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Secure Digital Multimedia QR Code

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Abstract: QR codes have been used widely for various purposes. For example, it facilitates information retrieval by simplifying typing the Internet link to get to specific website content. Rich information, including multimedia content, can be shared with others by generating QR codes to represent the source of the content. Users just need their smartphones and activate their QR code reader to access the information. By considering the potential of QR codes, it can be used to promote the services offered by labs at Universiti Utara Malaysia. Students do not know about the labs, which requires more information. However, some information is confidential which are not intended for public use. No application can be used to address this situation. However, this can be solved by having a QR code with access to the document easy and faster. This project proposed using secure QR codes to protect information about labs and facilitate access to the students about the lab.

Keywords: *QR Code, Security, Authentication, Multimedia, Web*

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1. Introduction

Nowadays, a QR code is the best way to get instant web traffic from print media promotion by simply linking your websites to the QR code [1]. With a simple QR code scan and inserting a secure key, the user can get multimedia content such as rich text, PDF, images, audio, videos, social media profiles and event details. In fact, it was the best online tool to help the lab master promote the lab, secure information in the SOC labs, and no application to tell the users about the labs in SOC.

Besides that, QR Code security has been a highly debated issue across the globe. Nonetheless, it's important to note that QR Code technology has no security issues [2]. Despite this, there are cases where contents can be encrypted by applying advanced encryption standards (AES) to protect sensitive content. It will lie in its key length options and faster. The time required to crack an encryption algorithm is directly related to the length of the key used to secure the communication in 128-bit, 192-bit or 256-bit keys [3]. Therefore, to get the content to have to decrypt it with a password.

Furthermore, creating the QR code itself does not need to cost anything, but the value-added can be immense if executed effectively. Besides that, it is available 24 hours with one QR Code, and it lets them redirect to the web page or any specific content that is essentially important for users. QR codes are being used by millions of users and have become more popular [4]. It is because almost half of the people on the earth use a smartphone and enjoy QR code services. In 2020, 3,5 billion people will be using smartphones, roughly 45.12% of the global population. Moreover, QR codes have become an integral part of everyday life with they are available for Android and Apple IOS.

Moreover, QR Codes first appeared at the start of the decade, and marketers jumped at the fresh idea of engaging their audience with print media [5]. At that time, the end users had a terrible experience with the QR Codes because

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most people didn't have a smartphone, so no smartphone came equipped with one QR Code scanner. However, it turns out that QR codes have become popular and convenient nowadays as they are cost-effective, universally applicable, and help users reach their target audience offline and connect them directly to digital platforms [4].

2. Background and Related Studies

Secure Multimedia QR Code aims to provide an online platform for the web user to store multimedia content and encrypt the URL by using AES encryption and save in the QR Codes for additional security. In detail, web users can store multimedia content such as URLs, PDFs, images, videos, V Card Profile, and event details. Indirectly, this was able to share the multimedia content through our online platform to the public using QR Codes, and it was very convenient, fast in the simple scan only and helped users reach their target audience in the offline world. Besides that, the QR Codes can search by using QR Code Scanner and required to install or download in the device that can access the Internet.

There was no existing system for Secure Multimedia QR Code, but there was some QR Code generator system on the Internet. Therefore, analyzing an existing or competitor system may provide valuable information regarding how current systems meet users' or market target needs. Besides that, it is also able to identify the potential usability problem to avoid in the new system. Furthermore, some helpful feature that exists in the competitor system or other system can also feed into the design process as potential user requirement.

SCANOVA is an online software tool that allows users to generate static or dynamic QR Codes, and advanced QR Code generators such as CANOVA allows users to design, manage and track QR Codes for marketing and operational use cases. However, the limitation was not providing the additional security for the QR Codes, and it was no free online software tool. In detail, users can sign up for a 14-day free trial and choose the QR Code category from the dashboard. Figure 1 shows the screenshot of the tool.

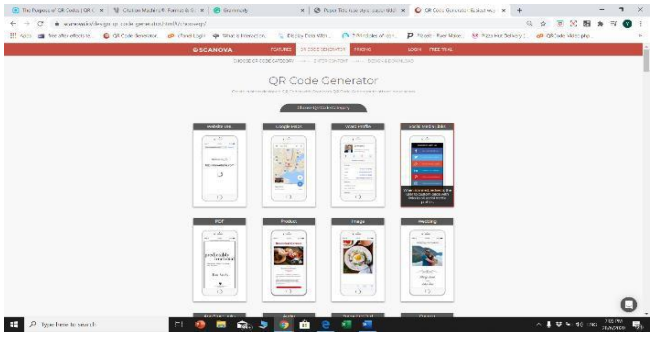
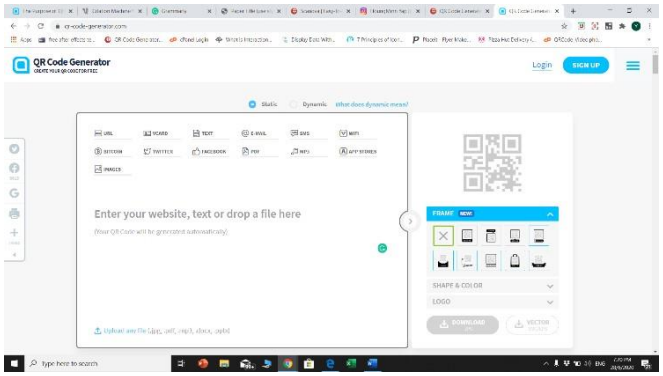


Figure1. Screenshots of scanova.io

QR Code Generator is an online software tool that allows users to generate static or dynamic QR Codes by inserting the multimedia content and allows users to design, manage and track QR Codes for marketing and operational use cases. However, the limitation was not providing the additional security for the QR Codes, and it was no free online software tool. In detail, users can sign up for a 14-day free trial and choose the QR Code category from the dashboard. Figure 2 shows the screenshot of the tool.

Figure 2. Screenshots of qr-code-generator.com



3. Project Methodology

In this project, the development methodology is throwaway prototyping which is very cost-effective and uses a series of prototypes to detect and forecast possible problems. It can prevent these from happening as soon as the product or service is introduced to the market. Problems are usually very costly occurrences. To avoid that, we can reduce the expenses. Next, project completion is quick. Since throwaway prototyping can detect the issue quickly. So that transition from one step to the next will be faster and smoother. By using the throwaway prototyping, the result can be assumed and is something that will certainly work for me, supervisor or guidance and the users. This is because it has been thoroughly tested through the use of prototypes. The end product may be meet the users need and expected to reach the needs of the target market. Figure 3 shows the throwaway prototyping.

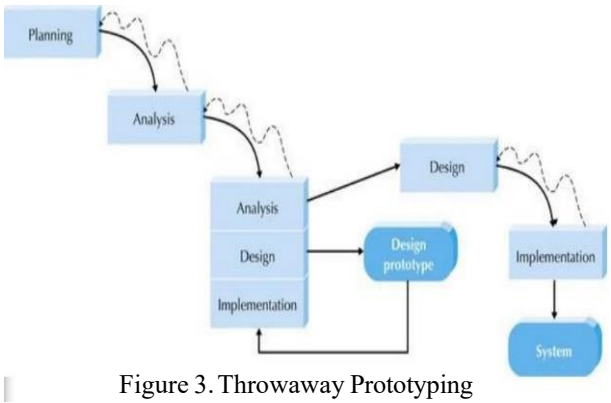


Figure 3. Throwaway Prototyping

There are four phases of the throwaway Prototyping

process that come in sequence, planning, design, implementation and system. The detail of the process will be explained below.

In planning, a system named "Secure Multimedia QR Code was planned to develop by using mobile apps and a website. In mobile apps, scanner QR codes will create and generate multimedia QR codes on the website. In fact, planning got many activities to include:

a) Explaining the problem statement of this project
b) Explaining the objective of the project
c) Explaining the significance of the project
d) Explaining the scope of the project

Once planning has been completed, the functional and non-functional requirements will be identified, and the project's weaknesses will be analyzed. Besides that, a use case diagram will come out.

Once analysis phases are completed, QR Code Scanner's interface will be designed using android studio, and the interface of generation QR Code will be designed using Cpanel. The database for the system is Cpanel, and the class diagram and sequence diagram will come up.

Once planning has been completed, implementation of the project will then take place. Low fidelity Prototypes will be created and introduced to the supervisor, who will utilize them for testing and evaluation purposes.

4. Design And Development

This section lists all functional and non- functional requirements Secure Multimedia QR code, the use case(s) model, analysis object model, and dynamic model. An initial interface prototype is also included at the end of this section. Each requirement is either mandatory (M) or desirable (D), or optional (O). M-Requirement that the system must do, D-Requirement that the system preferably does, and O-Requirement that the system may do. Table 1 lists the requirements for the system.

Table 1. List of the requirements

NO	REQUIREMENT ID	REQUIREMENT DESCRIPTION	PRIORITY
	SMQRC_01	**Register Account**	
1.	SMQRC_01_01	New users are needed to insert their details:	M
		a. First Name b. Last Name c. Email d. Password e. Address f. Phone Number g. username And click the register to complete the registration	
2.	SMQRC_01_02	System will send one email to the new user when the user was just registered	M
3.	SMQRC_01_03	System will come out error message- "email taken" if the email has already been taken by another user.	M
4.	SMQRC_01_04	System will come out error message – "invalid email format" if didn't follow format.	M
5.	SMQRC_01_05	Users are able to back to login page by clicking the "already got account? Login here"	O
SMQRC_02		**Login**	
6.	SMQRC_02_01	Users and Admin are required to fill in their username and choose the role to log into the system.	M
7.	SMQRC_02_02	Users and admin can request for a password reset by clicking the "Forget Password? Reset here" when forget their password. (Insert email and username and system will verify the email and username from database. After that, system will send verification email to user or admin. If incorrect username or email, system will prompt "error email or username".	M
8.	SMQRC_02_03	System will prompt error message such as "Invalid username or password!" if the user or admin inputs a wrong username / password combination.	M
SMQRC_03		**Manage own Account**	
9.	SMQRC_03_01	Users and admin are able to edit their personal information details except username because username was primary key: a. First Name b. Last Name c. Email d. Password e. Address f. Phone Number	M
10.	SMQRC_03_02	System will prompt error messages – "invalid format" if users fill in details on fields that are didn't follow format such as email format.	M
11.	SMQRC_03_03	users able to back to main page by click back and it will cancel changing the personal information details.	O
SMQRC_04		**Manage user's Account**	
12.	SMQRC_04_01	Admins able to view all user's personal information details	M
SMQRC_05		**Manage Own Multimedia Content**	
13.	SMQRC_05_01	User able to edit Multimedia Content that already upload.	M
14.	SMQRC_05_02	User able to view Multimedia Content that already upload.	M
15.	SMQRC_05_03	User able to delete Multimedia Content that already upload.	M

The requirements presented in Table 1 were translated into the computer system functionality. The following process is to visualize and model the requirements using the appropriate model method and tool. Unified Modelling Language (UML)

was used [6]. The models used in this work are one behavioural diagram use case representing the structural components of this system. The diagrams were drawn using Star UML. There are 17 major use cases register, login, manage own account, manage user's account, Manage own multimedia content, Manage User's Multimedia Content, Store Multimedia Content – Vcard Profile, Store Multimedia Content – PDF, Store Multimedia Content – Website URL, Store Multimedia Content – Event, Store Multimedia Content – Video, Customize QR Code, Scan QR Code, Search QR Code, Save QR Code After Scan, forget password and Submit Bug.

Figure 4. Use Case Diagram

The use case details the dynamic behaviour of the application and website. There are two types of roles in this system: user and staff admin. Applicants are able to sign up, log in, create QR Code, manage multimedia content, scan QR Code and Search QR Code. The Staff Admin was able to manage user's multimedia content and the user's account.

5. Design and Development

A secure Multimedia QR Code and QR Code Scanner prototype were developed. Atom software is the open-source text and source code editor to write the PHP coding. MySQL was used to facilitate crucial functions like user authentication and database for data storage. Screenshots of the following show the selected interfaces of Secure Multimedia QR Code and QR Code Scanner.

The following figures show the interfaces of the web application:

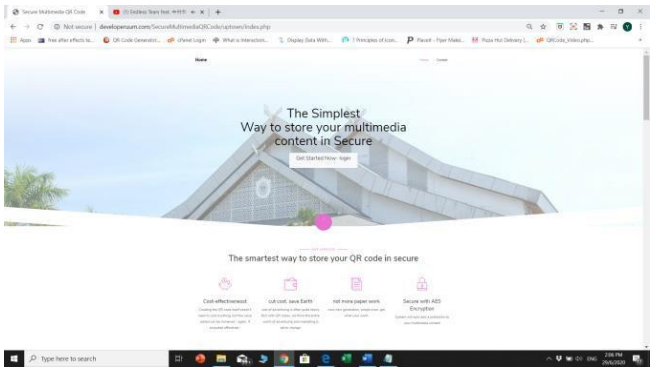


Figure 5. Index Page of Secure Multimedia QR Code

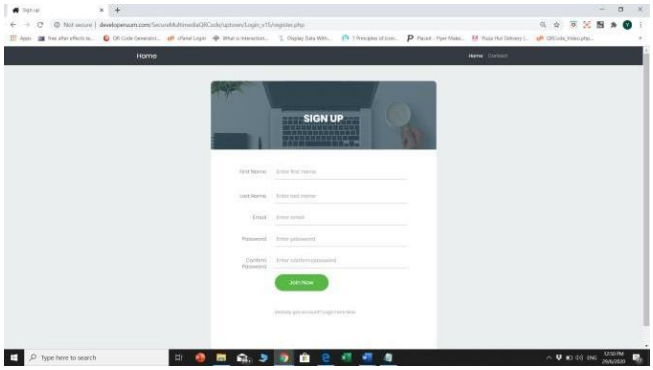


Figure 6. Login Page of Secure Multimedia QR Code.

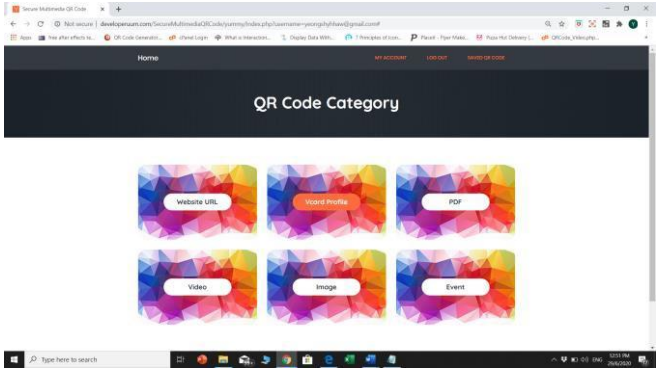


Figure 7. user dashboard of Secure Multimedia QR Code

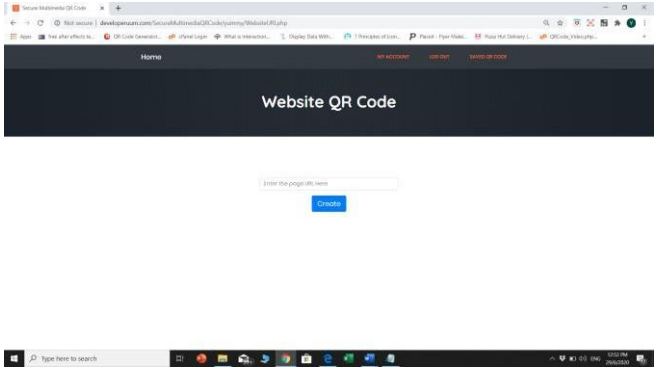


Figure 8. Website QR Code Page of Secure Multimedia QR Code

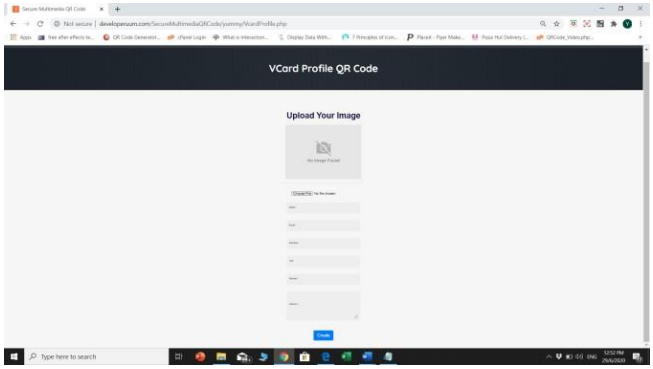


Figure 9. V Card Profile QR Code Page of Secure Multimedia QR Code

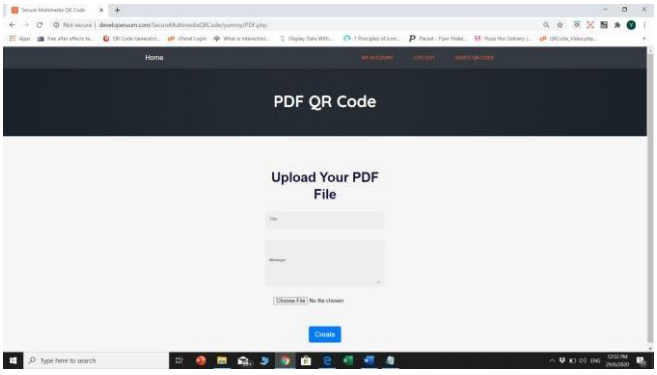


Figure 10. PDF QR Code Page of Secure Multimedia QR Code

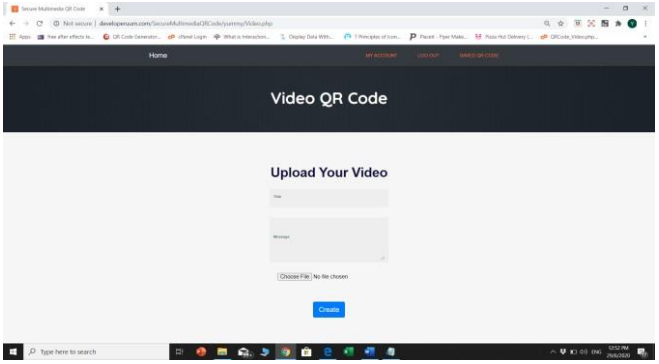


Figure 11. Video QR Code Page of Secure Multimedia QR Code

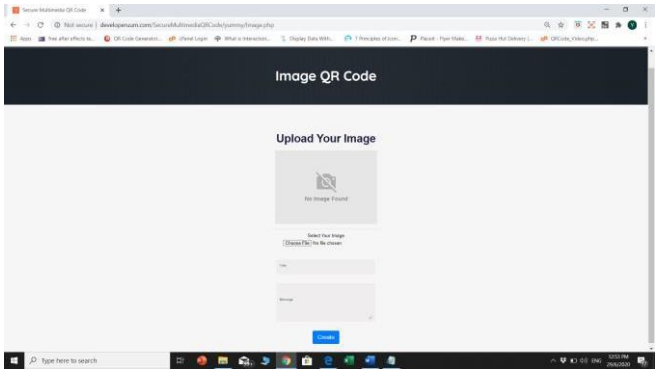


Figure 12. Image QR Code Page of Secure Multimedia QR Code

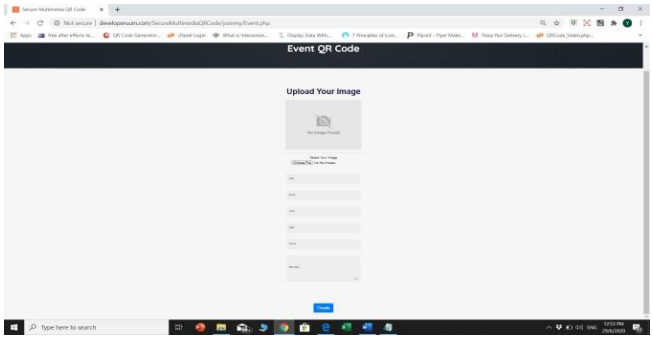


Figure 13. Event QR Code Page of Secure Multimedia QR Code

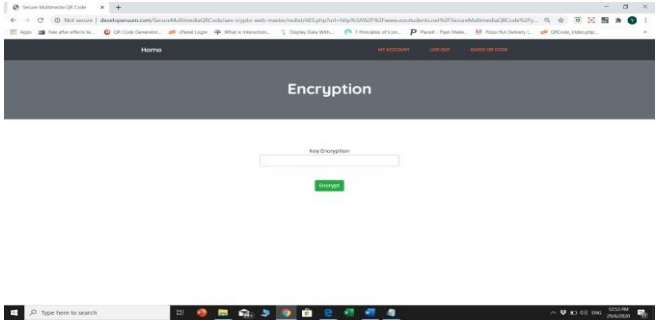


Figure 14. Insert Encryption Page of Secure Multimedia QR Code

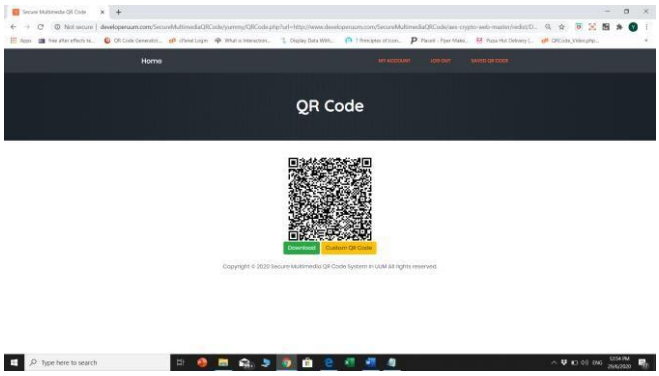


Figure 15. QR Code Page of Secure Multimedia QR Code

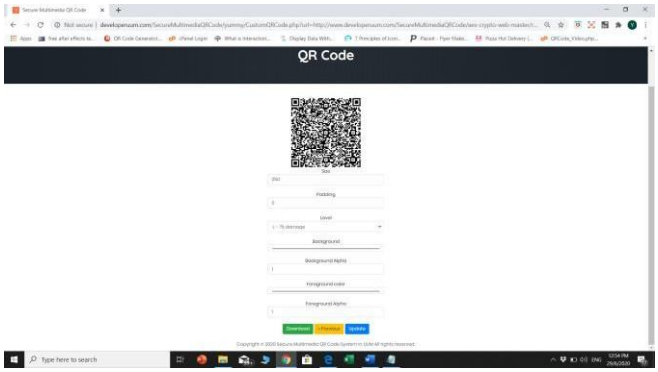


Figure 16. Users' URL QR code page

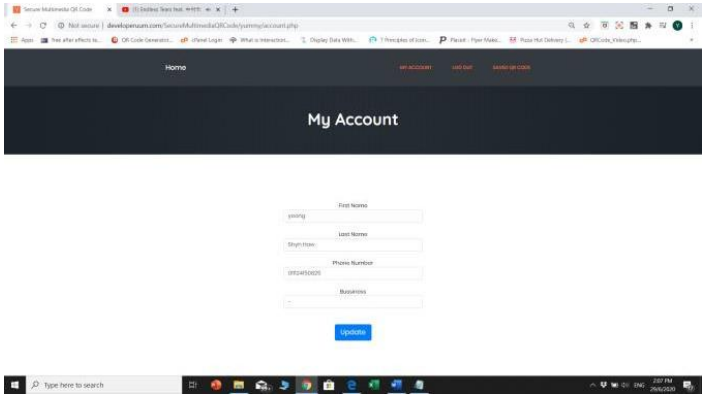


Figure 17. My Account page

Figure 18. Search QR code

Figure 19. Saved QR code after scanned

Many types of evaluation have existed. However, usability evaluation was chosen for the project evaluation because this method focused on how well users can learn and use the system to achieve our goal. It also refers to how satisfied users are with the process created. A survey was conducted to measure how easy or difficult they found each task and how confident they felt when following links.

Thirty participants participated in the evaluation study in which they were given the link to the page and a Google form to record their feedback. The respondents comprised 16 males and 14 females. 93% of the respondents were aged between 21 and 25 years, and the rest were between 26 and

35. 86% thought that additional security was needed for the existing QR code. Further, 86% knew about Advanced Encryption. Apart from the respondent's demographic background, they were also asked about the other aspects of the system, including the usefulness of SMQRC and QRSC, Ease of Use of SMQRC and QRSC and Satisfaction with SMQRC and QRSC. The respondents rate their agreement with the following statements on a scale of 1- strongly disagree to 5- strongly agree. Table 2 shows their responses.

Table 2. Respondents' feedback on the systems

Questions	**1**	**2**	**3**	**4**	**5**
Overall, I am satisfied with the ease of completing these tasks	0 (0%)	0 (0%)	1 (3.3%)	22 (73.3%)	7 (23.3%)
Overall, I am satisfied with the amount of time it took to complete these tasks	0 (0%)	0 (0%)	7 (23.3%)	12 (40%)	11 (36.7%)
SMQC enhances my effectiveness in saving multimedia content	0 (0%)	0 (0%)	0 (0%)	24 (80%)	6 (20%)
SMQRC and QRCS does everything I would expect it to do	0 (0%)	0 (0%)	3 (10%)	21 (70%)	6 (20%)
SMQC and QRCS meet my needs	0 (0%)	1 (3.3%)	2 (6.7%)	19 (63.3%)	8 (26.7%)
SMCQ and QRCS is easy to use.	0 (0%)	0 (0%)	2 (6.7%)	18 (60%)	10 (33.33%)
SMCQ and QRCS are user-friendly	0 (0%)	0 (0%)	2 (6.7%)	17 (56.7%)	11 (36.7%)
SMCQ and QRCS are flexible.	0 (0%)	0 (0%)	5 (16.7%)	15 (50%)	10 (33.33%)
I can use SMQR and QRCS without written instructions	0 (0%)	2 (6.7%)	5 (16.7%)	11 (36.7%)	12 (40%)
I can easily remember how to use SMQR and QRCS	0 (0%)	0 (0%)	4 (13.3%)	16 (53.3%)	10 (33.33%)
I can use SMQC and QRCS successfully every time	0 (0%)	0 (0%)	4 (13.3%)	18 (60%)	8 (26.7%)
I can recover from mistakes quickly and easily when using SMQC and QRCS	0 (0%)	0 (0%)	6 (20%)	17 (56.7%)	7 (23.3%)
I feel I need to have SMQC and QRCS	0 (0%)	0 (0%)	3 (10%)	18 (60%)	9 (30%)
SMQC and QRCS is wonderful and pleasant to use.	0 (0%)	0 (0%)	4 (13.3%)	15 (50%)	11 (36.7%)

6. Conclusion and Future Works

The paper described the designs and development of the Secure Multimedia QR Code System. There are still many aspects that can be studied. The application can be expanded in the future by providing a better user experience and improving security. Better security functions can be provided to protect the safety of all users. Most respondents felt that Secure Multimedia QR Code (SMQR) and QR Code Scanner (QRSC) are useful. The use of QR codes has the great potential to be used in various areas like exam papers [7], ticketing systems [8], the authenticity of products [9], and user identity [10]. Therefore, there are a lot of opportunities for the application of secure QR codes to facilitate information retrieval and authentication.

Acknowledgements

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