



Campus-Based Tracking and Monitoring System

BREGABIEL, MELANIE L.; SANTIA, CRISTINA D.

Masters in Information Systems

Northern Negros State College of Science and Technology

melaybregabiel1210@gmail.com; cristinasantia09@gmail.com

DOI: <https://doi.org/10.47760/ijcsmc.2024.v13i08.008>

ABSTRACT:

Visitors can pose potential risks to the safety of school children, necessitating the enhancement of visitor and personnel management protocols by school administrators. In order to address these challenges, a Campus-based tracking and monitoring system incorporating QR Code technology has been proposed for Carlos Hilado Memorial State College-Fortune Towne Campus. This system, which includes a web-based interface and Android application, is designed to manage, monitor, and secure the entry of individuals on campus. It features capabilities for data storage, retrieval, archiving, report generation, and real-time tracking of campus activities. By utilizing QR codes, the system captures and stores individual data efficiently, enabling future tracking and identification of specific individuals when needed. The transition to an automated system aims to reduce reliance on paper documents, minimize errors, and enhance the efficiency of staff operations. The study evaluates the system's effectiveness and user acceptability across several criteria: Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability. According to the ISO 25010 standard for Systems and Software Engineering, which assesses Systems and Software Quality Requirements and Evaluation (SQuARE), the system received an "Excellent" rating. This rating confirms that the Campus-based tracking and monitoring system with QR Code is well-suited for implementation at the campus.

Keywords: school safety, QR Code, SQuARE, visitor information management system, campus-based tracking and monitoring system

INTRODUCTION

In the aftermath of the COVID-19 pandemic, institutions have been compelled to reevaluate and enhance their protocols for monitoring and managing access within their facilities. The necessity for stringent monitoring became evident as institutions sought to mitigate the spread of the virus and ensure the safety of individuals on campus (Nicola et al., 2020). The traditional methods of manual entry logging and oversight proved inadequate in addressing the need for real-time tracking and secure data management.

The International Labor Organization (ILO) posits that the guardhouse is a critical checkpoint for regulating and controlling the movement of individuals entering and exiting the campus. This system plays a crucial role in safeguarding the premises from unauthorized access and potential threats. The evolution of monitoring technology has introduced automated systems designed to streamline the tracking process, offering enhanced accuracy and efficiency compared to manual methods (International Labor Organization, 2018).

Currently, the campus relies on manual procedures to monitor the entry of clients, faculty, and staff. This approach not only results in delays but also presents significant challenges related to data security. Identified issues include inefficient tracking of individuals, inadequate protection of personal data, and the slow generation of essential reports. These shortcomings highlight the need for a more robust and automated solution.

To address these challenges, this study proposes the development of an advanced monitoring system that ensures secure data management and efficient tracking of campus entries. By leveraging modern technology, the proposed system aims to enhance operational efficiency, reduce delays, and provide a reliable mechanism for data security and reporting. This approach is anticipated to significantly improve the overall management of campus access in a post-pandemic context.

OBJECTIVES OF THE STUDY

The primary objective of this study is to design and implement a Campus-Based Tracking and Monitoring System that addresses the challenges of post-pandemic campus management. Additionally, it seeks to develop a system that not only enhances operational efficiency but also meets the heightened standards of data security and management required in the post-pandemic era. Specifically, this system aims to achieve the following objectives:

- a. develop an automated system for accurately and efficiently monitoring the entry and exit of campus clients, faculty, and staff and to streamline the process, reducing delays and improving the overall effectiveness of campus access management.
- b. establish robust mechanisms for securing the personal data of clients, faculty, and staff by safeguarding sensitive information related to campus entry and transactions, thereby protecting privacy and enhancing data integrity.
- c. implement features for tracking and recording data transactions associated with campus access including maintaining detailed logs of individual movements and interactions within the campus to support accurate and real-time monitoring.
- d. create a system capable of generating predefined reports of on-campus transactions that are customizable and accessible, providing valuable insights for administrative purposes and ensuring compliance with institutional policies.

MATERIALS AND METHODS

Research Design

This study employed a developmental research approach in conjunction with descriptive research methods to guide the development and evaluation of a Campus-Based Tracking and Monitoring System. Developmental research is particularly suited for this study as it focuses on the iterative process of designing, refining, and assessing technological solutions within the context of educational technology. Richey and Nelson (2005) outline that developmental research involves stages such as problem definition, literature reviews, and research procedures, which align with the methodological framework of this study.

The developmental research framework guided the iterative design and refinement of the web-based system, ensuring that it meets the functional requirements and quality standards essential for effective campus management in a post-pandemic environment. It followed a set of criteria based on ISO/IEC 25010 Systems and Software Engineering - Systems and Software Quality Requirements. This approach allows for the systematic development and evaluation of the system, incorporating feedback and making adjustments as necessary to address identified needs and challenges.

Participants of the Study

The study employed purposive sampling to select participants who are directly involved in or impacted by campus access management. The sample size comprised five representatives from each of the three key stakeholders from Carlos Hilado Memorial State College-Fortune Towne Campus: 1) campus director, 2) campus security personnel, and 3) faculty and administrative staff.

This purposive sampling ensured that the participants were well-informed and directly involved in relevant aspects of campus operations, providing comprehensive and informed feedback on the development and implementation of the Campus-Based Tracking and Monitoring System.

Data Gathering Procedure

The study utilized a combination of survey questionnaires and standardized evaluation criteria (Standard ISO 25010 Systems and Software Engineering - Systems and Software Quality Requirements and Evaluation (SQuaRE)

- System and software quality models). The data collection procedure was designed to ensure a thorough assessment of the system's performance, functionality, and user satisfaction in the post-pandemic context.

Structured survey questionnaires were administered to participants to capture detailed feedback on various aspects of the system, such as its usability, effectiveness, and impact on campus access management. The questions were aligned with the specific needs and experiences of the respondents, providing valuable insights into the system's performance and areas for improvement. On the other hand, the assessment of the Campus-Based Tracking and Monitoring System followed the ISO/IEC 25010 standard for Systems and Software Engineering. This standard outlines the quality models and evaluation criteria necessary for ensuring that the system meets high standards of performance, reliability, and security.

Data Analysis

The study employed a structured questionnaire grounded in the ISO 25010 standard for Systems and Software Engineering, specifically focusing on the Systems and Software Quality Requirements and Evaluation (SQuaRE) framework. This standard serves as a comprehensive guideline for assessing the quality of systems and software. The evaluation framework employed in this study encompasses eight

critical quality characteristics: Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, Maintainability, and Portability.

Each of these characteristics plays a pivotal role in determining the overall quality and effectiveness of the system under evaluation. Respondents were asked to rate the system's performance across these dimensions using a five-point Likert Scale. This scale ranges from 1 to 5, with 5 representing "Excellent" and 1 representing "Poor" with the intermediate values representing "Good," "Average," and "Fair," respectively. Utilizing this scale enabled a refined evaluation of the system's quality, supporting an in-depth analysis of its strength and areas needing enhancement according to established criteria.

Range of Mean Score	Interpretive Category
4.20-5.00	Excellent
3.40-4.19	Good
2.60-3.39	Average
1.80-2.59	Fair
1.0-1.79	Poor

RESULTS AND DISCUSSION

Table 1. The result of the survey using ISO/IEC 25010

	Total Mean Score	Verbal Interpretation
Functional Suitability	4.5	Excellent
Performance Efficiency	4.2	Excellent
Compatibility	4.2	Excellent
Usability	4.2	Excellent
Reliability	4.2	Excellent
Security	4.3	Excellent
Maintainability	4.1	Good
Portability	4.2	Excellent
	<u>4.24</u>	<u>Excellent</u>

The data presented in the table indicates that users rated the system as “Excellent” in several key areas including Functional Suitability, Performance Efficiency, Compatibility, Usability, Reliability, Security, and Portability. These ratings suggest that the system effectively meets the diverse needs of its users in terms of software requirements, ensuring that it performs as intended across various operational contexts. The consistent excellent rating across these categories reflects the system's robust design and its ability to deliver a high level of functionality, efficiency, and security while being user-friendly and adaptable to different platforms.

In the aspect of Maintainability, the system received a rating of “Good.” This suggests that while the system is capable of being modified to enhance performance, correct errors, or adapt to changes in its operational environment, there may be underlying limitations with the system's capacity. The "Good" rating implies that the system offers a satisfactory level of maintainability, enabling necessary updates and modifications, but it may not be as easily or efficiently maintained as it is in other areas where it excels.

This assessment highlights the system's potential for improvement in maintainability, which could further enhance its adaptability and longevity as user needs and environmental conditions evolve.

The system demonstrates exceptional performance in meeting the core software requirements of its users, particularly in areas crucial to functionality, efficiency, and security. While the overall quality is commendable, the "Good" rating for maintainability points to an opportunity for further refinement, ensuring that the system remains responsive to future changes and continues to perform at a high level throughout its lifecycle.

The figure below shows the Log In page of the system wherein the users are allowed to access all the modules based on their access level by logging in using their username and password. This feature also permits users to retrieve a forgotten password.

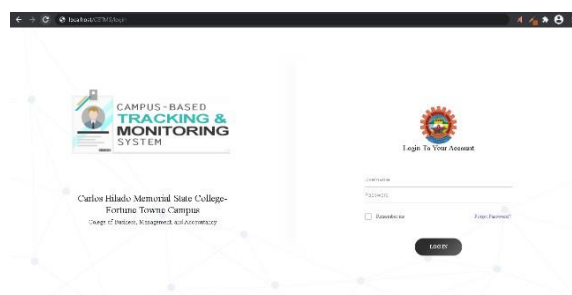


Figure 1. Log In Page of the System

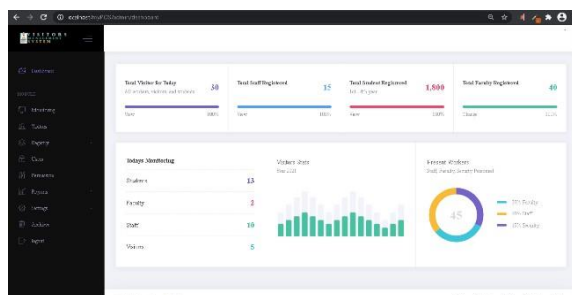


Figure 2. Dashboard of the System

The dashboard on the other hand is a visual interface that consolidates and displays key information and metrics in a clear and organized manner. The dashboard as shown in the figure is designed to be interactive and user- friendly, allowing users to quickly access and interpret data.

CONCLUSION AND RECOMMENDATION

The study's results indicate that the campus-based tracking and monitoring system that makes use of QR Code technology is an ideal fit for implementation. The majority of survey responses obtained throughout the study phase provide substantial support for this finding. The data demonstrates the system's viability as a feasible option for tracking and monitoring across the campus by showing that it successfully satisfies the demands and expectations of potential users.

A number of important recommendations have been identified in light of the survey results to increase the system's efficacy and reach. It is advised that the online version of the campus-based tracking and monitoring system with QR Code technology be used. Switching to an online platform for the system will probably increase accessibility, enabling users to communicate with it more effectively and instantly from anywhere on campus. It is also recommended that the system be implemented over the entire

campus. Increasing the system's distribution throughout the campus would provide thorough coverage and make it easier to track and monitor people or assets all over the university.

The system's functionality would be increased and its potential benefits would be maximized by being online and campus-wide, guaranteeing that all pertinent stakeholders can fully utilize its potential. The recommendations are meant to be used in conjunction with the system's capabilities to improve overall management, security, and operational efficiency in the campus setting. As a result, the study highly recommends the deployment of a campus-based tracking and monitoring system using the QR Code as a stable, scalable, and effective solution adapted to the institution's needs.

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