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Secure digital wallet by using QR code: mapping of mobile payment in partially connected environment

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ABSTRACT

Mobile payment is rising attention worldwide to pay for items from sender to receiver. QR (Quick Response) code technology relies on scan-and-pay techniques, does not require specific hardware, and allows a sender to easily scan the destination address of the payment directly from the receiver's smartphone. Existing QR (Quick Response) Code-based payment solutions require full internet connectivity for transactions. Sometimes, the user does not have internet for mobile payment. To resolve this issue an innovative hybrid method is proposed which uses web and mobile-based applications for E-payment and transactions using QR (Quick Response) Code in a partially connected environment. Online senders can pay by scanning the QR code provided by the offline receiver. A prototype of the proposed model has been developed as Cloud Sarafa System (CSS) which offers a flexible solution. A Prototype of the proposed model tested via use cases and test cases. Data was collected from 350 participants to evaluate the performance report against the prototype of the proposed model which endorsed positive.

1. Introduction

The Internet has been perceived as a user-friendly medium for communication [1, 2]. The Internet has become necessary for academics, communication, entertainment, and business transactions [3, 4]. With the huge development of the Internet, electronic commerce has become increasingly significant. The appropriation of digital payments is increasing at an extreme pace and has helped the world change into a digitally empowered society. Most people today no longer carry cash. Mobile payment has become popular for the payment of transactions through mobile or mobile banking applications [5]. Recently era, transactions have been done through diverse payment solutions that increase the easiness of doing everyday tasks and make the transaction process easier for customers and vendors. E-payment solutions are getting significant attention worldwide. Researchers show an increasing interest in the transition towards technological-based payment solutions. The Major considerations of these payment solutions are security and reliability [6, 7]. As a security measure, carry a little cash in case of an emergency, Users prefer internet banking, and perhaps sometimes forget to carry cards and have internet [8]. Various distributed studies have been conducted over the years, addressing alternative points of view of mobile e-payment, including versatile, action plans, the mobile payment market, plans, and procedures, as well as requirements and difficulties [9].

In this era, Mobile wallets represent the most popular choice of mobile transaction payment. Like e-wallets, they enable the customer to store billing and shopping data that the customer can check with a single tick while shopping through a smartphone. QR (Quick Response) mobile payment is extensively used as an alternative to smartphones to pay cash. The system developed is not only for the payment of

merchants but can also be used for person-to-person payments (P2P). The QR (Quick Response) code system is becoming popular due to its quick readability and increased storage capacity. It has a predefined e-matrix barcode which is readable by a QR (Quick Response) code scanner or camera of a smartphone [10]. Additionally, it makes the procedure quicker by decreasing the quantity of client inputs. Using QR (Quick Response) code codes involves one party generating the code, and the other party scanning it. This necessitates the physical collaboration of both parties, making it inclined towards proximity-based payments [11-13]. Existing QR (Quick Response) mobile payment solutions require a fully connected environment for transactions that need internet connectivity to send and receive money. Sometimes, people do not have an internet connection with a smartphone for mobile E-payment. In this study, the proposed model has been designed for QR (Quick Response) code code-based money transfer in a partially connected environment. The Prototype of the proposed model has been implemented as a mobile app in which users can transfer money in both cases online and offline. In this proposed model, the user has a unique ID as a secret key which is saved on that device and a receiver center uses a web application and can recharge the customer's account via the cloud. The secret key is securely saved in the cloud to maintain its security policy by which transactions will be successful and customers can also recharge their accounts by transferring amounts in our bank accounts from their App registered bank accounts.

2. Related Work

Online peer-to-peer transactions allow users to send money to each other quickly and easily, without handling the complicated process of writing and sending a cheque or transferring physical cash. For driving the cashless [14-16], there are several QR-based mobile wallets as a service provider available in the list of E-payment solutions that transfer money. This study highlights several existing E-payment solutions that use using QR (Quick Response) code method for the completion of transactions. Voice Note Mobile and web application QR (Quick Response) code-based payment solutions [17] have been proposed for e-payment and transactions that support QR (Quick Response) code voice features to address existing monetary management issues. Using the Voice Note application, the sender sends money by generating the QR (Quick Response) code, the receiver then scans the code via the Voice Note App and completes the transaction. A simple voice command can be used for transactions, and the user can also check the balance using voice commands. Assessments are carried out to estimate the total time taken to complete the transaction for different scenarios. An online dynamic QR (Quick Response) code quick pass terminal application [18] has been proposed for a mobile payment solution. Dynamic QR (Quick Response) code-era hardware must be fitted out with an SE security unit for capacity and security of asymmetric key data, with self-destruction capacities that can exclusively be connected for one-time scanning payment. Application for WeChat payment proposed in the Smart Wireless Business Laundry Service System [19]. This is the washing machine's automatic control service. This scheme has been used successfully in a washing machine, a shop in Chengdu, when a customer submits a laundry request to the laundry control center, the control center sends WeChat Public Accounts, the number and directions of the idle washing machine, the time of the laundry service and other data back to the customer terminal to generate QR (Quick Response) code. After the customer scans and the payment is successfully processed, the organization will automatically check the washing machine to complete the laundry service. JazzCash [20, 21], Easypaisa [22, 23] Alipay [24-26] are popular running mobile payment and branchless banking applications that provide services for transferring money through QR (Quick Response) code scanning, and the system will also maintain the log of all transaction.

2.1 Critical Analysis of Existing QR (Quick Response) code based Mobile E-Payment Solutions

Table 1 shows the completion of existing QR (Quick Response) code-based mobile E-Payment frameworks. Mobile E-Payment frameworks have quickly emerged as a business transaction method worldwide, offering a cheap and direct approach to buying or selling items and sharing money. Universally, scientists have made numerous E-wallets by utilizing various kinds of advances. This study concludes several existing QR (Quick Response) code-based mobile E-Payment solutions although the fact that these existing systems are restricted to performing transaction activity in a connected environment. The user (Sender and Receiver) must have internet connectivity on smartphone for the completion of a transaction. From existing QR (Quick Response) code-based mobile E-Payment frameworks users can only exchange payment but can’t be able to withdraw.

Table 1

Critical Analysis of Literature

Existing E-Payment Solutions	Runs on a fully connected environment	Required QR-code method for completion of transaction.	Sender required Internet Connectivity	Receiver required Internet Connectivity
E-Payment and Transactions using QR Codes [16]			Yes	Yes
Voice Note mobile and web-based Quick Response Code (QR Code) payment solution [17]			Yes	Yes
Online dynamic QR (Quick Response) code quick pass terminal application [18]			Yes	Yes
Wireless intelligent business laundry service system [19]			Yes	Yes
Running QR code-based Transaction Services			Yes	Yes
JazzCash [20, 21]			Yes	Yes
Easypaisa [22, 23]			Yes	Yes
Alipay [24-26]			Yes	Yes

In real-life scenarios, every time a user does not have an internet connection with smartphone for mobile payment that is the main breakthrough of these existing QR code-based mobile E-Payment solutions and becomes the concern of this study. There is a need for QR (Quick Response)-based mobile E-payment solutions that run online/offline in both use cases. To overcome this challenge, this study proposed a QR (Quick Response)-based mobile payment transaction framework that produces QR (Quick Response) codes on a mobile application, or website, with a particular sum of cash chosen by the recipient and can be balanced by the payer in a partially connected environment. In this solution, the user can generate a digital signature QR (Quick Response) Code from which the receiver can scan and withdraw money. Sarafa cloud mobile and web application which is a QR (Quick Response) code-based payment solution is developed to overcome the existing E-payment management issues and provide customer service in a partially connected environment. In this case, either the receiver or sender must have an internet connection for QR (Quick Response)-based mobile E-payment solutions by which the user can transact in a partially connected environment easily.

3. Proposed Model

Mobile banking apps are becoming more efficient to provide better customer service. The global payment system context continues to change the trend towards technical enhancement [27]. QR (Quick Response) Code-based mobile banking is commonly used as an ideal solution to cash payment via a mobile device. In addition to providing commercial payment services, the existing mobile banking system can also be used for person-to-person payment (P2P). In this study, an innovative hybrid method is proposed which uses web and mobile-based applications for E-payment and transactions using QR (Quick Response)-Code in a partially connected environment. The research aims to develop Cloud Banking for customers by using the constructs of Oracle APEX and Firebase (JSON Storage) the user interfaces designed with the android and web-based technologies. The entire prototype of the proposed model has been developed keeping the distributed client-server computing technology with centralized storage of the database in mind. A prototype of the proposed model has been developed as a cloud Sarafa system (CSS) which offers a flexible, QR (Quick Response) technology-based solution.

In the proposed model, users can effectively exchange specific amounts of cash without having to drive to a bank to withdraw cash. As an alternative, the user of this service can essentially just scan the QR (Quick Response) code and send cash to the other party in a partially connected environment.

If the sender does not have an internet connection for mobile payment, don't need to worry about it. The sender can generate a QR (Quick Response) code from the CSS app and the receiver can scan that QR code from the sender's smartphone for the transaction of money. In this case, the receiver must have an internet connection on a smartphone for the completion of mobile payment. In this way, money will be transferred from sender to receiver in a partially connected environment by using CSS efficiently.

3.1 Workflow of the Proposed Architecture of CSS System

- Fig. 1 shows the architecture of the CSS system which describes the flow of said system. The description of the proposed model is divided into two segments named Backend and Frontend which are discussed further
- There are two users' offline user (Sender), and online user (Receiver)
- Initially both users must log in after the creation of an account into the Cloud Sarafa System (CSS) system and their secret key synchronized with the local Database

- Offline users (Sender) can generate QR (Quick Response) codes
- Online users (Receivers) scan the QR (Quick Response) code from the sender's smartphone and then send it to the cloud service for verification of the user
- After the verification of the user, the system sends an SMS to both users for the confirmation of E-Transaction
- This scenario becomes wise versa in the case of the offline user (Receiver), the online user (Sender)

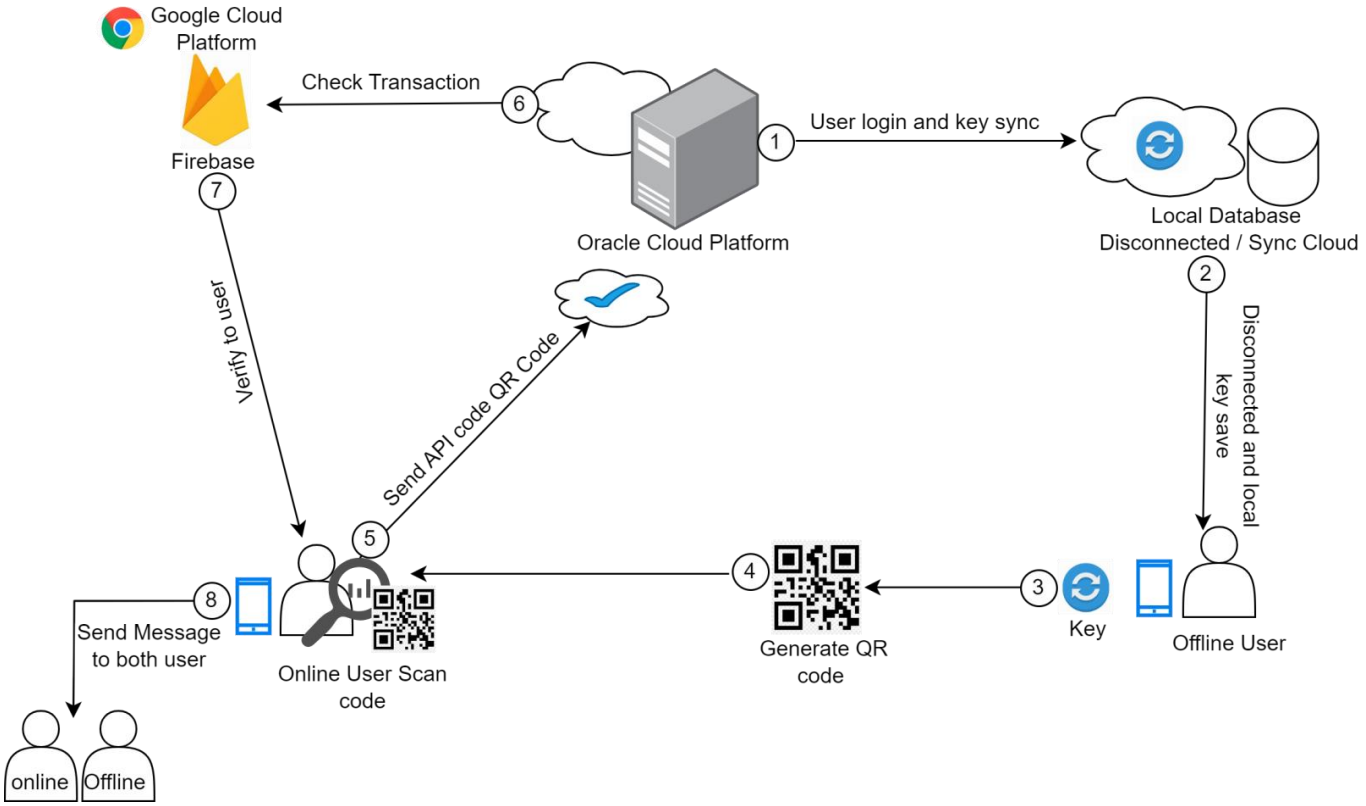

Fig.1. Architecture of Cloud Sarafa System

3.1.1 Backend segment

This segment is responsible for several modules which perform backhand tasks widely. In this segment, coded the real payment transactions, creating special QR (Quick Response) codes, database, confirming accounts, etc.

3.1.1.1 Database module

The system stores and synchronizes data with the NoSQL cloud database because of its simplicity and flexibility where all user information will be stored. Data is synchronized across all clients in real time and remains accessible when the app is offline. The data is stored as JSON and synchronized to each connected client in real-time. The Firebase real-time Database is cloud hosted. When users register, log in, transactions all users' data is stored for record purposes in the Firebase database. This module stores every single piece of information about the user's credentials, maintaining transaction logs, etc. NoSQL cloud database must communicate with the Firebase real-time database which is hosted on the cloud database Just like any user who is trying to log in or use the CSS app. Firebase Real-Time Database is a lightweight and cost-effective storage option that supports JSON. The information stored includes the user's account ID, password hash financial tokens, etc. Integrates web services with the Oracle Applications Cloud. It can integrate heterogeneous applications within the enterprise via web services or expose business functions over the Internet to Oracle Cloud partners and customers.

3.1.1.2 QR module

When the server receives a suitable GET request from the users, the QR (Quick Response) generator code will be executed on the server. The server will transform the provided data into a code and send the created bar code to the user's gadget. The offline users first create an account online, then after the creation of the account user logs in syncs the key disconnects to WIFI and generates a QR (Quick Response) code for payment.

First, the online user will create his account then he will scan the QR (Quick Response) code of the offline user who has generated the code. After the online user has scanned the QR (Quick Response) code, it will be then sent to the cloud service for verification.

3.1.1.3 Transaction module

When online users generate the QR (Quick Response) code check the cloud service for matching the QR (Quick Response) code then send it to the Firebase database to save the transaction purpose then generate SMS and Email for both users online and offline users to inform transaction has been successfully done, if transaction has not success so also send SMS to both users.

3.1.1.4 Front end segment

This segment has two interfaces named web and customized E-mobile payment app mobile application called Cloud Sarafa System (CSS). All front-end pages have been created in Android Studio with the JavaScript framework for Android mobile applications. The website shall have the same functionality as the mobile application, except for a few-dimensional differences.

3.2 Customized E-Mobile Payment Application Module

Discover the advanced features of our Customized E-Mobile Payment Application Module, crafted to elevate user experience, bolster security, and redefine digital transactions. Dive into the functionalities within the Homepage Folio, Create QR (Quick Response) Code Folio, Scan QR (Quick Response) Code Folio, and Transactions Folio for a holistic digital payment solution.

3.2.1 Homepage folio

The Account QR (Quick Response) code is the first thing users see upon logging in online. By focusing on and tapping the display, they can scan the code, which then leads them to a screen for modifying payments. In the top centre, there is an interface to the page sign, which can only appear if the user has not logged in to the home page menu section as shown in Fig. 2, which can be accessed from each page once the user logs in. The top displays the email address, so you will be reminded of what mail account you have signed up for. The primary alternative is "Home Page Folio" which returns the user to the primary image of the homepage as shown in Fig. 3. The second alternative is "Create a QR (Quick Response) Code," which will take the user to the page where a new code could be created. The third option is "Transaction History," which takes the user to the page where they see all their previous transactions, whether paid or received. The fourth option is "Wallet," which takes the customer to a page where they can add or change methods of payment an additional option is "Settings," which supervises the user to the page where the settings may be modified. The "Help" option took the user to the page of FAQ page the final choice was "Info," which took the user to the web page where all information is lawful. You can see the "Log Out" option at the bottom of the menu which gives users the option to sign out at any time.

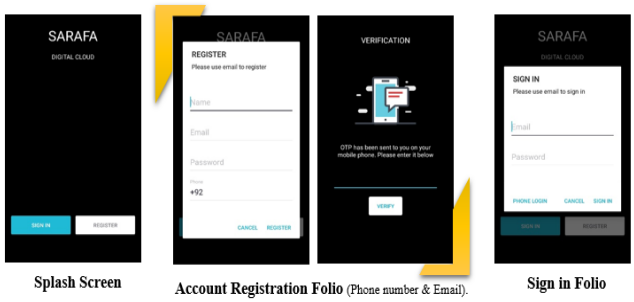

Fig. 2. Home Page Menu Section

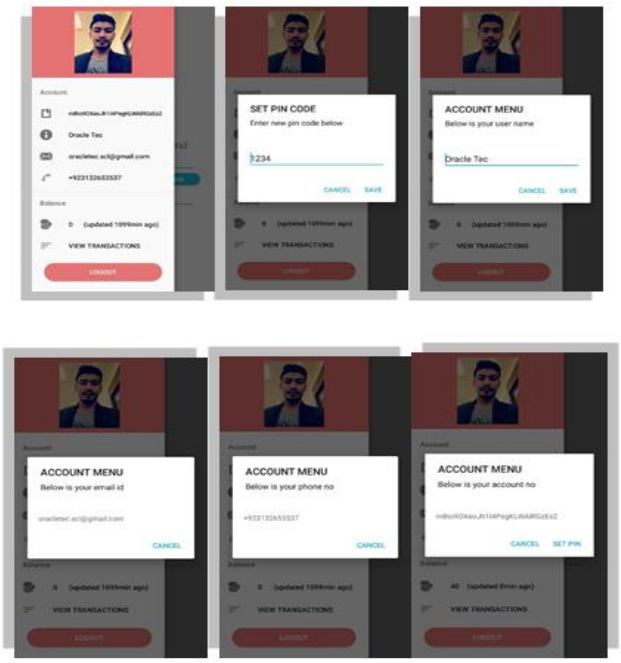

Fig. 3. Home Page Folio

3.2.2 Transactions folio

This page shows all payments received by the user. Each transaction appears as shown in Fig. 3 the user has earned cash with the amount of money paid, Furthermore, if the sender has agreed to pay anonymously the recipient may receive mysterious payments and does not know who he is from.

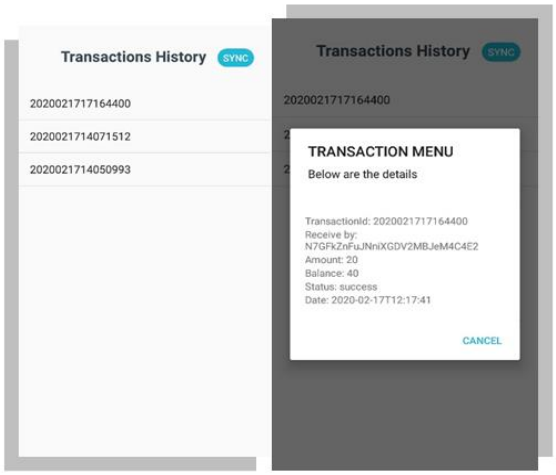

Fig. 4. Transaction Folio

3.2.3 Create QR code folio

This can be opened from the sidebar of the homepage to generate a new QR (Quick Response) code that a customer can share to receive cash. The user can choose the number for his QR (Quick Response) code, and the value will be in the centre of the screen when he selects "Submit". The QR (Quick Response) code generation process has appeared in Fig. 5.

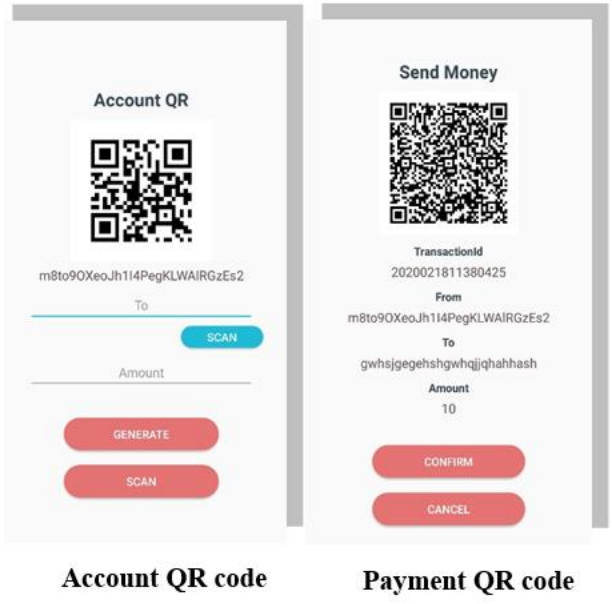

Fig. 5. QR Code Generation Folio

3.2.4 Scan QR code folio

The page's sidebar which generates a new QR (Quick Response) code for users to share to make money can also be accessed. The user can decide the fixed amount of their code which will appear in the center of the screen when they select "Submit." It can be transferred to the camera roll of the consumer from there. The user is guided to the codes that are saved there after closing the window. The scanning process of the QR (Quick Response) code is shown in Fig. 6.

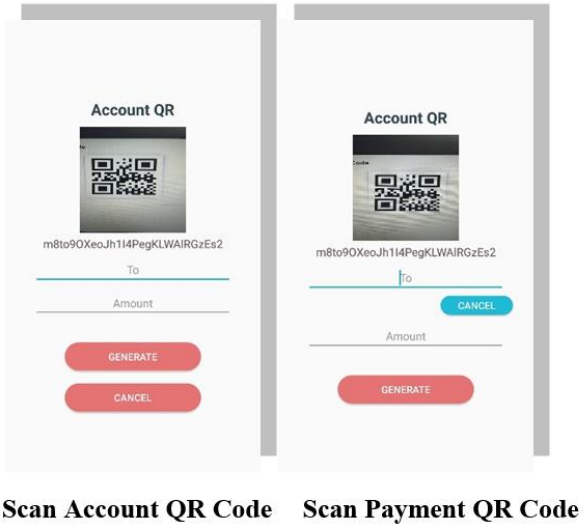

Fig. 6. QR Code scanning Folio

3.2.5 Customized web application module

Using an online platform allows customers without smartphones to generate and print QR codes at a library. While this facilitates accessing (Quick Response) codes without a smartphone, scanning still requires one. The website's design and functionality are crucial, especially since QR codes can't be scanned on the site. Users can create accounts, add payment methods, generate QR codes, adjust settings, and review terms and conditions.

4. Use Case of The Proposed Model

Use case diagrams [28] take into consideration the high degree of Functional Requirement analysis of the system to capture its dynamic aspect. These are primarily used to obtain the specifications and features of the program collected in use cases and to classify interacted internal and external users. These users are referred to as actors. Fig. 7 depicts the use case for the proposed (Quick Response) code-based E-Mobile payment solution as well as its prototype. The use case is the description of the user's interaction with the software product to attain a goal and set expectations of how the end user will work with the organization. Table 2 to Table 5 show the demonstration of the Use Cases and their consequences.

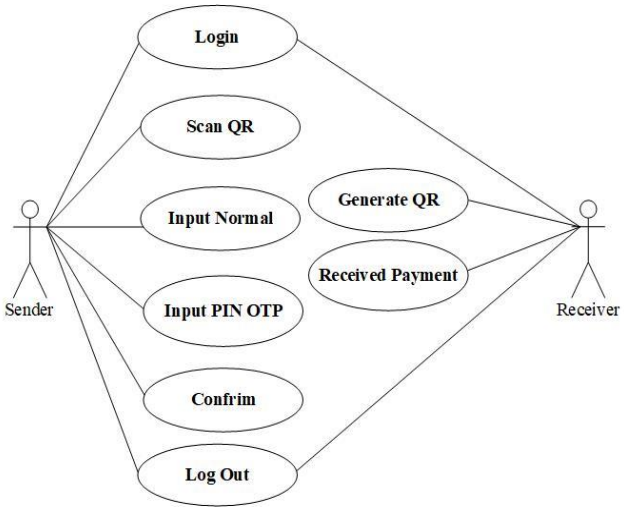

Fig. 7. Scenario For Generating (Quick Response) Code in The Proposed Model Folio

Table 2

Use Case-1

ID	UC-01
Name	Login Activity
Scenario	This use case helps a user to access the necessary functions by logging into the device / mobile app.
Admin	User
User	Server (Local Database)
Pre-Condition	- User must log into the system. - The user must have a valid account
Post-Condition	The system will display the relevant homepage

Main Success Scenario	- ID and password are provided by the user. - relevant the ID and Password by system - Relevant homepage displays by the system
Extension	- Missing ID and Password - ID and Password prompts by the system - Use case resumed at success scenario step 1. - Invalid ID and Password - The error message shows the program. - ID and Password prompts by the system - Use case resumed at success scenario step 1.

Table 3

Use Case-2

ID	UC-02
Name	The secret key synchronized with the user's account
Scenario	This use case allows system user's secret key synchronized against a user's account to access the relevant functionalities.
Admin	Server (Local Database)
User	None
Precondition	The user needs to sign into a customized system
Post-Condition	The system synchronized the user's secret key
Main Success Scenario	1. WIFI is ON. 2. The user sends a request for the creation of an Account 3. System registered user into the system against secret key
Extension	1. Disability of WIFI connection - System prompt for WIFI connection

Table 4

Use Case-3

ID	UC-03
Name	Offline user generates QR code for sending money
Scenario	Whenever a user needs to transfer money, but he/she does not have a WIFI connection but doesn't need to worry about it. This use case allows offline users to create QR codes for sending money because the secret key is synchronized with the user's account.
Admin	Offline user
User	Server (Local Database)
Pre-Condition	Offline users must register into a customized system whenever WIFI connection.
Post-Condition	The offline user generates a QR code for sending money.
Main Success Scenario	1. Offline user opens the customized app 2. The offline user presses the button to generate a QR code.
Extension	1. Invalid user - System displays error a password - ID and Password prompts by the system - Use case resume at success scenario step 1.

Table 5

Use Case-4

ID	UC-04
Name	Online users the QR code from offline users' smartphones to receive money.
Scenario	This use case allows Online user) to scan the QR code from an offline user's mobile phone to receive money.
Admin	Offline user, Online user
User	Smartphones of Offline users, Online users,
Pre-Condition	QR code generated by Offline users on a customized app.
Post-Condition	QR code scanned by Online user from Offline user's smartphone for receiving money
Main Success Scenario	1. Online user must login into the customized system. 2. Offline user generates a QR code on his/her smartphone. 3. Online user scanned QR code from Offline user's smartphone. 4. Request sent to the database for the verification of the user (who sends money) and transformation of money.
Extension	1. Invalid online user - System displays an error message - System prompts for top altitude, minimum altiresume - Use case resume at success scenario step 1.

5. Experimental Result of The Prototype of Cloud Sarafa System (CSS)

Mobile app testing [29] became the most demanded service in the market. E-assessment is appropriate for some assessments in this Unit. In the Mobile application testing strategy, mobile software is tried out to make sure that the functionality and usability is as safe as possible. In this study, the Cloud Sarafa system (CSS) which has been proposed with its implementation, needs to be tested first. Table 7 shows details of all strategies which are covered in CSS mobile app testing. The following strategies are kept in mind when this CSS app is tested Installation and Uninstallation Testing, Compatibility Testing, Functional Testing, UI Testing, Performance Testing, Usability Testing, and Non-Functional Testing. In this table test description of test cases is described accordingly, required pre-condition and post-condition also discussed. Expected outcomes and actual results are discussed accordingly. During testing of the mobile app, compatibility testing fails because the CSS app is not compatible with different operating systems. Table 6 shows case strategies as below.

Table 6

Test Cases Strategies

Scenario ID	Dom-ain	ID	Description	Test Step	Pre-Condition	Post-Condition	Expected Result	Actual Result
TC_App_001	Installation and Uninstallation Testing	TC_App_Install_001	Verify the mobile app is installed properly	1. Download the app from a valid URL 2. Install the app	Valid URL	Users should be able to install the app properly	Installed the app Successfully	Same as the expected result
		TC_App_Install_002		1. Download the app from an invalid URL	Valid URL	Error Message prompts	A pop-up message box comes out "Can't Install"	Same as the expected result
		TC_App_Installation_003	Verify the mobile app is uninstalled properly	1. Long touch on app icon 2. Select uninstall option 3. Select ok for confirmation	The mobile app must be installed on the device	The mobile app should be uninstalled properly	Uninstalled the app Successfully	Same as the expected result
TC_App_002	Compatibility Testing	TC_App_Compatibility_001	Verify the mobile app is compatible with different OS	1. Download the mobile app on different OS.	Valid URL	Users should be able to install the app properly on different OS	Installed the app Successfully on different OS	Not the same as the expected result
TC_App_003	Functional Testing	TC_App_Functionality_001	Verify app launches correctly	1. Launches the app	The mobile app must be installed on the device	Users should able to launch the app properly	Launch the app successfully	Same as the expected result
		TC_App_Functionality_002	Verify user login properly	1. Enter valid username and password 2. Click on the Login Button	Valid URL	The user should be able to log in and see the verified OTP page	A pop-up message box appears "Verify Code"	Same as the expected result
		TC_App_Functionality_003	Verify user login OTP send and receive	1. Enter invalid OTP receive on SMS 2. Enter valid OTP received on SMS	Valid code input	The user should be able to log in and see the first page	Login Successfully	Same as the expected result
		TC_App_Functionality_004	Verify QR code generation of Account and Payment correctly	1. Launch the app 2. Account QR code generated automatically 3. Scan the sender/receiver QR code	The camera should be enabled, and the app have permission	Generation of QR code visible on the app	Scanning of the QR code visible on the app	Same as the expected result
		TC_App_Functionality_005	Scanning only the generated QR code of payment	1. Launch the app 2. Camera starts scanning 3. It cannot scan another image rather than a QR code	The camera should be enabled and the app have permission	Scanning of the QR code should be visible on the app	After scanning payment details should be displayed	Same as the expected result

		TC_App_Functionality_006	Verify the sending of email notifications correctly	1. Notification triggers whenever payment is transferred successfully	None	Notifications sent and received by mail	Notifications visible in the mailbox	Same as the expected result
		TC_App_Functionality_007	Verify the sending of alert messages properly	1. SMS alert received on mobile	The device must have SIM and GSM network	Message sent and received from cloud APIs	Message visible on the device	Same as the expected result
TC_App_004	UI Testing	TC_App_UI_001	That text on the mobile app is readable verify it	1. Analyze the UI of mobile app	None	Text on the mobile app should be readable and clear.	Text on the mobile app is readable and clear.	Same as the expected result
		TC_App_UI_002	Verify that the app's display is adaptable and compatible with various display modes (portrait/landscape)	1. Analyze the adaptability and amenability of the mobile app	None	Display of mobile app should be adaptable and amenable to different display modes (landscape, portrait)	Display of mobile app is adaptable and amenable to different display modes (landscape, portrait)	Same as the expected result
TC_App_005	Performance Testing	TC_App_Performance_001	Verify delays or errors in getting information over the network	1. Network Enabled whenever app launched	Network connected	The network of devices should be enabled	The network of devices is enabled	Same as the expected result
		TC_App_Performance_002	Verify how quickly and in what format data is transferred from the API server	1. Analyze the format of data and its transformation period from the API server	None	Format of data should be settled and analyze period of transformation	The format of data is settled and analyze period of transformation	Same as the expected result
		TC_App_Performance_003	Verify the battery and memory consumption	1. Analyze the battery and memory consumption	None	Battery and memory consumption should be optimized	Battery and memory consumption are optimized	Same as the expected result
		TC_App_Performance_004	Verify that the loading time of the app is not too long	1. Analyze the loading time of app	The mobile app must be installed on the device	loading time of the app should not be too long	loading time of the app is not too long	Same as the expected result
TC_App_006	Usability Testing	TC_App_UT-001	Verify how user-friendly the app is in terms of ease of use	1. Analyze the ease of usability of the mobile app	The mobile app must be installed on the device	Mobile app should be user-friendly the app is in terms of ease of use	The mobile app is user-friendly the app is in terms of ease of use.	Same as the expected result
TC_App_007	Non-Functional Testing	TC_App_NFT-001	To test the password protection system	1. Analyze the password protection system	The mobile app must be installed on the device	A password protection system should be programmed	A password protection system should be programmed	Same as the expected result

6. Comprehensive Evaluation

User experience [30] indicates an individual's beliefs and perspectives about a framework, item, or system while associating with its specific conditions. It is indispensable to evaluate the user experience towards the application to guarantee that it added price despite potential users' backgrounds. A total range of 350 users participated in the user experience analysis. Participants forwarded the application's APK via email. The application is then installed onto their Android mobile phones. Directions on a way to transfer the application got. Users found it more comfortable to observe the installation instructions. For the questionnaire surveys, the following research questionnaires were forwarded to the users to evaluate the degree of user experience every single user had with the application. The users were asked to demonstrate their level of agreement with the statements using a Likert Scale. The study examined responses from all participants to evaluate the reliability, efficiency, and impact of the Cloud Sarafa app using SPSS. The main goal of evaluation of this study is to evaluate the performance impact of the Cloud Sarafa app. This study evaluated the level of automation achieved by the Cloud Sarafa app in the reverse engineering of feature models. Hence, formulate the following research questions.

RQ1: I used cash for transactions.

RQ2: I usually use the e-payment option for transactions.

To answer RQ1 and RQ2 this study investigates whether every person used cash for the transaction or receipt of an item and preferred the e-payment option for the transaction.

RQ3: I have a good feeling about the Sarafa cloud payment application.

To answer RQ3, the majority of participants strongly agreed that the application is easy to work with. An even number of participants agreed. Some participants (elderly) found the app difficult to work.

RQ4: Using the Sarafa cloud app payment is successful.

RQ5: Using Sarafa cloud app Account QR code scanning successfully.

RQ6: Payment QR code generation valid from the Sarafa cloud app.

RQ7: It was easy to transfer payments using the Sarafa cloud app.

To answer RQ4, RQ5, RQ6, and RQ7 concluded that user experience with QR code generation, and QR code scanning that good. The majority of participants strongly agreed that QR code generation, and QR code scanning are correct for successful payments via the Cloud Sarafa app.

RQ8: Transaction response time was good under a partially connected environment.

To answer RQ8, measure the execution and responsive time of the transaction under a partially connected environment where either the sender or receiver must have internet connectivity for E-transaction. Most participants strongly agreed upon it by their experiences. The remainder of the participants moderately Agreed. Few participants disagreed too as shown in graphical.

RQ9: In complete, I'm satisfied with this application.

RQ10: This app has all the functions and capabilities I expect it to have.

To answer RQ9, and RQ10, the majority of participants strongly agreed that the Cloud Sarafa app has a high level of automation for QR code generation, and QR code scanning capabilities for E-transaction under a partially connected environment as shown in graphical.

7. Result

In this study, an innovative hybrid method is proposed which uses web and mobile-based applications for E-payment and transactions using QR-Code in a partially connected environment. This study formulates use cases and test cases for a said system for testing the functionality and usability of the Cloud Sarafa app and evaluating user experience which was conducted to estimate the performance impact of the Cloud Sarafa app. Feedback of user experience test on SPSS for mearing the frequencies of response which is shown in Fig. 7. This review shows that most participants are satisfied with the proposed E-transaction system (Cloud Sarafa app) which works under a partially connected environment because the user can easily transact their cash.

8. Conclusion

QR-Code is used in this context for e-payment systems to facilitate customers in partially disconnected environments building up a reliable, verified, well-performing money-related administration framework for the exploration setting by considering existing financial administration applications in the present market was the fundamental goal of the creators of this extensive report. Universally, scientists have made numerous E-wallets by using various kinds of approaches. Even though they give solutions for clients while doing financial exchanges, they also have a few limitations. Sarafa cloud mobile and web

application which is a Quick Response Code (QR Code) based payment solution evolved to overcome the existing E-payment management issues and provide customer service in a partially disconnected environment. Practical application and test results indicate that the arrangement can generate and display QR code information and accept the payment function by both scanning and scanning, greatly improving the payment arrangement's security performance.

9. References

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