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Log Monitoring System using Quick Response (QR) Code: A State University's COVID - 19 Contact Tracing System

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ABSTRACTS

Contact tracing is the technique employed by public health units and the national close contact service to track down persons who may have been exposed to COVID-19 by interaction with a suspect, confirmed, or probable case during their infectious period. This study focused on the development of a Log Monitoring System Using Quick Response (QR) Code in Samar State University as an institution's tracing system for COVID - 19 preventions. The study was designed as a tool for managing the everyday logs of the employees, students, and visitors to track down the person who is in close contact to a COVID - 19 positives. The waterfall model was used in developing the system and descriptive research design was used to determine the effectiveness of the system along with functionality, reliability, usability, efficiency, maintainability, and portability. The participants of the study were the employees, students, and visitors of SSU. Each participant has given an ISO 9126 quality standard questionnaire for the evaluation of the effectiveness of the system. The result revealed that using the system, the conduct of contact tracing of the possible COVID - 19 suspected individuals was done easily and with reliability.

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1. INTRODUCTION

During the current COVID-19 pandemic and previous pandemics, a variety of digital health initiatives were used to control disease transmission. These control techniques have been shown to be effective in decreasing the initial wave of COVID-19 in various countries; among these strategies, contact tracing is regarded the cornerstone of containment and receives a lot of attention. According to the study of [Ferretti, et al. \(2020\)](#), contact tracing entails locating, quarantining, and notifying infected individuals' contacts. This is a technique employed by public health units and the national close contact service to track down persons who may have been exposed to COVID - 19 by interaction with a suspect, confirmed, or probable case during their infectious period. ([New Zealand Government Ministry of Health, 2020](#)). One of the most efficient approaches to stop the transmission of this virus and identify the main and secondary contacts of confirmed COVID-19 patients is to use this kind of technologies and tools ([Dunford, et al., 2020](#); [Chen, Yang & Wang, 2020](#)). Hence, it has led to a fast rise of COVID-19 contact tracing technologies in different countries in the world.

In the Philippines, various contact tracing system has emerged. Different Local Government Units (LGUs) in the different regions of the country implemented its contact tracing system to boost the LGUs contact tracing program amid the rising number of COVID - 19 cases. Local Government Unit of Catbalogan City, Samar employed this type of system. It was deployed to the different establishments in the city to

monitor the logs of the individuals using Quick Response (QR) code to capture easily their data. In this way, it will be accessible to locate the persons who are in close contact to a COVID - 19 positive individuals. Every resident of the city and non - residents who works in the said area need to register their information manually to avail a "quarantine pass" - an identification card with QR code, that served as their access to enter different establishments. One of the establishments that was recipient of the said system is Samar State University (SSU), one of the higher institutions in the Philippines located in the city of Catbalogan. The system was implemented in SSU, however, only those logs of the employees and visitors who have their quarantine passes can be recorded by the system. Information of the students who came from other places outside Catbalogan cannot be recorded. On the other hand, the system is limited only in capturing the logs who enter inside the campus. Information of the individuals who visited the different departments, colleges, and offices in SSU were not included in the functionality of the system.

As we know in this modern world, monitoring system is widely used in organizations like schools, to keep track of the day-to-day operations ([Balmes, 2016](#)). On the other hand, using unique QR code-based identity card, authorization as well as authentication in monitoring is very important for the growth of the organization ([Bole, et al., 2016](#)). Hence, it is possessing a really great advantage that among the whole types of code scanning technology, QR code-based monitoring system is the

most accurate (Wei, et al., 2017). This led to an idea to the researchers to develop a web – based log monitoring system with an integration of QR code for Samar State University. The system intends to quickly take a piece of information from the employees, students, and visitors who visited the campus in order to trace their daily logs that will be an advantage in tracking down the information of the persons who were in a close contact to a COVID – 19 positives. Individuals which include students, faculty and employees from SSU, and visitors from any part of the country who wanted to visit SSU can easily have their “quarantine pass” as the system has an automated registration. The system has the capability to record the entrance and exit logs inside the campus, and apart from that, information of an individual who enter and exit in the different department, colleges, and offices of SSU will be logged by the system. In this way, the duration of time of stay consumed by an individual in the different offices they visited within the campus can be easily tracked which was a big aspect to determine if a person is considered to be a close contact to a COVID – 19 positive individuals. In addition, to test the effectiveness of the system, ISO/IEC 9126 system quality standard will be applied (ISO/IEC 9126, 2022).

2. METHOD

Stakeholders in the Ilorin metropolitan This study utilized a developmental approach in developing the Log Monitoring System Using Quick Response (QR) Code and used a quantitative approach to assess the system’s effectiveness upon implementation. The researchers have chosen the Water Fall System Development Life Cycle Model as shown

in Fig.1 in order to achieve the objectives of the study. The Waterfall model defines several consecutive phases that must be completed one after the other and moving to the next phase only when its preceding phase is completely done. For this reason, the Waterfall model is the Waterfall model is recursive in that each phase can be endlessly repeated until it is perfected (Bassil, 2012). This methodology is composed of five phases such as planning and analysis phase, design phase, implementation phase, testing phase and maintenance phase.

2.1. System Planning and Analysis

The researchers determined the requirements such as gathering data from the end – user. After gathering of data, it was analyzed to test the validity. The probability of combining the requirements in the system to be developed is also studied.

2.2. System Design

The system was rationally planned to fulfill the functional requirements identified during analyzing requirements specification. In addition, the database as well as the interface was drawn on how it will be designed.

2.3. Implementation

In this phase, the whole system requirements and blue prints was converted into an actual coding. The researchers used the PHP programming language as a base program of the system and MySQL for its database.

2.4. Testing and Integration

Testing of the product was made. Each functionality was verified and

validated by the researchers to evaluate if the vital specifications was met.

2.5. Operation and Maintenance

After testing and evaluating the system, the errors discovered from the deployment of the system was refined, corrected and modified as well as the suggestions gathered from the end - users was considered.

2.6. System Architecture and Flow

The architecture and flow of the log monitoring system is presented in Figs. 1 and 2.



Fig. 1. Developmental Process

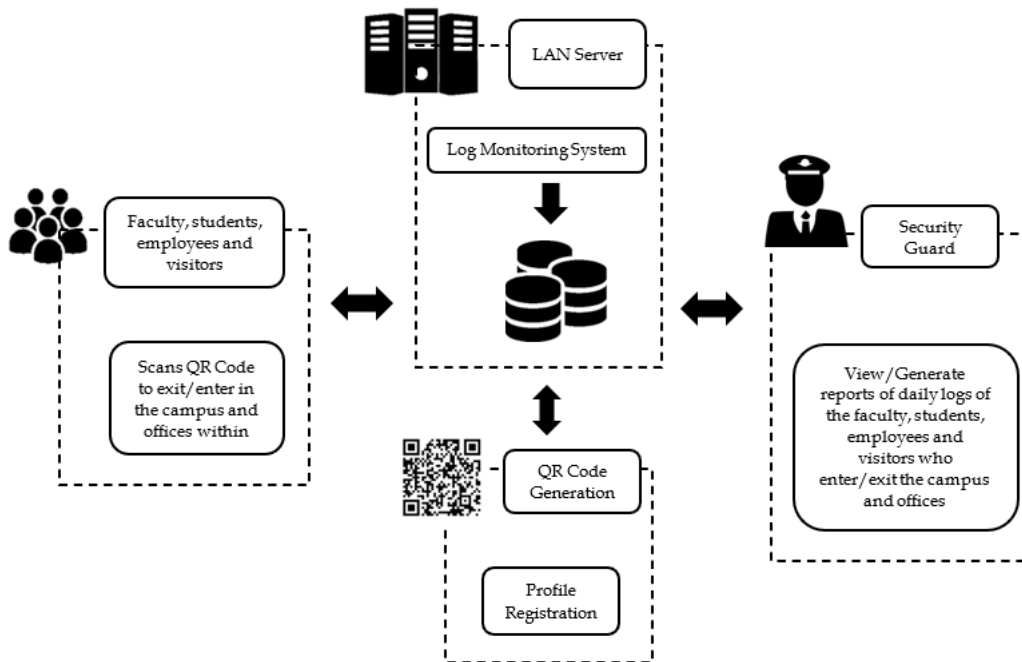


Fig. 2. System Architecture and Flow

2.7. Data Gathering Procedure

In general, the researchers provided a set of questionnaires as one of the basic instruments in conducting a beta-testing. With a total of forty (40) number of respondents; 10 faculty, 10 admin employees, 10 students, and 10 visitors to

test the effectiveness of the system. The respondents tested the system’s effectiveness in terms of its accuracy, functionality, reliability, and efficiency. The researchers had also used applicable statistical tools for the complete evaluation of the system in order to

acquire concrete feedbacks and opinions coming from of the respondents.

The effectiveness of the system applies the three (3) layers of testing namely: Alpha, Beta and Full Implementation. The mean uses the standard criteria under ISO/IEC 9126 in terms of functionality, reliability, usability, efficiency, maintainability and portability.

3. RESULTS AND DISCUSSION

Anchored to the objectives of the study, the result of the study was derived.

3.1. System's Interface

3.1.1. Log - in and Registration

Before entering to the main setup form in the log monitoring system, a login form will pop up as shown in Fig. 3 to allow the user to login with their own username and password. The function of the login form is to enter authentication credentials so that the users can access to the main form of the system. When the login form is submitted, the elemental code will be used to check and compare with the existing credentials in MySQL database. If the result matched, the users will be granted for further features of the system. On the contrary, in order for the client to have an account in the log monitoring system, the client should register first by providing their personal information such as: first name, last name, contact number, address, client -

type (faculty, student, admin employee, or visitor), and their respective offices/department. For the outsiders or the visitors, they need to select the offices/department that they wanted to visit.

3.1.2. Homepage

Once the user successfully logged - in into the system, the user will be redirected to the homepage interface as shown in Fig. 4. From the homepage, menu option is seen where QR code information is located. Unique QR code is automatically generated, once the user provides their information and successfully access the system.

3.1.3. QR Code Scanner

This interface shows how the QR code will be scanned as seen in Fig. 5. Once unique QR code is scanned, information of the user who enter the university will be automatically stored in the database.

3.1.4. Log Reports

This log reports interface is shown in Fig. 6 and Fig. 7. It presents the summary of the logs of the persons who enter and exit the campus. Once the summary of log reports is downloaded, information of the person who enter the specific office, the time they log - in and log - out, contact number, address and their client type (faculty, student, admin employee, and visitor) displayed. Reports can be downloaded in excel form.

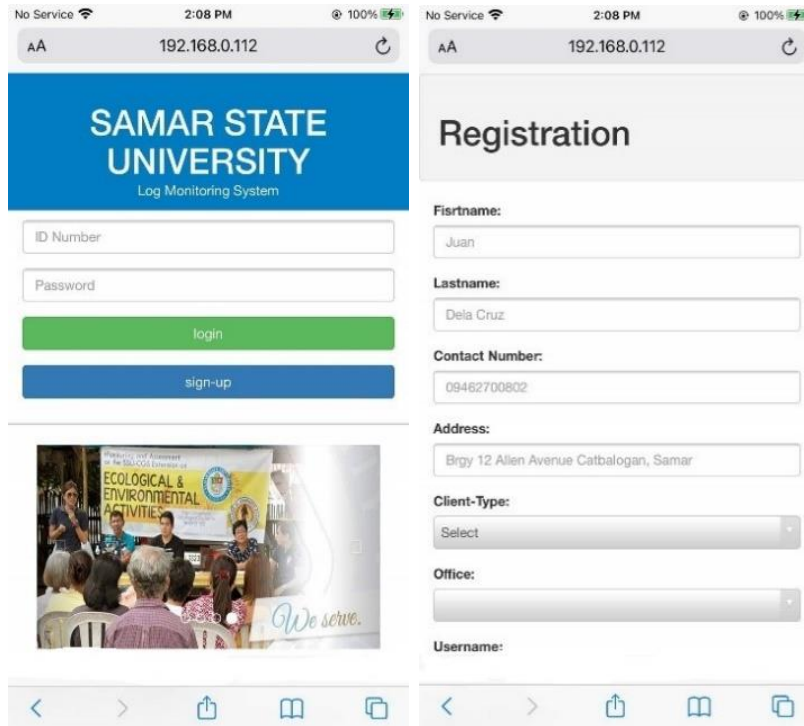


Fig. 3. Log - in and Registration For

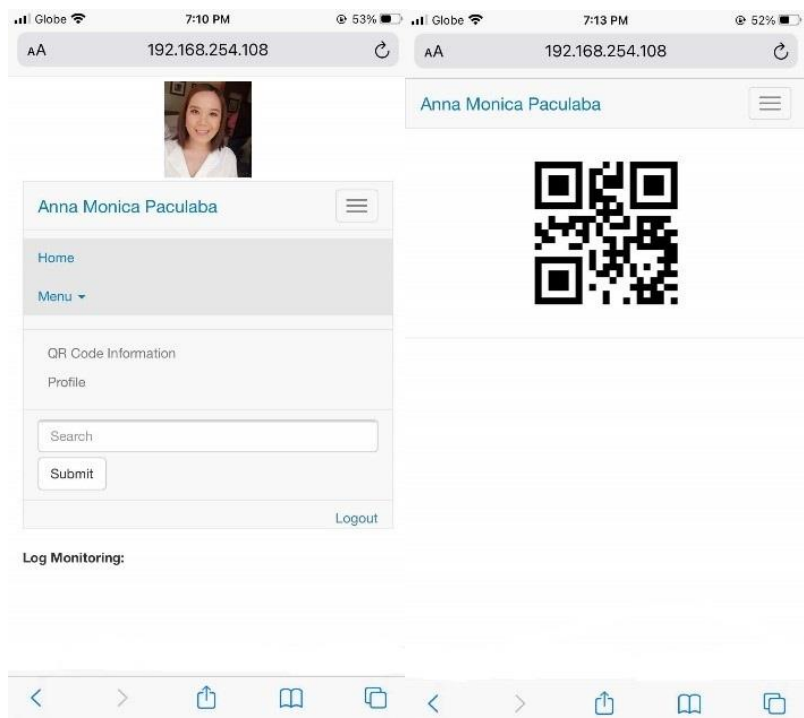


Fig. 4. Homepage

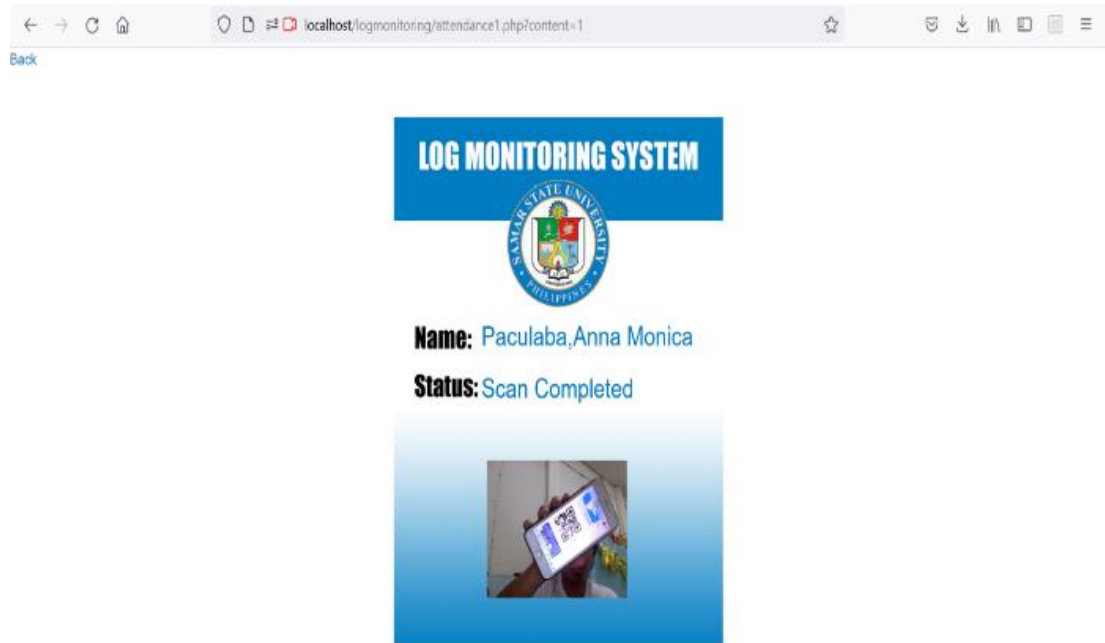


Fig. 5. QR Code Scanner

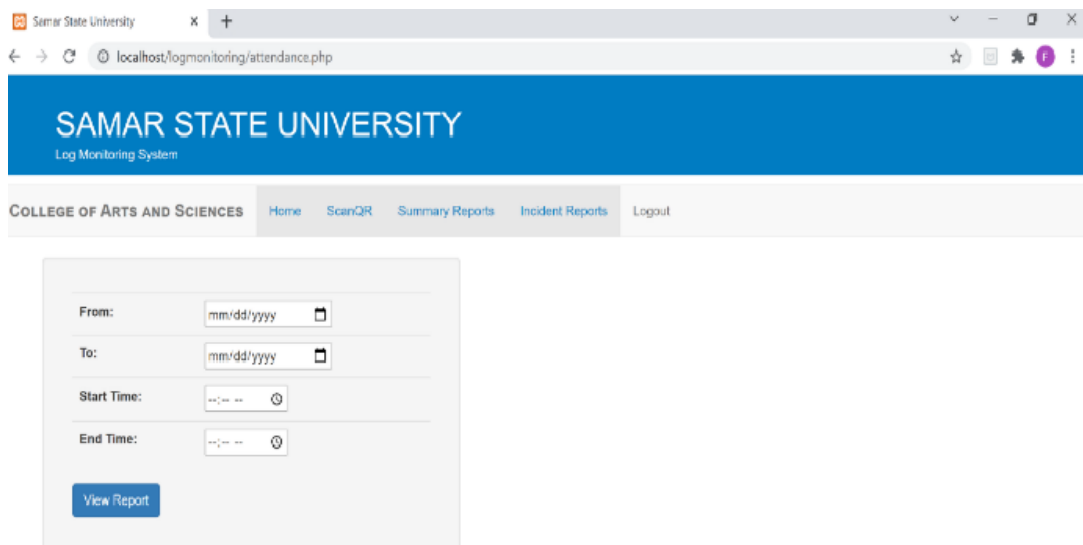


Fig. 6. Log Report Interface

Department:College of Arts and Sciences						
Date:2021-10-06 to 2021-10-06						
Time:12:00 - 16:00						
Lastname	Firstname	Contact Number	Address	Client Type	Time	Remarks
Paculaba	Anna Monica	9462031005	Jiabong Samar	Instruction	1:55 PM	IN
Paculaba	Anna Monica	9462031005	Jiabong Samar	Instruction	3:43 PM	OUT

Fig. 7. Summary of Log Report

3.2. End user’s System Performance Evaluation

The result of the end – user evaluation as shown in Table 1 indicates that the system over – all performance is “highly effective” with a numerical mean of 4.61. Among of the parameters, reliability of the system got the highest mean 4.68. The result implied that the system is free from error, capable of handling errors, can resume and restore lost data from failure, and can presents integrated reports. The

result agreed to the study of [Tworek \(2018\)](#), that the reliability of the information system is linked to the information security, availability, and responsiveness. This can be characterized as that the system is assured to be accurate and is conveniently accessible, user-friendly and accepted by its users, responsive, and high availability connected with high security.

Table 1. End user's Evaluation of System Performance Evaluation Result

Criteria	Mean Value	Descriptive Remarks
Functionality	4.65	Highly Effective
Reliability	4.68	Highly Effective
Usability	4.58	Highly Effective
Efficiency	4.56	Highly Effective
Maintainability	4.61	Highly Effective
Portability	4.55	Highly Effective
Grand Mean	4.61	Highly Effective

Legend:**1.51 - 5:00 Highly Effective****3.31 - 4.50 Moderately Effective****2.51 - 3.50 Effective****1.51 - 2.50 Slightly Effective****1:00 - 1.50 Not Effective****4. CONCLUSION**

Log Monitoring System using QR Code is one of the effective ways to monitor the logs of the faculty, students, admin employee, and visitors who enter the campus. Since log - in and log - out of the respondents are recorded, the conduct of contact tracing of the possible COVID - 19 suspected individuals will be

done easily and with reliability as the span of time of their stay in the area/office inside the university they visited is recorded by the system.

For the expansion and sustainable use of the Log Monitoring System using QR code, it is recommended that attendance monitoring of the students, laboratory

utilization monitoring, and other related activities will be included in the system.

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