SOLUTION TO CUSTOMER LOYALTY PROBLEM

A PROJECT REPORT

submitted by

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in partial fullfilment of the requirements for the award of the degree

of

Master of Computer Applications

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DECLARATION

I undersigned hereby declare that the project report SOLUTION TO CUSTOMER LOYALTY PROBLEM, submitted for partial fulfillment of the requirements for the award of degree of Master of Computer Applications of the APJ Abdul Kalam Technological University, Kerala is a bonafide work done by me under supervision of Prof. Baby Syla. This submission represents my ideas in my own words and where ideas or words of others have been included, I have adequately and accurately cited and referenced the original sources. I also declare that I have adhered to ethics of academic honesty and integrity as directed in the guidelines of Institutional ethics committee of the college and have not misrepresented or fabricated any data or idea or fact or source in my submission. I understand that any violation of the above will be a cause for disciplinary action by the institute and/or the University and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been obtained. This report has not been previously formed the basis for the award of any degree, diploma or similar title.

Place : Trivandrum

Date : 19-11-2019   Vyshak Puthusseri

DEPARTMENT OF COMPUTER APPLICATIONS

COLLEGE OF ENGINEERING TRIVANDRUM

CERTIFICATE

This is to certify that the report entitled **SOLUTION TO CUS-TOMER LOYALTY PROBLEM** submitted by **Vyshak Puthusseri** to the APJ Abdul Kalam Technological University in partial fulfillment of the requirements for the award of the Degree of Master of Computer Applications is a bonafide record of the project work carried out by her under my guidance and supervision. This report in any form has not been submitted to any University or Institute for any purpose.

Head of the Dept   Project Guide

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If words are considered as symbols of approval and tokens of acknowledgement, then let words play the heralding role of expressing my gratitude.

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Vyshak Puthusseri

ABSTRACT

Coupon fraud is one of the biggest problems in a business world. Our problem is related to discount coupon tampering in a retail chain. In this, a manufacturer distributes their product to the retailers where they provide discounts to the products. All the retailers get access to the discount coupons of the products and this is shared to the customers. Customers can redeem the discounts of the product and buy them in low cost. Our aim is to solve the tampering in these coupons so that the manufacturers do not face loss. We use blockchain to solve this problem. The immutability and transparency in blockchain help us to do this. We generate the coupons as e- coupons(QR-code) into blockchain network as a hash of the product details including the timestamp. Once we do this no one can change them due to the immutability feature provided by the blockchain also everyone in the chain can view the sales made. It also enables the B2B and B2C in the e-commerce.

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Chapter 1

Introduction

The paper coupon market has been with us almost since shopping was first invented. Practically all retail outlets, big or small, have used coupons at least once in their lives. The primary motivation is either to attract more customers by offering them a discount or to enable them to pay in advance for gift vouchers that are subsequently passed on to third parties. The major disadvantage of the paper based coupon was its cost and difficulties in distribution of the coupons. Also the accounting process becomes extremely time consuming. There are issues related to study the market feedback. A very high proportion of paper coupons are never returned. Paradoxically, a bigger problem is that no firm evidence can be identified to help explain why some actually are returned! All these problems can be solved by digitizing the coupon industry. But a major problem arises due to the arrival of digital coupons. The coupons are getting manipulated by some individuals, which causes a lot of loss to the merchants. So in many situations the loyalty of the customer has to be cross validated by the retailers.

With the normal encryption mechanism, up to a certain extent this problem can be solved. But if the attacker was highly skilled with tremendous computation power those techniques wont last long. We approach this problem with the disruptive technology, the blockchain. The retailers can generate coupons for a particular product and can share it with the universe using any social media. The coupons are stored in an open source blockchain platform called Ethereum. With the underlying security mechanism of the ethereum blockchain, our system was tamper-proof, as till date nobody was able to break the blockchain network.

Chapter 2

Requirement Analysis

2.1 Purpose

Using coupons is a popular and easy way for shoppers to cut the cost of groceries, personal care items and other household products, but couponing is not easy without its rules and regulations. It is important for couponers to understand the guidelines and stay within the legal boundaries when using coupons. Failure to do so could result in coupon fraud, which can lead to criminal charges.

2.2 Definition of Coupon Fraud

The Coupon Information Corporation (CIC) has defined coupon fraud as occurring *"Whenever someone intentionally uses a coupon for a product that he/she has not purchased or otherwise fails to satisfy the terms and conditions for redemption, when a retailer submits coupons for products they have not sold or that were not properly redeemed by a consumer in connection with a retail purchase; or when coupons are altered/counterfeited."*

The aim of the project is to build a system that can completely eliminate the coupon fraud and to ensure the end to end security between at all user level levels. This document explains various features of the management system and its requirements.

A blockchain-based digital coupon issuing system can solve all these problems. In the case of hashCODE, the verification process is made as simple as giving in a coupon hash as input and obtaining the coupon details. The hash of each and every coupon generated by the retailer lives in the blockchain along with the smart contract. It makes sure that coupon cannot be changed as it would corrupt data in all other blocks of the blockchain as well. In a blockchain, individual blocks can only be added with the consent of all other parties. This prevents the generation of fake coupons.

The major objectives behind this work are as follows:

- Elimination of coupon fraud

- Soft copies ensure that no coupons are lost

- End to End security at different level of users.

2.3 Overall Description

Blockchain coupon verification for retail chain can benefit the retail marketing in large. The manufacture can provide a trusted platform to their retailers and customers to verify their discount coupon from anywhere in the globe. This can happen only through technical integration with current technology. Blockchain for retail chain can be the correct solution for this. All retail chain comes under some manufacture, the manufacture publishes some discount coupons to increase their sales, they induce some validity to it, then they release the coupon to the customers. The customers can redeem the coupons from any outlets of the manufacture, where the retailer will collect the coupon verify it and provide the corresponding discount associated.

- Manufactures
  Manufactures are the one who setups the retail chain. The retail chain can be spread across the globe, various part of the country or can be within a state. Our particular product is focusing on a large retail market where the retail outlets are spread across the globe.

- Retailers
  In most of the scenarios the manufacture provides the full authority of publishing the coupons to the retailers, where it's a large market. The retailer is the one who manages a outlet under the manufacture, so he is responsible for the sales of the product under that locality. So, he can publish various coupon according the marketing needs, to increase his sales.

- Customers
  Customer simply uses the discount coupon published by the retailers, while having their purchase.

2.3.1 Product Functions

The main functions of the proposed system include:

- Retail market setup – Adding the retailers.

- Adding the product details.

- Coupon code generation.

- Publishing the coupon.

- Verifying the coupon code at any end level.

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2.3.2 Hardware Requirements

- Intel Core i3 or equivalent processor

- 4 GB or more RAM

- 750 MHZ or more CPU Speed

- 500 GB or more hard disk space

2.3.3 Software Requirements

- Linux

- Ethereum blockchain

- NodeJS

- Web3 framework

2.4 Functional Requirements

Functional requirements outline the intended behaviour of the system. This behaviour may be denoted as tasks or functions that the specified system is intended to perform. The proposed system consists of the following parts. They are given below:

2.4.1 Web Interface

A web interface facilitates the interaction of the users with the system. The manufacture adds the retailer, retailer generates the discount coupon. A QR code is used corresponding to each coupon, this QR code get scanned and discount get redeemed by the customers.

2.4.2 Ethereum Blockchain

Ethereum blockchain is very much similar to the bitcoin network. Ethereum blockchain provides a platform to build decentralized applications known as Dapps. Similar to the bitcoin network, Ethereum is purely decentralised. One of the factors that distinguish Ethereum blockchain from bitcoin is that it is programmable. In addition to the transactions, each block in the blockchain contains a code snippet called smart contracts. It helps in bringing together people and organisations from different dimensions of society without any third party dependency. Ethereum

blockchain contains blocks of transactions. Each block contains a list of transactions and a code snippet called smart contract. Ethereum uses an algorithm called proof of work algorithm to verify the entire network. An important data structure that is used by Ethereum is the Merkle tree. Each and every transaction in Ethereum is represented by a hash value. Merkle tree is a tree made of transaction hash values. Inside a block, two transactions are paired to form a single hash. Then two paired transactions together form another hash. This process continues until we get a single hash at the root. The root of a Merkle tree will be an outcome of the entire transactions within that block. Smart contacts are the crucial components which live inside the blocks of blockchain in the form of snippets of code. Solidity is the most popularly used smart contract programming language. The solidity code is very similar to javascript. Smart contracts are a set of rules and conditions which has to be followed during transactions. Smart contracts are an integral part as it eliminates the need for trusted third parties.

2.5   Non Functional Requirements

Non-Functional requirements define the general qualities of the software product. Non-functional requirement is in effect a constraint placed on the system or the development process. They are usually associated with product descriptions such as maintainability, usability, portability, etc. it mainly limits the solutions for the problem. The solution should be good enough to meet the non-functional requirements.

2.6   Performance Requirements

- Accuracy: Accuracy in the functioning and the nature of user-friendliness should be maintained in the system.

- Speed: The system must be capable of offering speed.

2.7   Quality Requirements

- Transparency: The system provides correct data to all participants

- Scalability: The software will meet all of the functional requirements.

- Maintainability: The system should be maintainable. It should keep backups to atone for system failures and should log its activities periodically.

- Reliability: The acceptable threshold for the downtime should be as long as possible. i.e.mean time between failures should be as large as possible. And

if the system is broken, the time required to get the system back up again should be minimum.

- Consistency: The data should be consistent and precise The system would need a stable internet connection to store and retrieve data from the blockchain database.

Chapter 3

Design And Implementation

3.1 Overall Design

Our system is a blockchain based digital coupon validation system. The system enables the retail chains to issue coupons. The retailers can verify the coupon when the customer came to redeem it. It also makes the verification much more efficient by enabling customers and retailers to verify the genuineness of the coupons. And there by enabling the solution to the customer loyalty issues.

3.2 User Interfaces

One of the main aims while designing the system was to abstract as much lower level details of the system as possible from the user. This system provides a web interface for its users. The interface is developed using NodeJS's Express framework.

3.3 System Design

The only technology on earth today that could handle all these problems and provide us with immutable, verifiable and trustworthy certificates is 'Blockchain'. The proposed system uses the public blockchain technology called Ethereum blockchain and the highly distributed. Here the focus is on solving the problem with the digital coupons storing and validation. This system provides the retailers to verify the genuinely of the coupons brought by the customer.

3.3.1 Creating the discount coupon

The authenticated retailer can add discount to a particular product with a particular time validity. Those data was hashed using the sha256 algorithm and was stored in an etherum blockchain. The hashed code will be published and will be shared in various media in the form of a QR code for better representation. Whenever the retailer added a new discount coupon, he can create the respective coupons and will publish it.

3.3.2 Verifying the coupon

The customer can bring those coupons and redeem them for a particular product. A coupon will only work for that particular product. All those constraint checking was done at the time of verifying. From the scanned QR code, the hash code will be detected, and it will be matched with the particular index of the deployed contract. By using the corresponding index, the aggregate data can be retrieved.
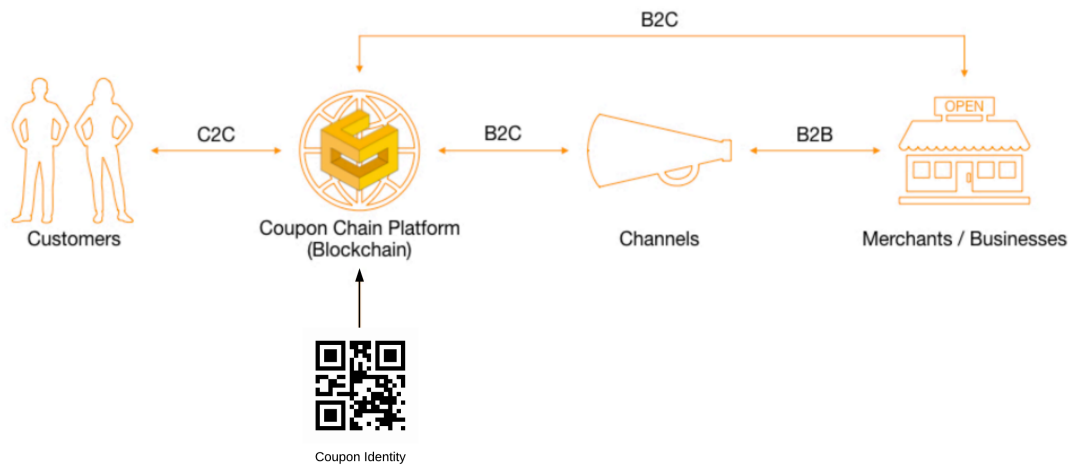

Figure 3.1: Graphical flow

3.4 Data Flow Diagrams for the System

These diagrams gives a clear picture about the privileges of each user. Also the entire working flow was specified in this. The DFDs are as follows:
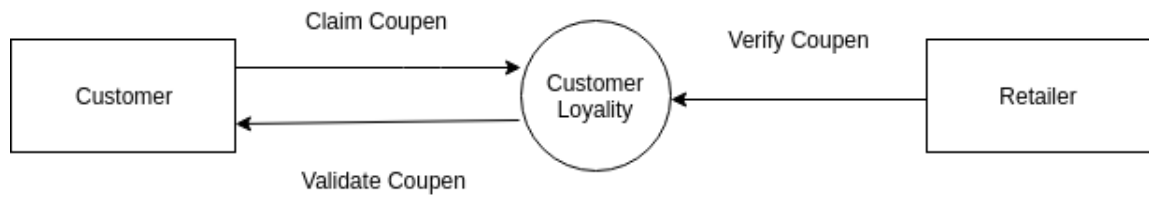

Figure 3.2: Level 0.1 Data Flow
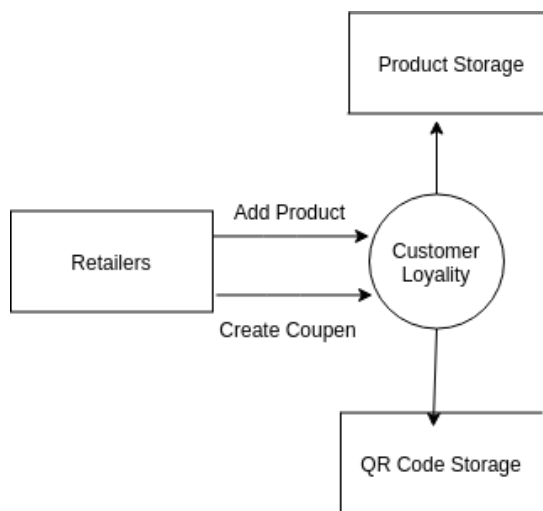
Figure 3.3: Level 0.2 Data Flow
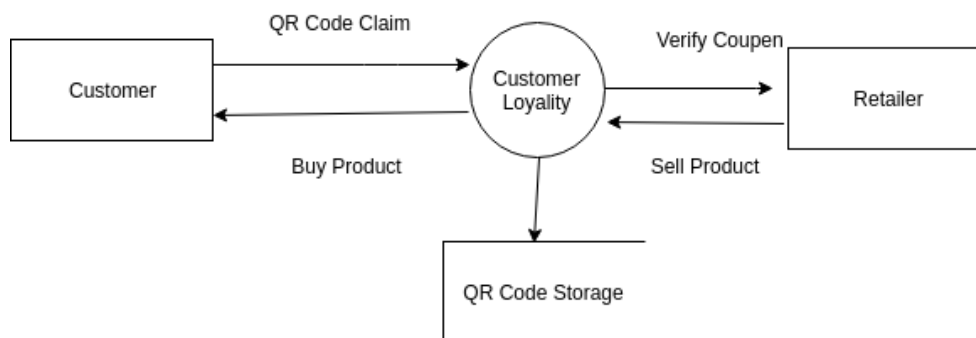

Figure 3.4: Level 1.1 Data Flow

Figure 3.5: Level 1.2 Data Flow

3.4.1 Screenshots

screench0t 1 and 2

scfreenshot 3 and 4

scfreenshot 5 and 6

Chapter 4

Coding

Algorithm 1 AddProduct

1: Start
2: Input product details
3: Store the student details in database
4: Store the mapping value for each product
5: Stop

Algorithm 2 AddDiscount

1: Start
2: Input the discount details
3: Create the hash value with the timestamp
4: Store the mapping value for each hash value
5: Create the respective QR code
6: Stop

Algorithm 3 VerifyCode

1: Start
2: Read the QR code
3: Obtain the hashcode from the QR code
4: Obtain the corresponding mapping value
5: Display the details of the discount coupon.
6: Validate the corresponding coupon
7: Stop

Chapter 5

Testing and Implementation

System testing is the stage of implementation which is aimed at ensuring that the system works accurately and efficiently before live operation commences. Testing is the process of executing the program with the intent of finding errors and missing operations and also complete verification to determine whether the objective are met and the user requirements are satisfied.

The ultimate aim is quality assurance. Tests are carried and the results are compared with the expected document. In that case of erroneous results, debugging is done. Using detailed testing strategies a test plan is carried out on each module. The test plan defines the unit, integration and system testing approach. The test scope includes the following: A primary objective of testing application systems is to assure that the system meets the full functional requirements, including quality requirements(Non-functional requirements).

At the end of the project development cycle, the user should find that the project has met or exceeded all of their expectations as detailed in requirements. Any changes, additions or deletions to the requirements document, functional specification or design specification will be documented and tested at the highest level of quality allowed within the remaining time of the project and within the ability of the test team.

The secondary objective of testing the application system is to identify and expose all issues and associated risks, all known issues are addressed in an appropriate matter before release. This test approach document describes the appropriate strategies, process, workflows and methodologies used to plan, organize, execute and manage testing of software project "Solution to customer loyalty problem"

5.1 Unit Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Register retailers	Generate public key using the input details	Same as expected	Pass
2	Generate coupons	Coupons generated	Same as expected	Pass
3	Add the coupons hash to blockchain	coupons hash added to blockchain	Same as expected	pass
6	Retailer login to the system to verify coupons	Create new discounts	Same as expected	Pass
4	Verify the coupons	Displays the transaction details if the coupons is valid	Same as expected	Pass

Table 5.1: Unit test cases and results

5.2 Integration Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Ganache-cli and Web3JS connection	connection establishes	Same as expected	Pass
2	Front end-Blockchain connection	connection sets up	Same as expected	Pass
3	Store and retrieve data	Stores and retrieves coupons	Same as expected	Pass

Table 5.2: Integration test cases and results

5.3 System Testing

Sl No	Procedures	Expected result	Actual result	Pass or Fail
1	Run ganache-cli	Ganacle-cli runs	Same as expected	Pass
2	Deploy contracts	Contract deploys	Same as expected	Pass

Table 5.3: System test cases and results

Chapter 6

Results and Future Scope

It is observed that the system performs all the functionalities as expected. The main aim behind this venture was to solve the issues related to the customer loyalty using the blockchain technology. The retailer can successfully login and generate discount coupons, edit and digitally sign the coupons. Anyone can verify the credibility of the coupons generated.

6.1 Advantages and Limitations

The proposed system features a lot of advantages over the existing system. It solves the problems of the existing system. The proposed system is way more secure than the existing system in many ways. Like any other system, this system also has its own advantages and limitations. The point is that its advantages override its limitations.

6.1.1 Advantages

- The system proposes an innovative blockchain based solution to customer loyalty problem

- The authentication data of the credential which gets published to blockchain is immutable, trustful and verifiable.

- The new approach of verifying the coupons(scan the QR code) simplified the workflow to be more efficient.

- The system can save the organization from the huge loss that can happen in long run.

- The core data of the credential is secure and private even the blockchain technology crashes in the future.

6.1.2 Limitations

- Nowadays, the applications related to the blockchain technology are still in the experimental phase.

- The blockchain technology is not widely accepted by the public since most of the people trust third-party organizations.

- The retailer needs to use the private key to login to the system. However, the private key is a set of some irregular hexadecimal characters which is hard to remember.

6.2   Future Extensions

The system can be generalized so that in future the online shopping websites can incorporate our system to scale their architecture. Also if a supply chain management system using the blockchain was added along, it will be more useful.

The combination of AI with our system can increase the overall profit of the retail chain as the retailer can use machine learning techniques to choose for which product the discount has to applied and what should be the discount for that particular product. So in future we are trying to scale our architecture into a fully fledged e-commerce company.

Chapter 7

Conclusion

The retailers create a promo code for a particular product with some discount and add the corresponding details get added into the blockchain. Corresponding to the data added, a hash value gets generated. Using the hash value, a QR code is going to be generated, and which is going to be publicly advertise. The customer with that QR code can go to a verified dealer and he can give the discount as prescribed. Till date no one was able to tamper the blockchain technology and so our system. The system provides permanent solution for the customer locality problem, makes it easily accessible from anywhere and everywhere. Cryptography protection ensures that the data is tamper-proof and immutable. The digital coupons help us to avoid the delay in physically doing the transactions. Moreover, it can help us to save time. It solves all such problems of traditional coupon industry. The implementation of this system will mop off fake coupons generation and manipulations.