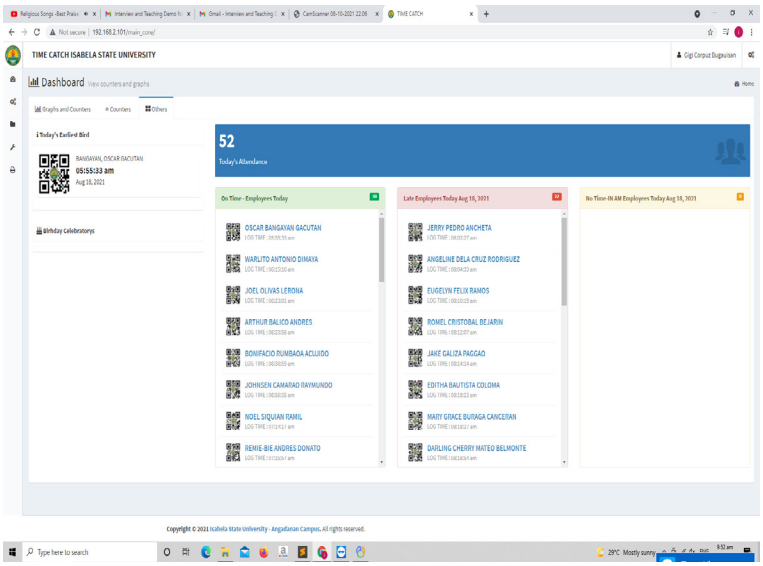
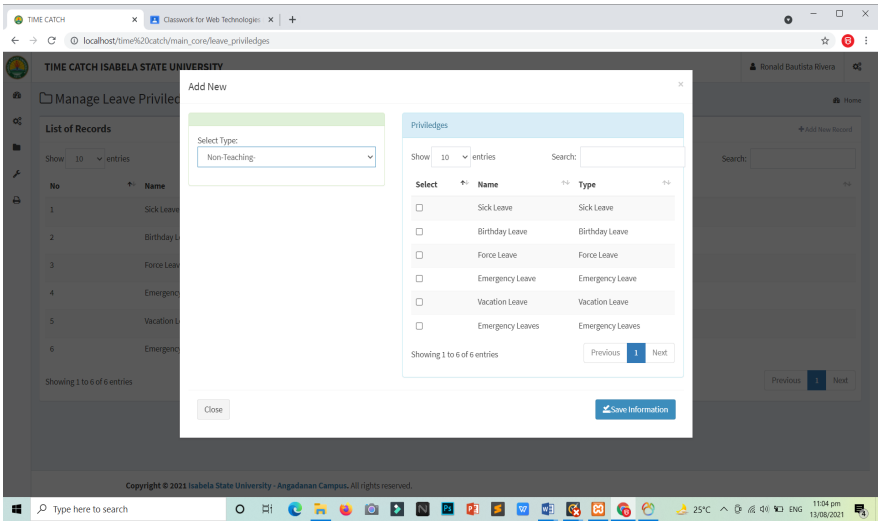


(c)

Figure 7. The monitoring dashboard

The Leave Application

Employees use the Leave Application Module (Figure 8) to submit a leave request. It begins with the processing of leave entitlements by the Human Resource Officer. Next, the various leave entitlements applicable to each type of job are labeled. Finally, every employee's leave request must be reviewed and approved by their immediate supervisor's account (Program Chair/Dean Account). If the leave application is approved, a leave application form is printed. Otherwise, a leave request will be marked as declined.



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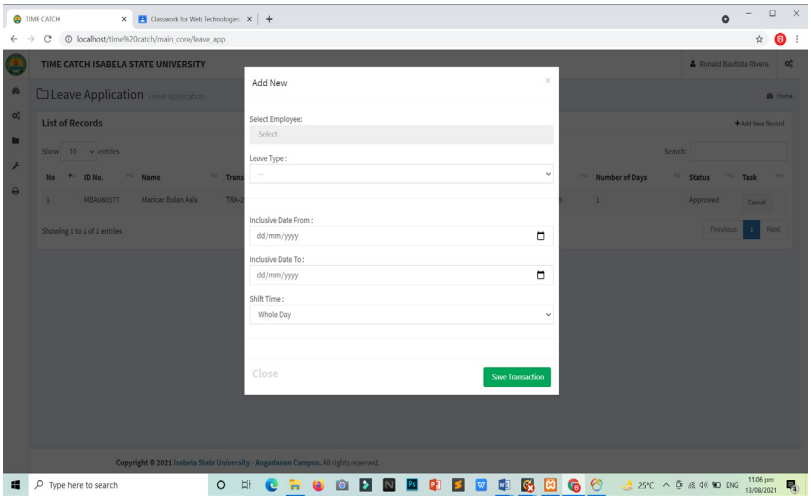


(b)

(c)

Figure 8. The leave application module: (a) Manage leave privileges; (b) Add leave application; (c) Leave form

The Credit Units Manager

The credit unit manager module manages an employee's credit units. The user will simply add an employee's credit unit, tag the source from which the credit unit was obtained, encode the inclusive dates, and save it (Figure 9).

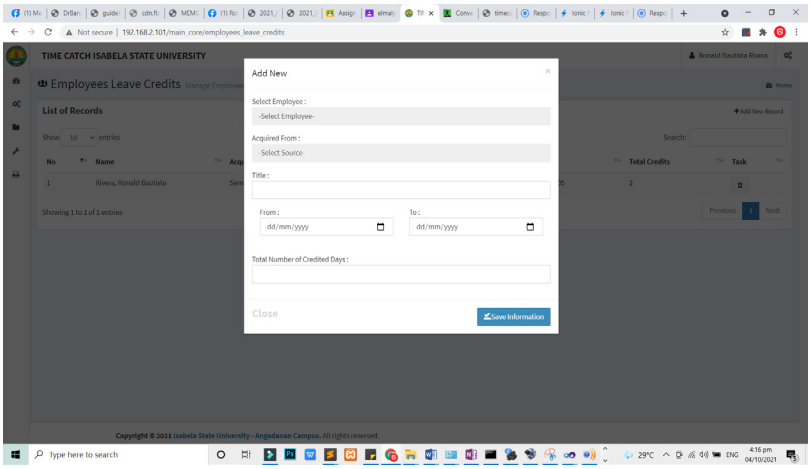
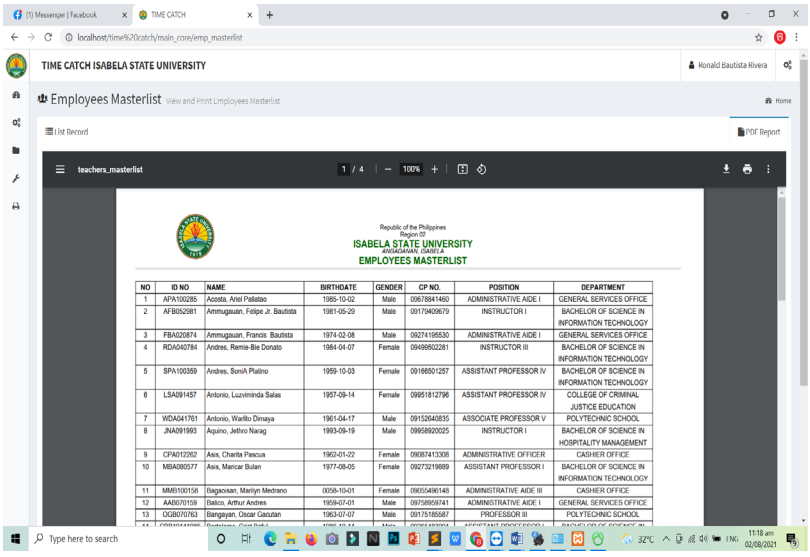


Figure 9. Credit units manager

Report Generation

The system generates reports such as the master list of employees, the leave application form, the QR Code ID for casting attendances, the Daily Time Record (DTR), and the Remaining Leave Credits. Figure 10 shows the screenshots of the auto-generated reports.



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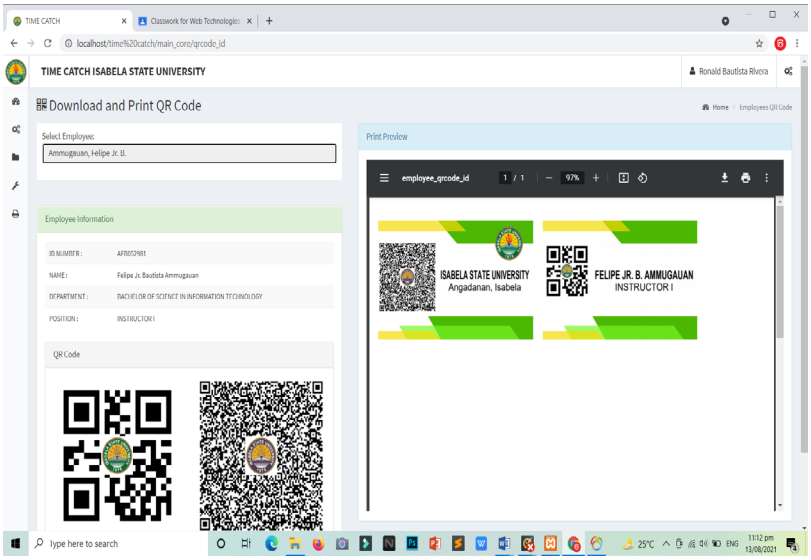
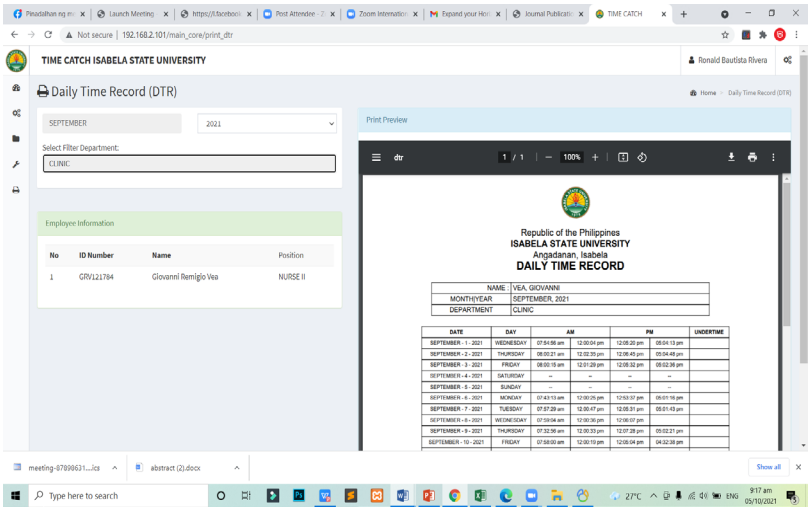
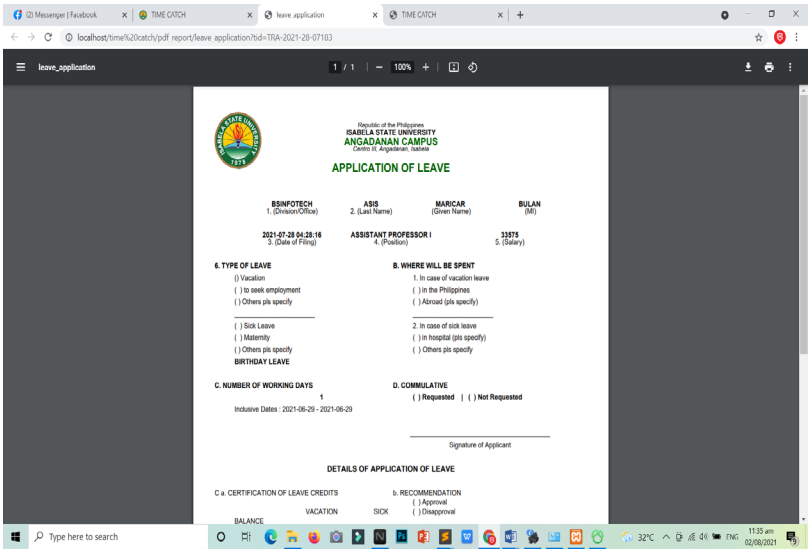

TIME CATCH ISABELA STATE UNIVERSITY
Download and Print QR Code
Select Employee:
Employee Information
QR Code
Print Preview
ISABELA STATE UNIVERSITY
Angadanan, Isabela
FELIPE JR. B. AMMUGAUAN
INSTRUCTOR I

(b)


TIME CATCH ISABELA STATE UNIVERSITY
Daily Time Record (DTR)
Employee Information
Print Preview
Republic of the Philippines
ISABELA STATE UNIVERSITY
Angadanan, Isabela
DAILY TIME RECORD

(c)



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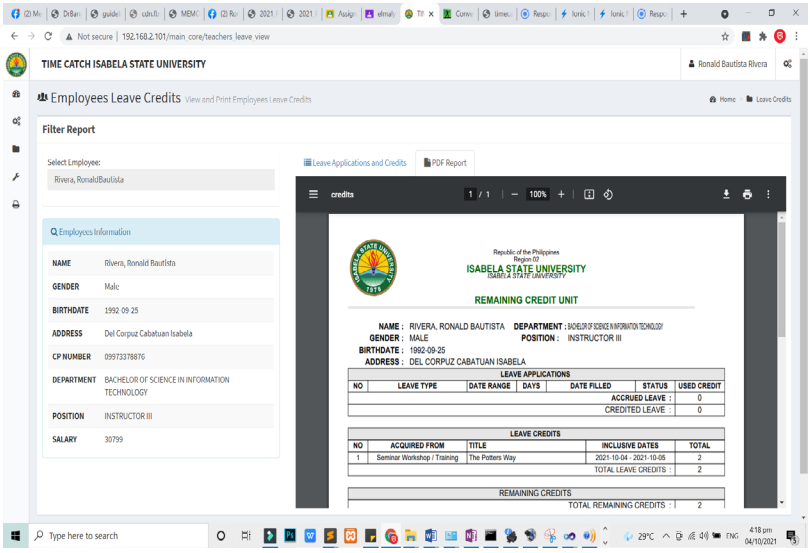

(e)

Figure 10. Auto-generated reports: (a) Master list of employees; (b) QR code ID; (c) Daily time record; (d) Leave application form; (e) Remaining credit units

Evaluation

Respondents of the Study. Purposive Sampling was used to identify the respondents of the study (Table 1).

Table 1
The respondents of the study

Type of Respondent	Number of Respondents
Non-Teaching Staff	10
Teaching-Staff	18
Total Respondents	**28**

Questionnaire. The researchers used a questionnaire to gather data from the respondents based on ISO 25010, which was adopted from the study of Atanacio and Lacatan (2019) entitled Development and Evaluation of Rural Health Unit Record Management System with Data Analytics for Municipality of Bay, Laguna using ISO 25010.

Statistical Treatment. Data were analyzed utilizing mean distribution. The following arbitrary scale in Table 2 was applied to determine the functionality of the system.

Table 2
Equivalent weighted mean and interpretation of scale on the evaluation of TIME CATCH using EAMS

Scale	Weighted Mean	Interpretation
5	4.51-5.00	Strongly Agree
4	3.51-4.50	Agree
3	2.51-3.50	Neutral
2	1.51-2.50	Disagree
1	1.00-1.50	Strongly Disagree

In finding the weighted mean in the presentation, analysis and interpretation of data, the researchers used Equation 1:

$$W = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i} \quad (1)$$

W = weighted average
n = number of terms to be averaged
w_i = weights applied to x values
X_i = data values to be averaged

The interpretation of the scale was adopted from the study of Joshi et al. (2015) entitled Likert Scale: Explored and Explained. British Journal of Applied Science & Technology.

RESULTS AND DISCUSSION

The evaluation result from the participants is based on ISO 25010 Standards in terms of Functionality, Efficiency, Usability, Reliability, Security, Maintainability, and Portability.

Table 3
Mean rating and qualitative description of respondents on functional suitability of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Functionality	Mean	Qualitative Description
The software performs the tasks required	4.71	Strongly Agree
The results expected were delivered	4.92	Strongly Agree
The system can interact with another system	4.93	Strongly Agree
The software prevents unauthorized access	4.88	Strongly Agree
Category mean	4.86	Strongly Agree

Table 3 shows that the system's users strongly agree with the functional characteristics of the systems, as revealed by the category mean of 4.86. Specifically, the participants have shown strong agreement that the system can perform the required task, deliver expected results, interact with another system, and prevent unauthorized access, as indicated by the mean of 4.93, 4.92, 4.88, and 4.71, respectively.

Table 4
Mean response and qualitative description of the respondents in evaluating the efficiency of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Efficiency	Mean	Descriptive Interpretation
The system responds quickly in all its functionality and operation	4.96	Strongly Agree
The system utilizes all its resources efficiently	4.80	Strongly Agree
The users can go directly to the desired function/operation or use a structured navigational menu	4.74	Strongly Agree
The system is demonstrably effective with the intended audience, including people of varying abilities and experiences	4.75	Strongly Agree
Category mean	4.81	Strongly Agree

The analysis in Table 4 shows that the participants strongly agree on the 4.74-4.96 efficiency of the developed system, as indicated by the category mean of 4.81. Further analysis shows that the system responds quickly in all its functionality and operation, utilizes all its resources efficiently, and has the choice of going directly to desired function/ operation or using a structured navigational menu. The system is demonstrably effective with the intended audience, including people of varying abilities and experiences, with a mean ranging from 4.74-4.96, qualitatively described as strongly agreed by the participants.

Table 5
Mean response and descriptive interpretation of the respondents in measuring the reliability of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Reliability	Mean	Descriptive Interpretation
Most faults in the software have been eliminated over time	4.74	Strongly Agree
The software was capable of handling errors	4.75	Strongly Agree
If the program creates a permanent record for a user, that record is secure and confidential. There is a provision for erasing the record when the information is no longer valuable in providing services	4.85	Strongly Agree
Category mean	4.78	Strongly Agree

In terms of measuring the reliability of the developed system (Table 5), the participants strongly agree that the program creates a permanent record for a user and that the record is secure and confidential. Furthermore, there is a provision for erasing the record when the information is no longer valuable in providing services, with a mean of 4.85. Moreover, the participants strongly believed that the software was capable of handling errors, and most of the faults in the software have been eliminated over time with a mean of 4.75 and 4.74, respectively.

Results further show that the participants strongly agree with the reliability characteristics of the system, as revealed by the category mean of 4.78.

Table 6
Mean response and descriptive interpretation of the respondents in assessing the usability of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Usability	Mean	Descriptive Interpretation
The user easily understands/comprehend how to use the system	4.50	Strongly Agree
The user learns to use the system easily	4.41	Agree

Table 6 *(Continue)*

Usability	Mean	Descriptive Interpretation
The user uses the system without much effort	4.32	Agree
The interface looked good and attractive	4.86	Strongly Agree
The organization is clear, logical, and effective, making it easy for the intended audience to understand	4.74	Strongly Agree
The individual can operate the system independently	4.45	Agree
Category mean	4.55	Strongly Agree

It is reflected in Table 6 that the participants have a strong agreement regarding the usability of the developed system, as shown by the category mean of 4.55. However, three out of the six sub-characteristics of usability have only been rated agree by the users. It involves the characteristic that the individual can operate the system independently (4.45), the user learns to use the system easily (4.41), and the user uses the system without much effort (4.32).

On the other hand, the participants strongly agree that the user easily understands/ comprehend how to use the system, the organization is clear, logical, and effective, making it easy for the intended audience to understand, and the interface looked good and attractive with means of 4.50, 4.74 and 4.86, respectively.

Table 7
Mean response and descriptive interpretation of the employees in assessing the maintainability of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Maintainability	Mean	Descriptive Interpretation
Faults and errors can be easily diagnosed	4.50	Strongly Agree
The software can be easily modified in accordance with what the user needs	4.50	Strongly Agree
The software continues functioning when modifications/changes are made	4.55	Strongly Agree
The software can be tested easily	4.60	Strongly Agree
Category mean	4.54	Strongly Agree

In terms of the maintainability of the system (Table 7), the participants strongly agree that the Software can be tested easily, the Software continues functioning when modifications/changes are made and the software can be easily modified in accordance with what the user needs and faults and errors can be easily diagnosed with means ranging from 4.50-4.60.

The category means of 4.54 further indicates strong agreement of the participants in terms of the system's maintainability.

Table 8
Mean response and descriptive interpretation of the respondents in assessing the portability of the Developed Attendance Monitoring System (TIME CATCH using EAMS)

Portability	Mean	Qualitative Description
The software can be easily moved from one to another environment	4.73	Strongly Agree
The software is installed easily	4.84	Strongly Agree
The software complies with portability standards	4.80	Strongly Agree
The software can replace other software	4.70	Strongly Agree
Category mean	4.76	Strongly Agree

Table 8 reflects the mean of the participant's responses regarding the portability of the developed system. The users have shown strong agreement regarding the portability characteristics, gleaned from the category mean of 4.76. The users believed the software could be installed easily, complied with the portability standards, and easily moved from one environment to another. In addition, the software can replace other software, as indicated by the mean greater than 4.50.

Table 9
Summary of category mean and qualitative description of respondents on the characteristics of the Developed Attendance Monitoring System (TIME CATCH using EAMS) based on ISO 25010

System's Quality Indicators	Weighted Mean	Qualitative Description
Functionality	4.86	Strongly Agree
Efficiency	4.81	Strongly Agree
Usability	4.55	Strongly Agree
Reliability	4.78	Strongly Agree
Maintainability	4.54	Strongly Agree
Portability	4.76	Strongly Agree
General mean	4.72	Strongly Agree

The results in Table 9 show that the respondents firmly agreed that the established system based on ISO 25010 is good quality, as indicated by the general mean of 4.72. Furthermore, the functional characteristics of the system have the highest mean rating, followed by efficiency, reliability, portability, usability, and maintainability.

CONCLUSION

In conclusion, the developed system addresses the issue of manually or conventionally checking employees' attendance and promotes reducing paper-based work. It also saves the time of preparation of employees' DTR (Daily Time Record), leaves application management, and provides contactless attendance monitoring for employees.

Therefore, the quality/functionality of the developed system can be used as a tool in implementing TIME CATCH (Timekeeping and Immediate Monitoring of Employees by Consistently Advocating Time Consciousness and Honesty) among the employees of Isabela State University-Angadanan Campus.

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