Fake Product Identification System using Blockchain

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Certificate

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Abstract

In the technological world, blockchain technology is becoming a necessity to prevent ourselves from very large number of cyber attacks and threats. Blockchain is becoming more and more famous due to its unchangeable state, it quickly covered all the main stream areas of technology. Cryptography which is transacting huge amount of digital money on the internet and this is all possible due to the features and qualities of blockchain. We are using this technology to cater one of the biggest problem that is counterfeit or fake products. So, in proposed project, Fake products are detected using a QR code scanner, where a QR code of the product is linked to a Blockchain. So this system may be used to store product details and generate unique code of that product as blocks in the database.

Table of Contents

List of Figures

List of Tables

Chapter 1

Introduction

This chapter provides an overview for the proposed system. It describes what and how the proposed system will be implemented, which technologies and techniques will be used to achieve the goal of producing the proposed system. It also describes the objectives of the proposed system and defines the scope of this project. Lastly, it discuss the problems and issues due to which there is a need for this proposed system to be in the real world.

1.1 Domain Overview

How many times have we heard that people bought some branded product but got deceived and stuck with a counterfeit instead of the original product! So, to counter this issue the proposed system is going to use 2-D barcode embedded on every product which will be tied to a blockchain. Now, the question arises what is blockchain? Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain. Each block in the chain contains a number of transactions, and every time a new transaction occurs on the blockchain, a record of that transaction is added to every participant's ledger. The decentralized database managed by multiple participants is known as Distributed Ledger Technology (DLT). Blockchain is a type of DLT in which transactions are recorded with an immutable cryptographic signature called a hash [1]. Figure 1.1, shows the properties of Distributed Ledger Technology (DLT).

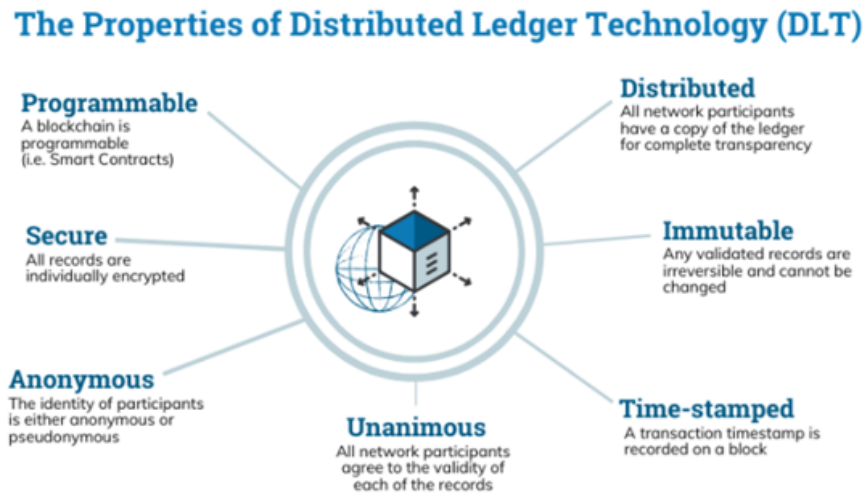

Figure 1.1: Distributed Ledger Technology

1.2 Objectives

The idea of this project came into existence because of the increase in the counterfeit products and to design an identification system to prevent selling and purchasing of counterfeit products with 2-D barcode using Blockchain.

The objectives of this project are:

i. To Design Anti Counterfeit System using Blockchain.

ii. To secure product details using a 2-D barcode.

iii. Provide security to the clients by offering data to client [2].

1.3 Problem Statement

Selling and purchasing of counterfeits are becoming more and more common nowadays especially in Pakistan. People buy products from wholesale market or from other places and sell them to other people saying that it is original or branded product like shoes, bags, watches etc. Most of the time, this issue arises in second hand purchasing where we cannot be hundred percent sure about the authenticity of the product. People cannot see the trail from manufacturer to the customer i.e., who made the product and to whom it was delivered and then if we are getting the same product or not. Global improvements in products and innovation are always accompanied by risk factors such as counterfeiting and duplication. Counterfeit products can affect the name of the organization and the well-being of its customers. Counterfeit detection is the biggest test today. Counterfeit products have a significant impact on a customer's organization and well-being. Therefore, the creator of the item faces a great disaster [2].

1.4 Project Scope

Proposed project will solve the issue of which product is original and which product is counterfeit for good. It will boost the confidence of people in buying the products from anywhere. It will build a trust between the manufacturer and the customer. An overview of proposed system should solve the brand anti-counterfeiting certification issue and will focus on expansion of sales channels and provide small providers opportunity to prove the source of each component product. The system is built on the blockchain, and the companies that wants to implement this system must register and modify contract status with fully disclosed smart contract information. Anyone can easily prove the legitimate source of their business. It also serves as proof that the consumer has purchased the item that the retailers can prove that they deliver seriously. With products that use this tamper-proof blockchain system, you no longer have to worry about competing with cheaply sold counterfeits. Proposed system is a user-friendly and does not confuse the user. User can easily navigate and do stuff that he wishes. Manufacturer and customer both will be needed to register first and then the manufacturer can add product. Whereas customer or user can see the product and authenticate their originality. User can also see the authenticity of the product before buying. User can see the product details by scanning the 2-D barcode generated from blockchain which will ensure the integrity of the data that the product is what they are saying or not.

Chapter 2

Literature Review

This chapter provides an oversight of the previous projects and research papers. It discusses their approaches, techniques used and technologies that they have implemented or suggested to implement in the future. This chapter basically give an idea about what has already been done and how it was done.

2.1 Existing Research

A Survey of Counterfeit Product Detection by Prabhu Shankar, R. Jayavadivel. Counterfeit products are growing exponentially with the enormous amount of online and black-market. So, there is a strong need to address the challenges of detecting counterfeit products and designing appropriate technology to improve detection accuracy. This is one of the active research areas to be explored in the current world. This paper discusses various techniques for identifying counterfeit products [3]. Smart Tags for Brand protection and anti-counterfeiting in the wine industry by steven, Marko. This paper describes a brand protection and anticounterfeiting solution for the wine industry based on smart tags and Cloud enabled technologies. The main idea behind smart tags is to utilize quick response codes and functional inks supported by the Cloud system and two-way communication between the winemaker and end-user.

A Blockchain-based Supply Chain Quality Management Framework by Si Chen, Rui Shi. In this paper, the authors proposed a blockchain-based framework. This framework will provide a theoretical basis for intelligent quality management of the supply chain based on blockchain technology. Furthermore, it provides a foundation to develop theories about information resource management in distributed, virtual organizations [4]. Authors of this paper discusses how the traditional cloud storage model runs in a centralized manner, so single point of failure might lead to the collapse of system. The system is a combination of the decentralized storage system, IPFS, the Ethereum blockchain, and attribute based encryption technology. Based on the Ethereum blockchain, the decentralized system has keyword search function on the cipher text solving the problem in traditional storage systems where cloud server returns wrong results [4].

Authors of this paper proposes a system that provides solution to originality and authenticity of published and posted online digital content like music, books, etc. The system utilizes emerging technologies that primary include blockchain and (interplanetary file system)IPFS. The solution is focused on authenticity of online books, but the solution in terms of architecture, design, logics, smart contract code are generic enough to be easily extended and is used to provide the originality, authenticity, and integrity to all other forms of digital assets. The authors considered two scenarios based on approval results provided by author for every publication requesting an attestation or validation before uploading the content [5]. Authors of this paper introduces the concept of Blockchain technology in information security of the food supply chain and comparing it with the traditional supply chain system. The proposed system focus on the disadvantages, promoting the blockchain in tracking, monitoring, and auditing the food supply chain and helping manufacturers to record the transactions in authenticity. The proposed system is not implemented in practical; they just gave the theoretical idea [6].

Authors of this paper demonstrates how blockchain works in the food supply chain with HACCP. The system proposed a new decentralized traceability system based on the internet of things and blockchain technology and explored the challenges in scaling block-chains in general. This system will deliver real-time information to all supply chain members on the safety status of food products. Also, the system can significantly improve the efficiency and transparency of the food supply chain, which will obviously enhance the food safety and rebuild the consumers' confidence in the food industry [7]. There exist numerous Blockchain-based applications are gradually being developed. Some of the applications focus on payment verification, such as digital currency [8], stock trading [9], or financial securities. Some focus on combining Blockchain with the Internet of Things (IoT), such as recording the device data of IoT [10]. Other Blockchain decentralized applications such as game [11], gambling [12], on-line voting [13], car renting [14], and so on. Here we will focus on a supply chain application, the recording data process on the supply chain is similar to their system's sale information recording. The preceding research in supply chain management based on Blockchain is discussed as follows.

In [15], the authors provide the design principles for supply chain management on Blockchain. The authors indicated that counterfeit products are an important issue that modern brands with multinational supply chain networks always need to acknowledge. By applying Blockchain in the supply chain data record, they can strictly monitor the flow of products. Authors of [16] analyses the advantages and disadvantages of binding RFID [17] and Blockchain technology on the supply chain and cover the process of information management in Blockchain application. The authors claims that given the Blockchain characteristics, the information recorded on the Blockchain can be completely trusted. In the case study for product traceability [18], and the implemented system is named originChain. This system applies traceability of products by replacing normal centralized database with Blockchain data storage. The main idea of this system is to record the lab's product sample-testing results. A product ownership management system [19] published in 2017 presents a system that implements Ethereum to provide the holding certificate of the consumer and combined the RFID of products to make sure that the product has its own identity stored in the Blockchain. However, the proposed scheme cannot guarantee that the product the consumer purchased from the seller is not a counterfeited one. Hence, the product counterfeit problem is still unsolved.

On the business side, a company called Seal Network [20] is combining Blockchain technology and Near-field communication (NFC) to develop a product authentication platform. This company inserts NFC chips into each item and use them as the certificates of the product. The NFC data is uploaded into the company's Blockchain. However, using NFC chips is not suitable for all types of products. For instance, fresh food or small commodities. Furthermore, in this kind of system, customers still get the products from the sellers and not directly from the manufacturer and reasonably the consumers may have concerns trusting the sellers. Ma et al. [21] proposed a fully anti-product forgery system to implement a Blockchain architecture provided by Ethereum to record product ownership on the Blockchain. By using this technology's transparency properties, and the guarantee that each record cannot be faked on the Blockchain, the end-users do not require to completely depend upon trusted third parties to carefully know the origin of the bought product.

Small and medium-sized organizations can make use of this anti-product forgery application that will bring down the fees which they need to pay to monitor the authenticity of the products and by this system the authors of this paper aim to solve the issue of brand anti-counterfeiting certification and providing the small salespersons an opportunity to validate the source of each component of their product [22]. Using the completely revealed smart contract details, anyone can simply verify the genuine source of the business and can even serve as proof for the end users' purchase of goods. For retailers, it is possible to prove whether they provide legitimate products by using this anti-counterfeit Blockchain system. So, by using this approach the users of this system will be benefited in a manner as firstly, they will have to pay a low transaction fee, and secondly, they need not be concerned about acquiring a fake product.

S. Uhlmann [23] explores the chances to lower down the fake products using the Blockchain technology and his thesis also shows that the counterfeiting of products cannot be brought down only by the use of technology, but people do require to maximize their general awareness and they should start challenging the caught counterfeited products legally in court and must be having an inviolable packaging of the products as well in order to assure of its safety. In this thesis, the issues and results of counterfeiting were acknowledged and different blockchain technologies and deployment models are discussed and analyzed to achieve the goal of reduction in the counterfeited products in the market. The authors believe that alone blockchain cannot bring down the fake products in the market, but it can be useful when combined with some other trending technologies of today's world like using Internet of Things (IoT) devices where each transaction of a product is saved, and this can allow proper transparency along with data security. The combination of the IoT and Blockchain technology might empower utilization on the ways to reduce counterfeits. we have observed in this paper that no such model is proposed which could effectively lower down the counterfeits, instead only ideas were provided as future work for the combination of Blockchain with IoT to prevent product counterfeiting. All the research papers from which this research is done is shown in Table 2.1.

Table 2.1: Research Papers

S.No.	Title	Year	Techniques Used	Description
1	RFID: Radio Frequency Identification	2005	RFID and Blockchain	Analysis of advantages and disadvantages of binding RFID and Blockchain on supply chain.
2	Anomaly Teletraffic Intrusion Detection Systems on Hadoop-Based Platforms: A Survey of Some Problems and Solutions	2012	Telecommunication and Blockchain	An Anti-product forgery application for small and medium sized organizations based on Blockchain.
3	ADEPT: An IoT practitioner perspective	2015	IoT and Blockchain	A blockchain based application for storing device data of IoT.
4	An agri-food supply chain traceability system for China based	2016	RFID and Blockchain	Analysis of advantages and disadvantages of binding RFID and Blockchain on supply chain.
5	A Blockchain-Based Supply Chain Quality Management Framework	2017	IPFS, Encryption and Blockchain	The system is a combination of the decentralized storage system, IPFS, the Ethereum blockchain, and attribute based encryption technology.
6	Blockchain Application in Food Supply Information Security	2017	IPFS and Blockchain	Introduces the blockchain in information security of food supply chain.
7	Application of Bitcoin Data-Structures & Design Principles to Supply Chain Management	2017	Supply Chain Network and Blockchain	Monitoring the flow of products through blockchain.
8	Adaptable blockchain-based systems: A case study for product traceability	2017	Centralized and Blockchain	Traceability of products by replacing normal centralized database with Blockchain data storage.
9	A novel blockchain-based product ownership management system (POMS) for anti-counterfeits in the post supply chain	2017	RFID and Blockchain	Implements Ethereum to provide the holding certificate of the consumer and combined the RFID of products.
10	A Survey Of Counterfeit Product Detection	2019	Smart Tags and Blockchain	Discusses various techniques for identifying counterfeit products.
11	A blockchain-based application system for product anti-counterfeiting	2020	Ethereum Blockchain	Provides authenticity of products through implementing Ethereum blockchain.
12	Fake Product Detection Using Blockchain	2021	Blockchain	Discusses the issues and problems of counterfeit products in the world.

Chapter 3

Requirement Specifications

This chapter provides the required information on the specifications of the proposed system. It describes the functionality and need of the proposed system and also the requirements that the user or customer has demanded.

3.1 Proposed System

Proposed system allows the manufacturer or the customer to register themselves in mobile app if they have not registered yet and if they are already a registered user in the system then they can simply login and access the functionality of mobile app. Now, the functionality of proposed system is when user is through all of the register and login process then user appears on the home page of the app in which user will find different options whether it is to add a product by giving its specifications or to select a product to check the authenticity of it by scanning its unique 2-D barcode generated by the system which will then display the specifications of that specific product. User can also see the product list for reviewing that which product are already exists in the list for manufacturer and as far as customer is concerned, they can view to see which items are present to see their authenticity. Proposed system is different from other traditional systems in a way that people often see online things and wants them badly but just stops or do not approach because they know that online people does not offer the same product and quality that they show through the pictures of the product. So, in proposed system we will be providing the product's authenticity so that the user can be assured that the product is real and not fake or counterfeit. Figure 3.1, shows the flow of our proposed system.

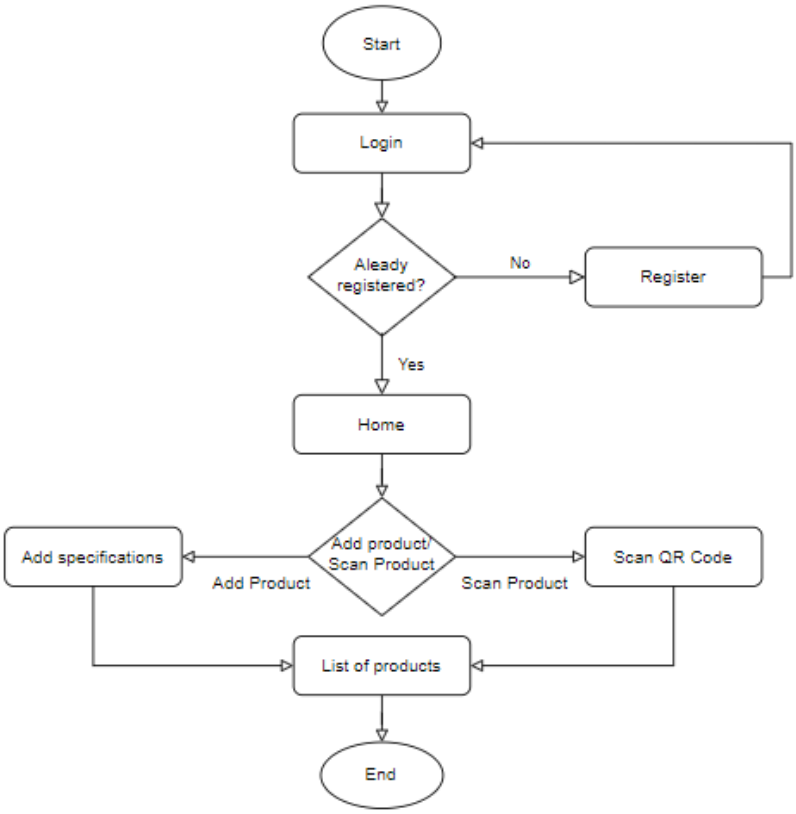

Figure 3.1: Flowchart of Proposed System

3.2 Functional Requirements

Following are the functional requirements of proposed system:

1. New user must register themselves first with the system to use the app. For registration, user must fill out the registration form.
2. Already registered user must login before using the app. For login, user must write their username and password correctly for successful login.
3. User must provide accurate specifications of a product to be added to ensure the authenticity of the products and their unique barcode.

3.3 Non-Functional Requirements

Following are the non-functional requirements of proposed system:

1. **Reliable**
   Proposed system is reliable in terms of performance and authenticity.
2. **Availability**
   Proposed system will be available to the user in every platform for them to use.

3. **Feedback**
   User can give feedback regarding their experience with the product whether it is good or bad. If it is bad, then we will improve the system according to the given input and for good feedback we will appreciate their feedback.

4. **Usability**
   Proposed system is user-friendly and easy to navigate. There is no complex things and hidden options. Everything is clear and right in front of the user. User can easily do things that they want.

5. **Effectiveness**
   The algorithms, tools and techniques used for creating this system is effective and efficient as they produce accurate and fast results.

6. **Integrity**
   Data backups will be done frequently so that there is no data loss in unforeseen situations.

7. **Security**
   Proposed system is very secure and safe in every possible manner. User's personal information and their records will be confidential and will not be exposed except to them.

8. **Cost-Effectiveness**
   Proposed system will be free of cost and will be available to the user online.

3.4 Use Cases:

Use cases of Proposed system as use case can provide deep understanding and extensive explanation of the system.

3.4.1 Use Case for Registration

Figure 3.2 shows the use case for registration and Table 3.1 shows the tabular description of use case for registration.

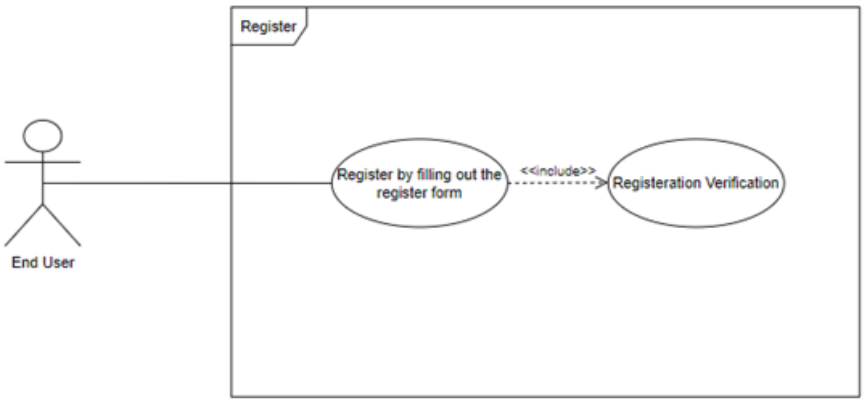

Figure 3.2: Use Case for Registration

Table 3.1: For Registration

Use Case Name	Registration
Use Case ID	AH01
Description	User must register by filling out the register form.
Primary Actor	End User
Stake Holders	End Users and company management
Pre-Condition	User must be new user to be registered.
Post-Condition	Successful registration of the user.
Basic Flow	• User will fill out the register form. • User will get a successful registration message.
Alternate Flow	• For wrong information of user, user can edit information and register again. • If user is registered already, a message will be displayed that you are already registered so no need for registration.

3.4.2 Use Case for Login

Figure 3.3 shows the use case for login and Table 3.2 shows the tabular description of use case for Login.

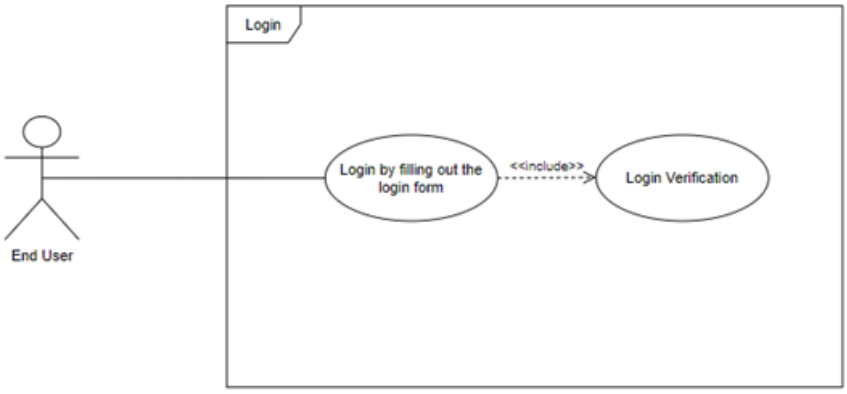

Figure 3.3: Use Case for Login

Table 3.2: For Login

Use Case Name	Login
Use Case ID	AH02
Description	User must login by filling out the login form.
Primary Actor	End User
Stake Holders	End Users and company management
Pre-Condition	User must be registered.
Post-Condition	Successful login of the user.
Basic Flow	• User will fill out the login form. • User will get a successful login message. • Home page will appear before the user.
Alternate Flow	• In case of wrong username or password, user will re-enter the username and password for login. • If user is not registered, a message will be displayed that will say the user is not registered.

3.4.3 Use Case for Adding Product

Figure 3.4 shows the use case for adding product and Table 3.3 shows the tabular description of use case for Adding a product.

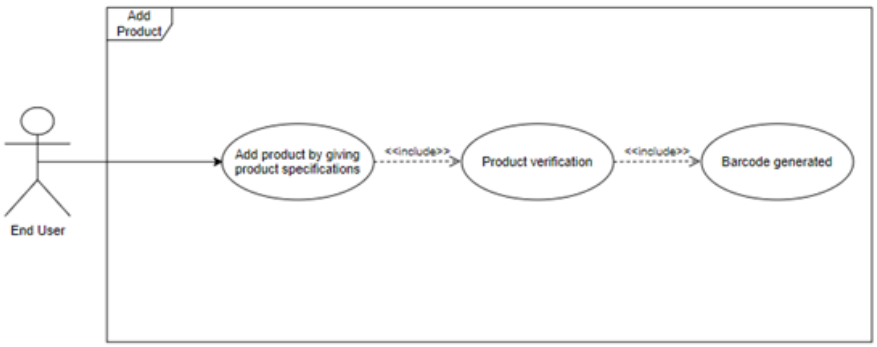

Figure 3.4: Use Case for Adding Product

Table 3.3: For Adding Product

Use Case Name	Adding Product
Use Case ID	AH03
Description	User can add a product by giving its specifications.
Primary Actor	End User
Stake Holders	End Users and company management
Pre-Condition	User must login successfully.
Post-Condition	Access to add a product.
Basic Flow	• User will select add product option. • Form will appear and user will give the specifications of a product. • Product will be added in the system.
Alternate Flow	• Product is not added or barcode for that product is not generated. • Product already exists in the system.

3.4.4 Use Case for Product Authentication

Figure 3.5 shows the use case for product authentication and Table 3.4 shows the tabular description of use case for Product Authentication.

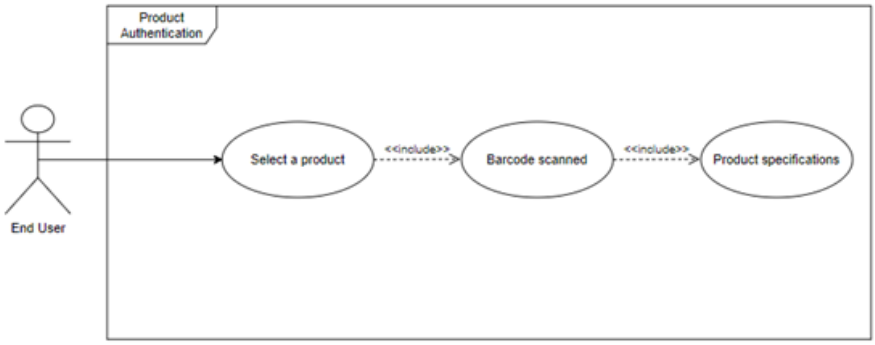

Figure 3.5: Use Case for Product Authentication

Table 3.4: For Product Authentication

Use Case Name	Product Authentication
Use Case ID	AH04
Description	User can view if a product is authentic or not by scanning its barcode.
Primary Actor	End User
Stake Holders	End Users and company management
Pre-Condition	User must login successfully.
Post-Condition	User will be showed specifications of scanned product.
Basic Flow	• User will select a product. • Barcode will appear on a screen. • User will scan it and product specifications will appear.
Alternate Flow	Product is not authentic as there is no record of it.

3.4.5 Use Case for Product Listing

Figure 3.6 shows the use case for product listing and Table 3.5 shows the tabular description of use case for Product Listing.

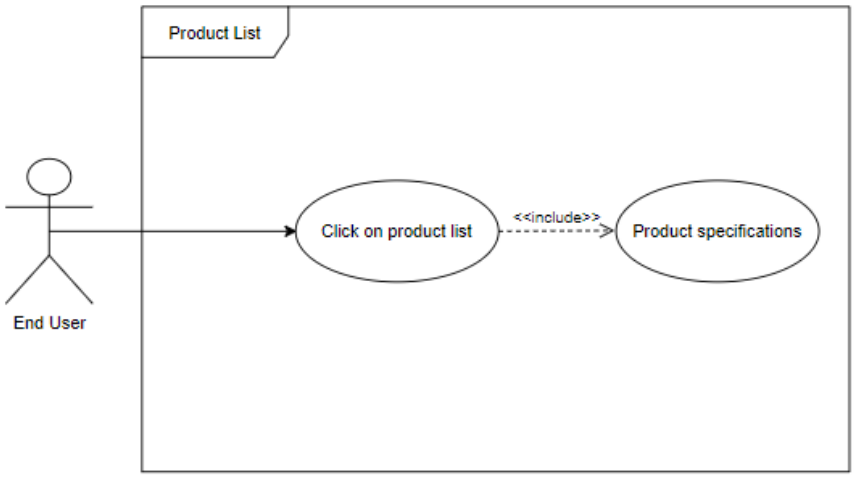

Figure 3.6: Use Case for Product Listing

Table 3.5: For Product Listing

Use Case Name	Product Listing
Use Case ID	AH05
Description	User can view list of products and specifications of the products.
Primary Actor	End User
Stake Holders	End Users and company management
Pre-Condition	User must login successfully.
Post-Condition	Access to view all products along the specifications.
Basic Flow	• User will select list of products. • Products will be listed down. • For specifications of a product, user must click on desired product.
Alternate Flow	Product is not present in the list.

Chapter 4

System Design

This chapter describes the design of the proposed system. It defines the different layers of the system and also the design constraints. It also describes the process which will be followed for the completion of the system design. It provides an inner as well as outer look on the proposed system functionality flow.

4.1 System Design:

Proposed system follows the 3-tier architecture that is presentation layer, logic layer and the database. This architecture is very reliable and efficient. All the three layers work together in such a way that if any thing is wrong with one layer, then other layers are not interrupted, and they continue to do their work.

4.1.1 Presentation Layer:

Presentation layer is the front-end of the project with which the user interacts directly. It is designed keeping in mind the comfort and ease of the user. Front-end is simple and easy to navigate. It is very appealing to the eyes and is user friendly. It is designed in android studio, flutter and dart language.

4.1.2 Logic Layer:

Logic layer is the backend of the project or the middle layer in 3-tier architecture. In this layer, all the operations and functions are performed. Like this, in proposed system, all the algorithms are implemented in this layer. Implementation of the backend is done with using blockchain technology and is done in android studio with kotlin language.

4.1.3 Database

This is the third and last layer of the 3-tier architecture which is database of proposed system which contains all the information regarding the user's bio data and product specifications. We have used Firebase as the database. It is very secure and helps protect the data of users and products.

4.2 Design Constraints:

Following are the design constraints of proposed system:

- User must have an android device with android version lollipop or higher.
- An internet connection is required.
- User must register to have its own account.
- User must put accurate and authentic information of the product.
- User must properly scan the barcode to check the authenticity of a product.

4.3 Design Methodology:

The methodology used for this project is Agile Methodology. It is very effective as well as efficient model which includes evaluation of the process at every step. It also monitors the progress that everyone has and helps them to work together and work better. Continuous communication between the user and the developers are kept priority so that nothing is out of sort for the customer. End result for this model is highly likable and appreciated. Figure 4.1, shows the Agile Methodology which we have used in the project.

Figure 4.1: Agile Methodology

4.4 High Level Design:

Following Figure 4.2, is the high level diagram of our system:

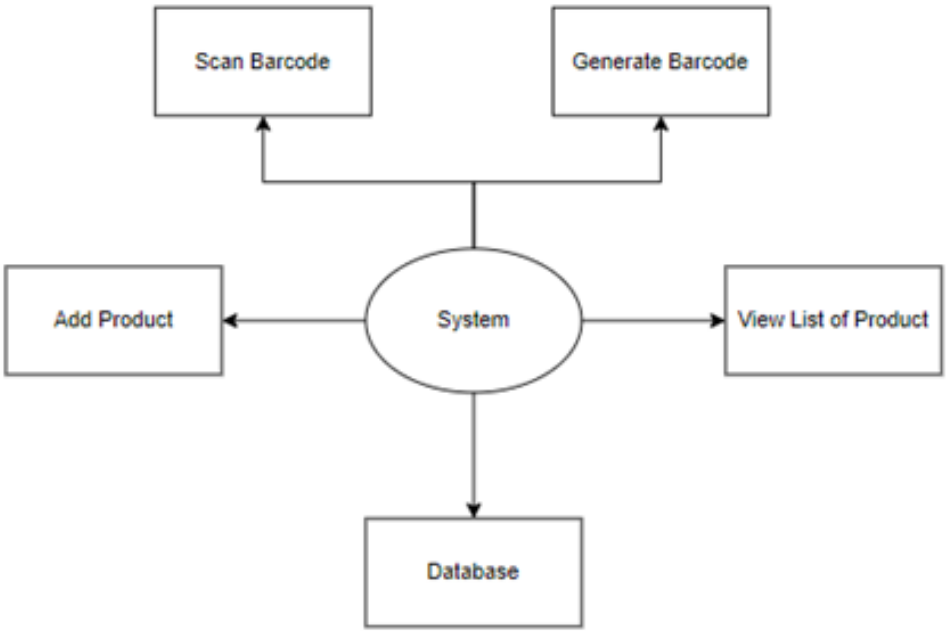

Figure 4.2: Block Diagram

4.5 Low Level Design:

Following Figure 4.3, is the high level diagram of our system:

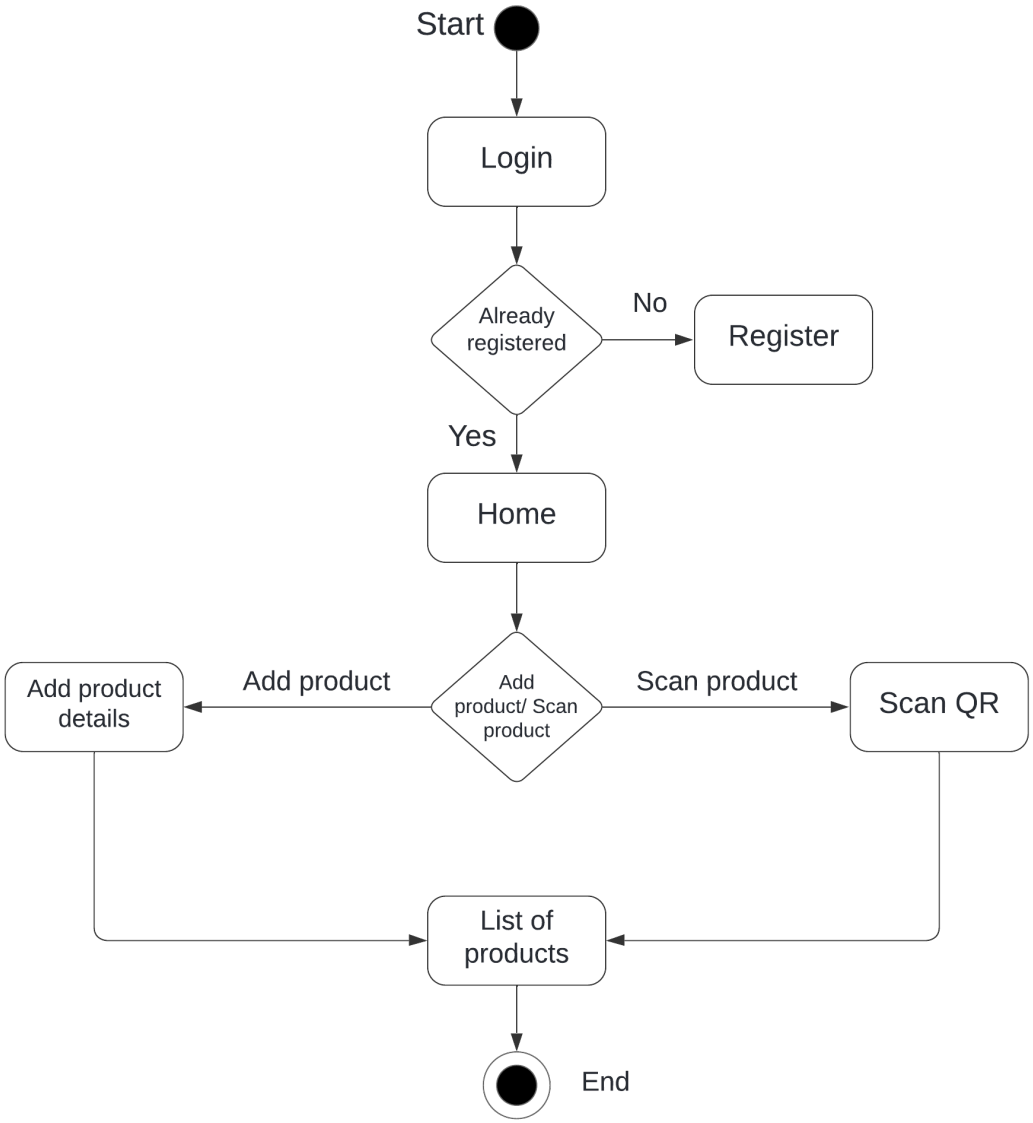

Figure 4.3: Activity Diagram

Following Figure 4.4, shows the conceptual model of our project:

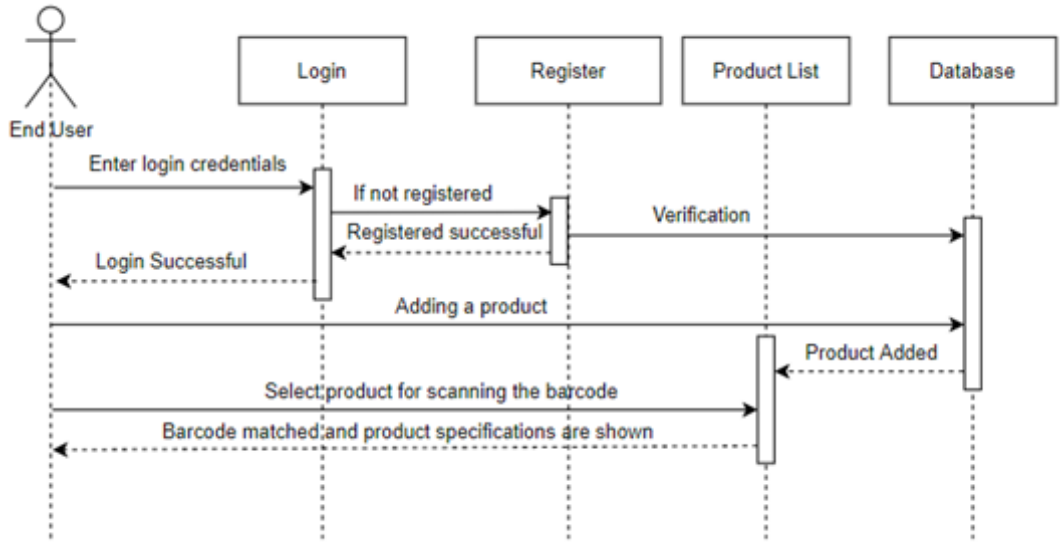

Figure 4.4: Sequence Diagram

4.6 GUI Design:

GUI is Graphical User Interface which helps the user to get desired outcomes of the request they want, and which is the most important purpose of any system that is to satisfy and please the user. This is done by functionality which very few users understands and with GUI which makes the user feel friendly and wanted like the system. Following Figure 4.5 and Figure 4.6 shows our GUI of mobile application:

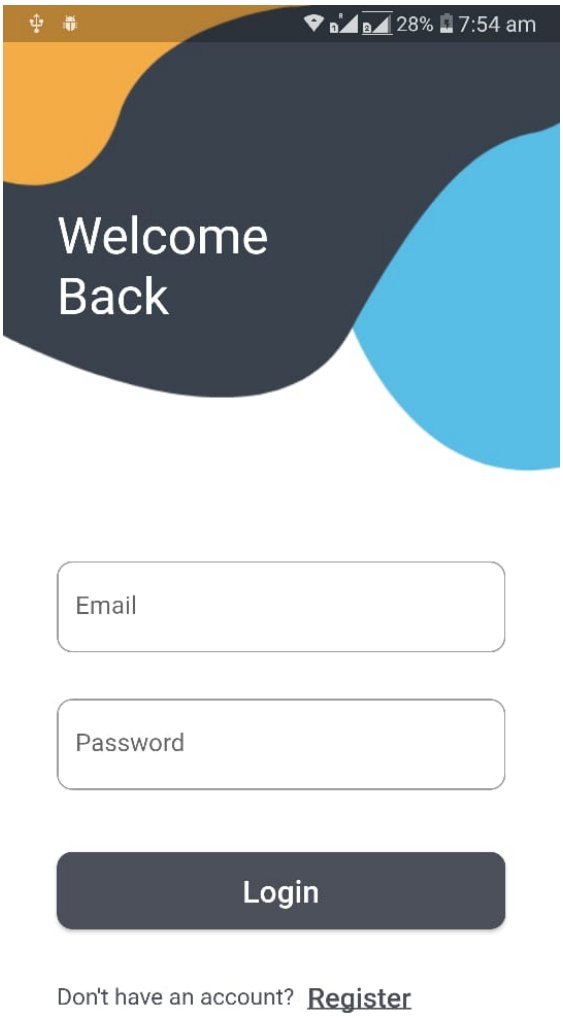

Figure 4.5: Login Page

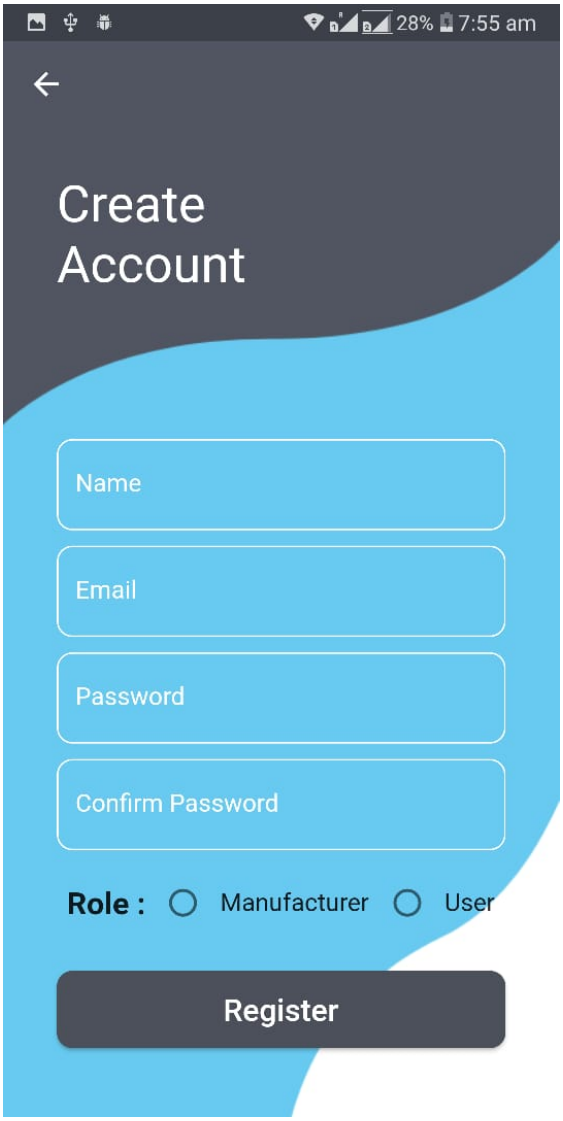

Figure 4.6: Registration Page

Chapter 5

System Implementation

This chapter provides the details regarding the implementation of the proposed system. It also describes the tools, languages and technologies which are used to develop the proposed system. It also provides the insight of the architecture of the proposed system.

5.1 System Architecture

Figure 5.1, shows the System architecture of our project:

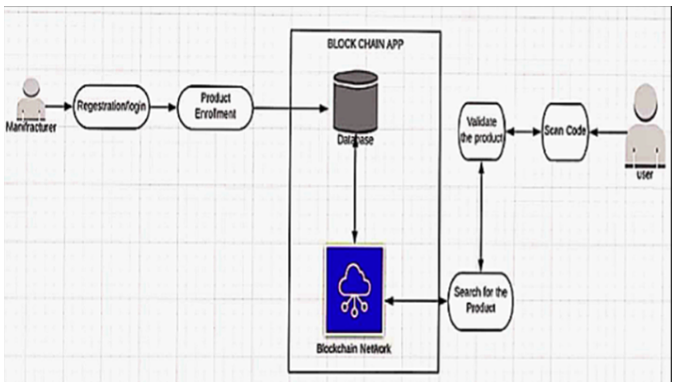

Figure 5.1: System Architecture

5.2 Languages Used for Development

We have used two languages mainly and those are as follows:

1) **Java/Kotlin**
Java is a high-level, class-based, object-oriented programming language that is designed to have as few implementation dependencies as possible.

2) **Solidity**
Solidity is an object-oriented programming language for implementing smart contracts on various blockchain platforms, most notably, Ethereum. It was developed by Christian Reitwiessner, Alex Beregszaszi, and several former Ethereum core contributors. Programs in Solidity run on Ethereum Virtual Machine.

5.3 Application Security

Our application is secure and safe as we have used blockchain in the development of it. On top of that, we have also included QR code so that nothing can be changed or hacked.

Figure 5.2: Secure Application

5.4 Tools and Technology Used in Development

Following are the tools and technologies that we have used in our project development:

1) **Android Studio**
Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.

Figure 5.3: Android Studio

2) **Blockchain**
Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack, or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain.

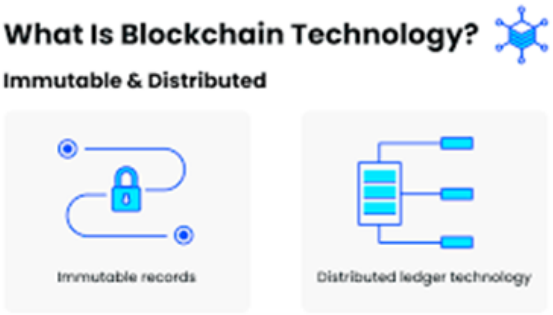

Figure 5.4: Blockchain

3) **Flutter**
Flutter is a free and open-source mobile UI framework created by Google and released in May 2017. In a few words, it allows you to create a native mobile application with only one codebase. This means that you can use one programming language and one codebase to create two different apps (for iOS and Android).

4) **Remix**
Remix, more commonly known as Remix IDE, is an open-source Ethereum IDE you can use to write, compile and debug Solidity code. As such, Remix can be a hugely important tool in Web3 and dApps development.

5) **Infura**
Infura provides the tools and infrastructure that allow developers to easily take their blockchain application from testing to scaled deployment - with simple, reliable access to Ethereum and IPFS.

Chapter 6

System Testing and Evaluation

This chapter provides the proof of the proposed system being fit to be delivered and be in the open world as the projects has gone through multiple types of tests. These tests detects every small mistake that you have done so if the system passes these tests then it is reliable, robust and error free project.

6.1 System Testing and Evaluation

System testing is testing conducted on a complete integrated system to evaluate the system's compliance with its specified requirements. System testing takes, as its input, all of the integrated components that have passed integration testing.
It is very important to do complete system testing to ensure that our user is completely satisfied and is not getting irritated and is not getting wrong outputs or results.

6.2 Types of Testing

Following are the types of testing which will be carried out on the project:

6.2.1 User Interface Testing

User interface testing is the process of testing a product's graphical user interface to ensure it meets its specifications. It is very important testing because if the user is not comfortable or at ease then our project will not be according to the specified requirements.

6.2.2 Usability Testing

Usability testing is a technique used in user-centered interaction design to evaluate a product by testing it on users. This can be seen as an irreplaceable usability practice, since it gives direct input on how real users use the system.

6.2.3 Performance Testing

Performance testing is in general a testing practice performed to determine how a system performs in terms of responsiveness and stability under a particular workload.

6.2.4 Compatibility Testing

Compatibility testing is a part of non-functional testing conducted on application software to ensure the application's compatibility with different computing environment.

6.2.5 Load Testing

Load testing is the process of putting demand on a system and measuring its response.

6.2.6 Security Testing

Security testing is a process intended to reveal flaws in the security mechanisms of an information system that protect data and maintain functionality as intended.

6.3 Test Cases

6.3.1 Test Case 1: Running Application

Table 6.1, shows the test case designed for checking if the application is executing properly or not.

Table 6.1: Test Case 1

Test Case ID	01
Unit of Test	Test to verify if the application is running
Steps of execution	Open application on a mobile
Expected Result	Application must open without crashing
Actual Result	Application opened without crashing
Status	Success

6.3.2 Test Case 2: Register

Table 6.2, shows the test case designed for checking if the user is registered properly or not.

Table 6.2: Test Case 2

Test Case ID	02
Unit of Test	Test to check if user is registering properly
Steps of execution	Click register and fill the form and submit
Expected Result	Registered success
Actual Result	Registered successfully
Status	Success

6.3.3 Test Case 3: Login

Table 6.3, shows the test case designed for checking if the user can log in properly or not.

Table 6.3: Test Case 3

Test Case ID	03
Unit of Test	Test to check if user can login after registering
Steps of execution	Write email and password and press login button
Expected Result	User should be navigated to home page
Actual Result	User navigated to home page
Status	Success

6.3.4 Test Case 4: Product Registration

Table 6.4, shows the test case designed for checking if the product is registered properly or not.

Table 6.4: Test Case 4

Test Case ID	04
Unit of Test	Test to see if product is adding properly
Steps of execution	User navigated to home page
Expected Result	Product must be added to the list with unique QR code
Actual Result	Product added to the list with unique QR code
Status	Success

6.3.5 Test Case 5: Product Scanning

Table 6.5, shows the test case designed for checking if the product is scanning properly or not.

Table 6.5: Test Case 5

Test Case ID	05
Unit of Test	Test to see if the scanner is reading the QR code properly
Steps of execution	Open scanner and bring it to the front of QR code
Expected Result	QR code should be read by the scanner and details regarding the product must be displayed
Actual Result	QR code read correctly by the scanner and details regarding the product is displayed
Status	Success

Chapter 7

Conclusion

Proposed project is beneficial to a lot of people as the counterfeit issue in third world country like ours is very crucial. People find difficulties in purchasing the actual or original product. So, our app is going to provide that help. All the results and implementation of the project is completed as mentioned in early phase of the development. By doing this project, we have learnt a lot of new technologies and ways to how the industry is being operated and how we can be a part of it.

Proposed project in the future can be acquired by any relevant company and can be made according to their company's standards and can also be mapped to their products and employee's database for authentication purposes. Company can made changes according to the needs of their customers. They can also take the application to web by creating its web based version. It will provide interoperability as well as enhance the scope of the application.

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