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Designing of Android Mobile Based System Using QR Code

Gresham Muradzikwa

School of Information Sciences and Technology, Harare Institute of Technology, Zimbabwe

Noreen Sarai

School of Information Sciences and Technology, Harare Institute of Technology, Zimbabwe

Weston D. Govere

School of Information Sciences and Technology, Harare Institute of Technology, Zimbabwe

Dumisani Sibanda

School of Information Sciences and Technology, Harare Institute of Technology, Zimbabwe

Abstract:

This paper explores a solution to create a cashless mobile payment system. The aim is to provide the most cost efficient and secure alternative to current systems. Current systems use SMS and USSD to process payments. These are not cost effective methods of communication. There is also no current method of processing credit payment on a mobile phone without the need for a specialized piece of hardware.

The system is broken up into three parts, a visual QR code, Qpay Android application and a payment server. The identification of mobile phone is encoded in a QR Code allowing the built in camera on a mobile phone to scan a card. This was improved on by using a HTTPS connection between mobile phone and server. HTTPS provides an encrypted communication channel. This paper shows that a mobile phone is capable of processing QR code payments on a mobile phone. Time taken to process a payment was within an acceptable limit.

Keywords: Quick response (QR) code, android, Qpay generator, mobile phone

1. Introduction

A user-friendly and convenient mobile payment solution is a key ingredient to support mobile users in conducting secure and reliable payment transactions using mobile devices. Mobile payment systems supporting QR codes are definitely needed by mobile users and merchants. A QR Code (short for Quick Response) is a specific matrix barcode (or two-dimensional code), readable by dedicated QR barcode readers and camera phones. The code contains up to 7,089 numeric characters. In this paper, we propose to use an innovative mobile payment system based on QR codes for mobile users to improve mobile experience in conducting mobile payment transactions. Unlike other existing mobile payment systems, the proposed payment solution provides distinct advantages to support buy-and-sale products and services with QR codes. This system uses one standard QR code (Data Matrix) as an example to demonstrate how to deal with underlying QR code-based mobile payment workflow, mobile transactions and involved security mechanisms.

2. Problem Statement

Payments in Zimbabwe have been conducted by cash, plastic money (cards), cheques and barter trade to mention a few. There is the emergence of mobile money which has attracted the business world. Currently the only mobile payment in Zimbabwe is the use of USSD which have much vulnerability such as: reliability, no memory and it is prone to hacking.

3. Research Objectives

To solve the above problem, the aim of the project is to develop a QR code based mobile payment system which will have the following objectives:

- To design the mobile Qpay scanning program using android eclipse software.

- To design a customised Qpay Generator which will generate the QR codes using java eclipse software.
- To be able to an electronic make transactions between client and customer

4. Literature Review

4.1 QR Code Payments

Quick response code – QR codes is a 2 dimensional bar code technology consists of black modules arranged in a square pattern on white background that enables the user to scan the codes and link with the mobile device to the Web address and access the information.

QR code payments were initially made possible by online banking account such as PayPal. With smart phones and QR codes, banking account information could be stored into our mobile phones, so instead of carrying a bunch of cards around, a mobile phone could do wonders. QR Codes based payments usually don't prefer to store card information in the mobile phone, instead store the card information in a secure online wallet which will be accessed using tokenized QR Codes. One example of the above implementation is Level Up, which is currently supported in both iOS and Android based phones.

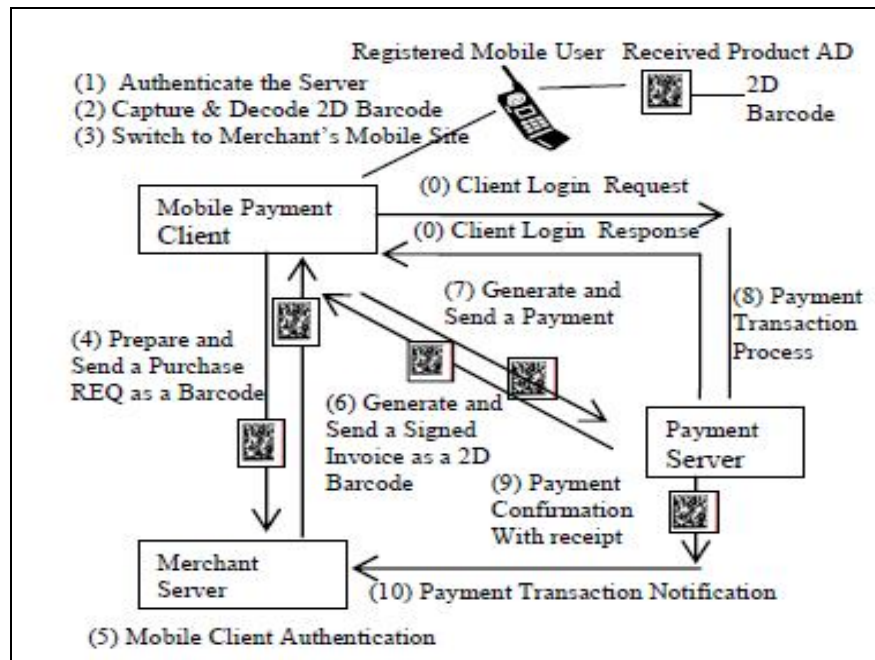


Figure 1: Fig 1: QR code based mobile payment process

The Figure 1 displays its underlying payment process, which consists of the following steps:

- **Step #0:** A registered mobile user uses his/her user account and PIN to login the mobile payment system by sending a login request to the mobile payment server. The mobile server processes mobile client authentication and sends a login response with the server certificate ID, and secured session ID, as well as a public key for the communications.
- **Step #1:** The mobile client authenticates the mobile server with received public and server's certificate.
- **Step #2:** The mobile client captures or receives a QR code for an interested product from its advertisement. There are two scenarios in which a mobile user can get a QR code. In the first case, a mobile user may use a mobile camera on the mobile device to capture the image of a QR code from a posted product. In the second case, a mobile user may receive a mobile ad on a mobile device from a merchant. Meanwhile, the mobile client decodes the received QR code, which includes product and maker's information, marketing data, merchant's mobile URL information.
- **Step #3:** The mobile user clicks the given QR code to switch the target merchant's mobile site using the provided URL in the received QR code.
- **Step #4:** The mobile user prepares and submits a purchasing request with a digital signature as a QR code to the merchant server.
- **Step #5:** The merchant server authenticates the mobile client based on the provided the secured session ID from the mobile client, as well as the public key. Meanwhile, the received signed request is validated by the merchant using the private key.
- **Step #6:** The merchant server generates and sends a signed purchase invoice with a transaction ID to the mobile client.
- **Step #7:** The mobile client prepares and sends a payment request with the same transaction ID and a digital signature to initiate a payment request. The digital signature is made using the client private key. The entire message is

encoded as a QR code.

- **Step #8:** A secure session is established between the payment server and the mobile client. In this step, the *payment server* validates the given security information, including the certificate from mobile client, session ID, public key, and received digital signature. The mobile payment server processes the payment transaction.
- **Step #9:** The payment server prepares and sends a payment confirmation with a QR code receipt to the mobile client. The mobile client displays the received confirmed message to the mobile user.

• **Step #10:** The mobile server also sends a payment transaction completion notice with a QR code to the merchant server. This code will be useful for the merchant to carry out the post-sale operations, such as pick-up validation or product delivery.

4.2 Summary

Examining QR Code vs Barcode, it is noted that barcodes have been the standard for many years. However, when comparing QR Code vs Barcode, it is easy to see why barcodes are being replaced by the newer QR codes. These QR Codes are becoming more common place due to their greater storage potential and ease of being read by a scanner. Damaged data can be restored from a QR Code but not from a barcode. Thus QR Codes are more reliable

5. Research Methodology

To address the security issues, we build a mobile enabled security framework in the QR code payment system. This security framework includes the following components.

5.1. Authentication Management

This component is built to support the required authentication functions for each party, including mobile client, merchant, and the payment server. In this system each party must be authenticated before any payment transaction.

5.2. Mobile Session Management

This function component is designed to assure the security of a payment session between involved parties.

5.3. Certification Management

This component is designed here to support the payment-oriented certification generation, validation, and management.

5.4. Mobile Key Management

This component is built to generate, distribute, check public and private key based on the Elliptic Curve Cryptography (ECC) or Advanced Encryption Scheme.

5.5. Message And Data Integrity Validation

This component is useful to check the message and data integrity for the communications between mobile client and the payment server using encryption and decryption methods.

5.1 A SWOT Analysis

Strengths	Weakness
<ul style="list-style-type: none"> • Updated technology: QR codes may work well for micropayments in a closed-loop proprietary payment system. • Easily acquire: Quick, and simple, a bridge from physical placement to digital content. • Strong management: Strong management can help QR codes reach its potential by utilizing strengths and eliminating weaknesses... .. This qualitative factor will lead to a decrease in costs. • Innovative culture: innovative culture helps QR codes to produce unique products and services that meet their customer's needs. The mobile payment and commerce landscape opens doors for innovative value-added services that enhance mobile payments. Such services can be provided before and after the actual payment transaction. 	<ul style="list-style-type: none"> • Platforms too diverse: Mobile devices do not have any particular standard, as compared to PCs and laptops. Mobile phones come in many shapes and sizes, so screen size is never constant. Besides, mobile platforms vastly differ from each other, using different OS' and browsers. Hence creating one campaign for all of them can get difficult. • Privacy issues: Mobile marketers need to understand and respect the fact that users would like their privacy online. So they should only indulge in promotional activity if they have the user's permission for it. • Navigation on a mobile phone: The mobile phone usually comes with a small screen and no mouse. This means that navigation on a mobile phone may get difficult for the user, even if it has a touch screen.

Opportunities	Threats
<ul style="list-style-type: none"> • New technology: Chances of implementing new technology are high because with having QR codes one can be innovative up to the extent of embedding new technology • New markets: Ability to penetrate new markets • International Expansion: A marketer’s dream is to have simple, effective and low-cost ways of bringing in customers to their digital content. 2D barcodes are basically free and offer an increasing audience of savvy and affluent customers. 	<ul style="list-style-type: none"> • Releasing a QR code with an error, if that code is a direct code. The QR code goes to a malformed URL. There is also a risk of overloading the environment with those whacky looking squares. Without a clear call to action, they are just visual noise. • As with any new technology that allows and encourages sharing data, there is always the chance that identification and financial information may be at risk. QR codes that are scanned to gain instant access to a text message are less likely to place a user’s identity and personal information at risk than near field communication used for a contactless payment.

5.2 Use Case Diagram

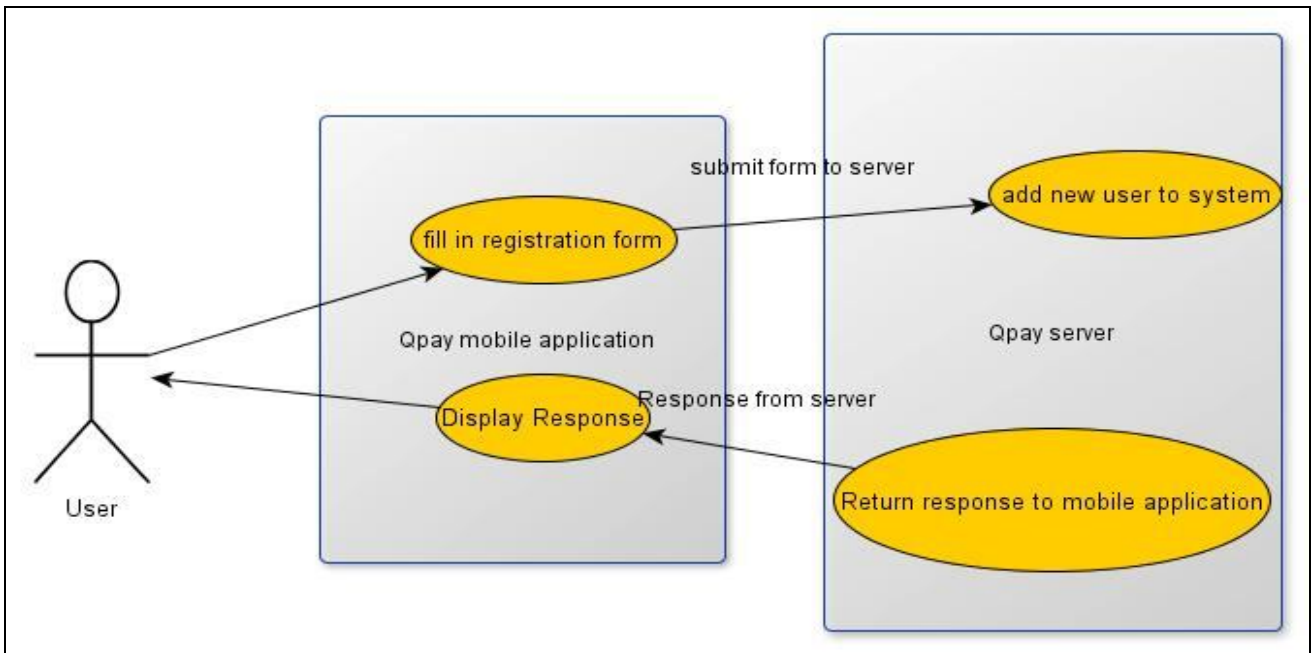


Fig 2: User registration diagram

The user after downloading the application the user is able to click registration button and there is a registration form available which upon completion one can submit to the Qpay server. After processing of the form the server can send a response back to the user if the request was successful.

5.3 System Flowchart

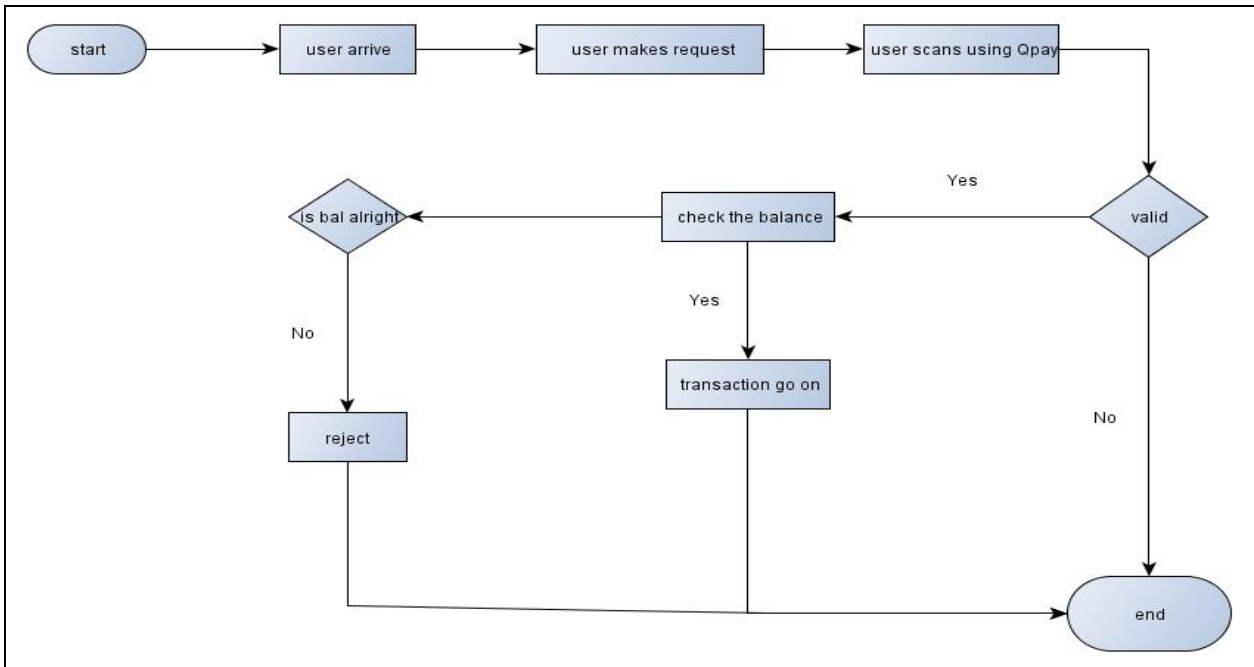


Fig 3: System flow diagram

- Start: the whole action starts
- User arrives: the user arrives at the point of sale to purchase the goods.
- User makes request: The user makes request by accessing the Qpay application by logging in.
- User scans: upon accessing the application the user scan the generated QR code which would have been generated by Qpay Generator.
- Check Balance: if the scanning is valid there is the checking of balance and if not, the system ends
- If balance is ok then the transaction goes on but if there is no money then the transaction is stopped and the transaction is rejected
- After all then the transaction then the whole process ends.

5.4 System Architecture

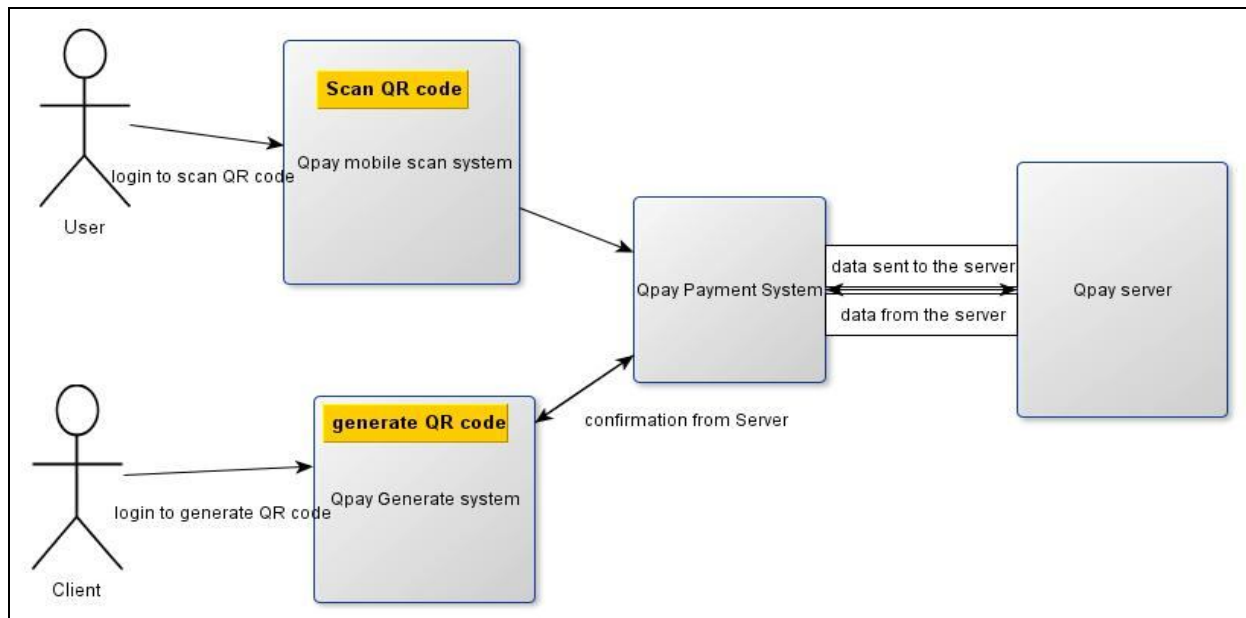


Fig 4: System architecture

- User: the user logs in Qpay using android mobile so that the user is able to scan the QR codes.
- Client: the client logs in the Qpay generate so that the client is able to generate QR codes.
- Qpay System: the Qpay system then takes scanned data and posts it to the server so as to make transactions.
- Qpay Server: the Qpay server, after all transactions have occurred posts back to the Qpay generate system as confirmation code.

6. Results Discussion

The aim of the project was to evaluate the feasibility of a cashless mobile payment system developed on Android Smartphone. The new system proved to be safer since they is no need to carry physical cash. Just like any other financial system, all sensitive data was to be encrypted. The security of the system was compared to similar payment methods. The system developed had some screen shots which are shown overleaf.

*Fig 5: Home Screen*

To get to home screen the user has to first login in or signup to use the system. The Home Screen has two buttons which are scan and wallet.

Scan Button: the scan the button gives you access to the option screen where you get to choose the option which one wants to use.

Wallet Button: the wallet button gives the user to see the wallet which comprises of the user details and the balance in the user account.

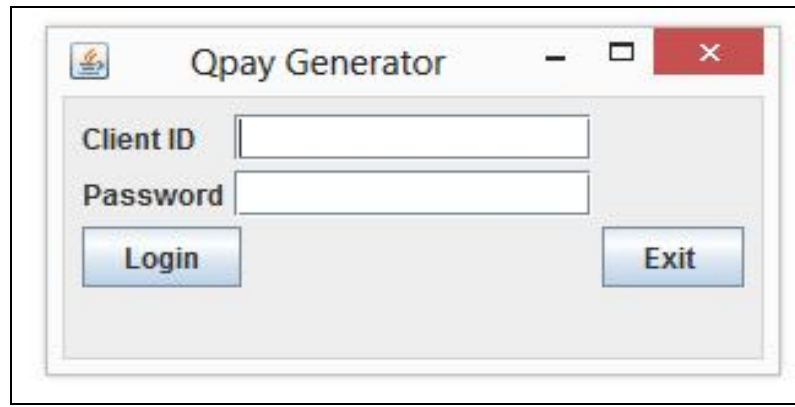


Fig 6: Scanning screen

The Scanning screen is used to scan the generated QR codes.

The user places scanned data in between the red line and it outputs the data on the screen.

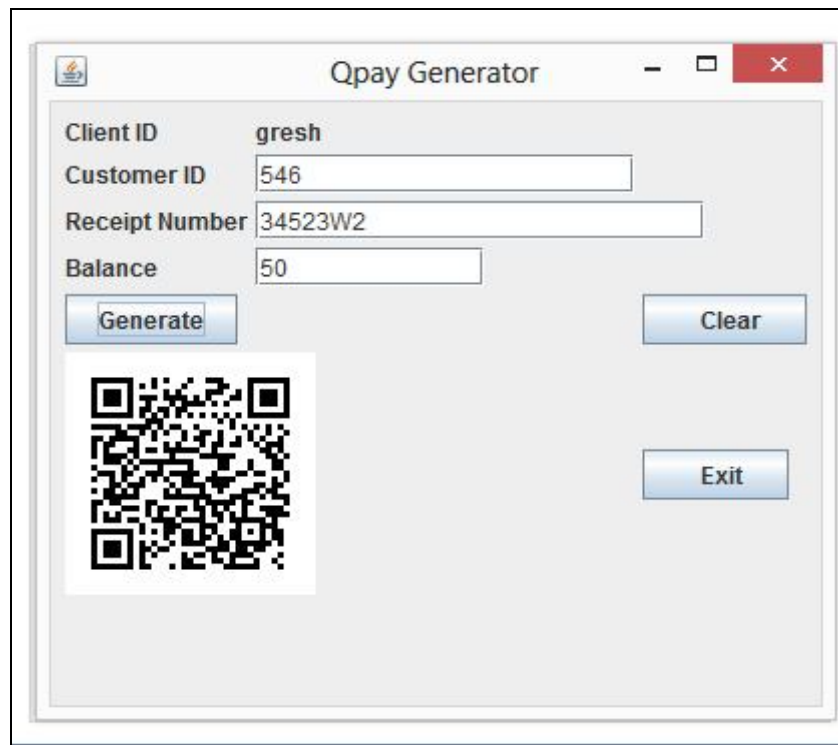
Use Qpay Button: used to post scanned data to the server which will be web based.


Fig 7: Qpay Generator login

The client signs in with the given ID and inputs password for the following logical reasons which are authentication, verification and validation.

Login Button: logs in the client and gives the client access it uses the Qpay Generator to generate QR codes.

Exit Button: gives the client option to exit the system if it is no longer required


Fig 8: Qpay Generator

The Qpay generator generates QR (Quick Response) Codes. When the client logs into the system the Client Id becomes permanent and uneditable, and the following variables which are Customer ID, Receipt number and balance are filled to complete the QR code generate process.

Generate Button: the generate button generates the QR code.

Clear Button: it clears the fields for new data to be generated.

Exit Button: it end the process and exits the system.

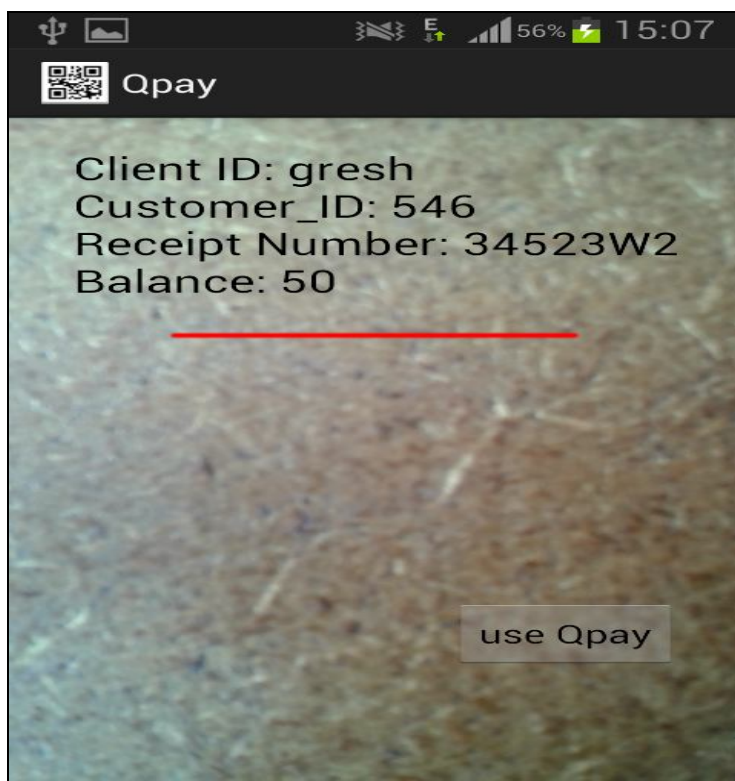


Figure 9: Fig 9: Scanned data

Scanned data is displayed on the mobile screen so that it is ready to be posted to the database. As shown in the figure above, there is the Client Id from previous diagrams which is gresh and all the other variables of the textfields are being shown. This is the data which is send to the database

Use Qpay button: is the button which posts data to the database

Red Line: this is where the scanning takes place. One place the QR code in-between the red line so that the scanned data is displayed.

7. Conclusion

The objectives of the project were met. Having been equipped with a clear statement of system requirements and design specifications the application was developed using Java Eclipse and android Eclipse. The system design and implementation was successfully done properly and the Qpay Android Application System is now working properly. The application was designed with the system requirements in mind thus; it fully meets all the specified requirements. An object-oriented approach was used during development in order to maximize on code reuse thereby minimizing development time. At the conclusion of each module, coding the system was tested for the syntax and logic errors and this process was carried out on incremental basics until the entire system was tested as a whole. In the research conducted it seemed that the young generation were accepting the use of QR codes since it was a technological innovation idea so this means that this demography is more accepting and trusting towards new technologies and looking for the most convenient choices.

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