

SUPER SHOP SUPPLY CHAIN MANAGEMENT SYSTEM USING BLOCKCHAIN

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This Report Presented in Partial Fulfillment of the Requirements for the Degree
of Bachelor of Science in Computer Science and Engineering.

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**DAFFODIL INTERNATIONAL UNIVERSITY
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APPROVAL

This Project titled “**SUPER SHOP SUPPLY CHAIN MANAGEMENT SYSTEM USING BLOCKCHAIN**”, submitted by **MD. ZAHID HASAN**, ID No: **151-15-4960** and **ASHRAF MAHAMUD RIFAT** ID No: **152-15-5973** to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 3rd May 2019.

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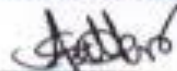
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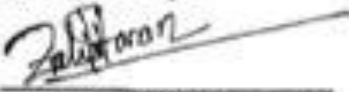
I hereby declare that, this project has been done by **MD. ZAHID HASAN (151-15-4960)** and **ASHRAF MAHAMUD RIFAT (152-15-5973)** under the supervision of **Prof. Dr. Sayed Akter Hossain, Professor and Head, Department of CSE** in Daffodil International University. I also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

Our project title “**Super shop supply chain management system using blockchain**” is a web based application for Bangladeshi “**Super shop owners and consumers**” which provides better traceability, ensure better quality and healthy products for super shop’s product consumers. In this application we tried to present a newer way to check any super shop products journey. Nowadays almost every middle class to high class background people used to shop at various kinds of super shops likes (Agora, Shwapno, Menna Bazaar) for their day to day groceries and others. This business is increasing very exponentially with the increase of Bangladeshi peoples gross income. But we never question about that “The product we are purchasing from various super shops **where are they from? Which processes are they gone through? Are those products quality properly maintained?**” In this project we try to solve this problem. By using our system we can trace or find any products root that we are purchasing. That means we can scan that products field to super shop journey via a simple mobile QR code reader. And off course we use here blockchain technology for all our data transparency and decentralization.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays almost every middle class to high class background people used to shop at various kinds of super shops likes (Agora, Shwapno, Menna Bazaar) for their day to day groceries and others. This business is increasing very exponentially with the increase of Dhaka peoples gross income. Sometimes reports comes out that **“products of super shops are not as qualitative as expected, are those products really worth that amount of money?”** But we

never question about that **“The product we are purchasing from various super shops *where* are they from? Which processes are they gone through? Are there quality properly maintained?”**

In this project we try to solve this problem. By using our system we can trace or find any products root that we are purchasing. That means we can scan that products field to super shop journey via a simple mobile QR code reader. And off course we use here blockchain technology for all our data transparency and decentralization. Our project title **“Superchain”** is a web and mobile based application for Bangladeshi **“Super shop owners and consumers”** which provides better traceability, ensure better quality and healthy products for super shop’s product consumers. In this application we tried to present a newer way to check any super shop products journey.

1.2 Motivation

Motivation can change anyone’s mind rapidly. Without motivation it is very hard to stick in a goal. Some key motivational factors that pushes us to do this project:

- Self satisfaction. It will be a great feeling to achieve something which we dream of that comes into a reality.
- To create something imapctful that can helps a community.
- Career advancement. The skills and knowledge I’ll gain can perform as a booster for my future career.

- Happy to learn something new.
- Blockchain is a new technology that has a very good potential to anything with data transparency, decentralization and temper data.
- Nowadays there running a craze in the modern technological field about blockchain after some of the blockchain based applications breakout. Now everyone is trying to convert their existing application to blockchain platform.

1.3 Objectives

We want to make a system for the people who used to shop at various super shop for their daily groceries and other purposes. We really believe that our client (both consumer and shop owners) will be mutually benefited. Consumers can trace quality and root of the products and owners can assure consumers that they are buying that products which are qualitative and if they want they can check it through blockchain. The blockchain algorithms itself designed such way that if we input some data into blockchain that will create a hash against that data. Then whenever we update that information it changes its hash. By tracking that hash we can trace in products information and find out there coexist any misinformation or not. Some of the main objectives which influenced us to did that project is given bellow:

- Ensure consumer knows all the phases that products gone through that they are purchasing.
- Ensure consumer that they are paying for that product that amount of money is really worth able.
- Increases business for the super shop owner.
- Data transparency so that that particular products related all the data can anyone see and can analyze and for that they do not need to logged into a system.
- All the consumers need to have a smart phone with a QR code reader (any kind and versions) for scan the product QR code.

1.4 Expected Outcome

Our expected outcome will be both consumers and super shop owners satisfactions. It is kind of new where consumer can see any particular products all the previous history before comes at the super shop and if they want they can authenticate that data through blockchain. Some of the main expected outcomes are given below:

- Ensure consumers satisfaction.
- Ensure healthy life for future generations.
- Reduce cost for health complications due to chemically contaminated foods.
- Ensure traceability of any products that exists in the systems of the super shop.
- Both consumers and business man mutual benefits.

1.5 Report Layout

In our report, we arrange other discussions in several chapters, which are:

- In chapter 2 we discuss background of our application, how we plan our application and why we chose this.
- In chapter 3 we discuss requirements specifications for our project. In this chapter the requirements for implementation presented in detail.
- In chapter 4 system design specifications and how the system is designed like font end design, back end design is allowed.
- In chapter 5 is based on system implementation and testing, where we find any bug about our application.
- In chapter 6 is our final chapter, where we focus future scope and conclusions about our application.

CHAPTER 2

BACKGROUND

2.1 Introduction

Nowadays almost every middle class to high class background people used to shop at various kinds of super shops likes (Agora, Shwapno, Menna Bazaar) for their day to day groceries and others. This business is increasing very exponentially with the increase of Dhaka peoples gross income. Sometimes reports comes out that “products of super shops are not as qualitative as expected, are those products really worth that amount of money?” But we never question about that “The product we are purchasing from various super shops where are they from? Which processes are they gone through? Are there quality properly maintained?” In this project we try to solve this problem. By using our system we can trace or find any products root that we are purchasing. That means we can scan that products field to super shop journey via a simple mobile QR code reader. And off course we use here blockchain technology for all our data transparency and decentralization. Our project title “Superchain” is a web and mobile based application for Bangladeshi “Super shop owners and consumers” which provides better traceability, ensure better quality and healthy products for super shop’s product consumers. In this application we tried to present a newer way to check any super shop products journey.

2.2 Related Works

For before building this application we did some research on this topic and reads some research papers. Where we find that some of the world’s biggest super shop chain is either working on blockchain based food safety or already they implemented that. Among all of the the really big player is **Walmart**.

Walmart is working with IBM to implement blockchain as part of new food safety requirements for its suppliers. By this time next year, Walmart and Sam's Club will ask suppliers of leafy greens like romaine lettuce and spinach to implement food traceability via IBM's blockchain technology focused on the global food supply chain.

The aim is to track food from farm to store in near real time using blockchain's distributed ledger system[1].

A project of collaboration between **Walmart, IBM and Beijing Tsinghua University** was unveiled in October, 2016. The project aimed to create a new model using blockchain technology for food traceability, supply chain transparency and audit-ability, and it was initially planned to track and trace Chinese pork [2].

They hope to enhance the safety of food by the power of blockchain technology designed to generate transparency and efficiency in supply chain record keeping [3].

According to the definition of the CODEX Alimentary, food traceability is“the ability to follow the movement of a food through specified stage(s) of production, processing and distribution” [4].

2.3 Comparative Studies

Since it is a very new concept to add blockchain technology with food safety and traceability so there are very little application, systems and resources are available out there. But some of the very big super shop chains like walmart and technological and economically very step forwarded countries like USA and CHINA have implemented that technology.

By having a more transparent and decentralized system, companies along the supply chain will be able to input data into the system with a degree of anonymity and control that may spur universal adoption[5].

As of 2018, supply chain and traceability solutions using blockchain technologies have only been implemented in limited pilot studies[6][7]. Several companies have started to explore using open-source blockchain bases, such as Ethereum or IBM’s Hyperledger, for usage in supply chains[6][8]. Some of these pilot studies combine other technologies, such as internet-enabled sensors.

2.4 Scope of the Problem

In the section scope of the problem we will discuss about what type of problems user can face what can be the solutions for that particular problems. Some of the questions can arise regarding our applications.

The questions and their most possible answers were given below:

- Why super shop will disclose their products data?
- Why they recruit new people (Admin, field, production, quality control, transport) managers to input data to blockchain?
- Why we use blockchain whenever we can build such kind of application by using databases?

The possible answers of the questions can arise scope of the problem sections are given below:

- It is our right to know that the products we are purchasing from where it comes which stages and procedures it gone through. If shop owner do not disclose that then it will one kind of mischief against our rights. On the other hand if the shop owner disclose data it increase customers trust upon the owner and as a result his business will be benefited most. At the end without customer business have nothing to do with products and services.
- If shop owner recruit some managers (admin, fields, productions, quality controls, and transports) then he have to spend some extra money for their salaries but on the other hand he can get the trust of the customer which can drives his business crazy.
- The main objective of using blockchain is to transparency and decentralization. We know that blockchain algorithm itself is designed such a way that if we input something to blockchain then it will creates a hash code against that action. Then for every update it creates new hash code for that. Most important thing is that if can not delete any data from blockchain. So by tracking all those hash code we can find any kind of misinformation according this product.

2.5 Challenges

The more challenges we will face the more we will know new things. All the things will work perfectly at the first attempt its not mandatory. By tackling down all the ups and downs we can achieve something that taste can be more sweeter than short cuts. Some of the challenges we faces at the time of developing this applications are given below:

- Make a application that has a very simple form for information input to the databases.
- There can be very big amount of data to be uploaded into the databases. It is nearly impossible for a single person so for overcoming that issue we split the task among various managers and those (field, production, quality control and transport) managers will takes care of only his area. He do not to worry about others area of work.
- Users here consumers generally do not want to creates account into any new systems so here we develop a system that don not need any login for consumers they only need to scan a QR code for getting any products information.
- Customer can check input data's validation through blockchain hash code.

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 Business Process Modeling

Business process modeling is used to understand the whole idea of an application. Our system is totally based on super shop owner and their consumers and our business process model defined how our system runs. That means we can say that business process modeling is the summary of the system. From the diagram of the business process modeling one can easily get idea how that particular system works. Below this paragraph we will discuss about some points regarding to business process modeling. The importance of business process modeling and why we use business process modeling.

Why business process model?:

- Makes everything visible to every so that whoever see that can easily understand what is happening into the system.
- Find problems and errors in the system flow.
- Specific roles of user can understand their specific task what they need to be done.
- Ensure both admins and consumers about their role.

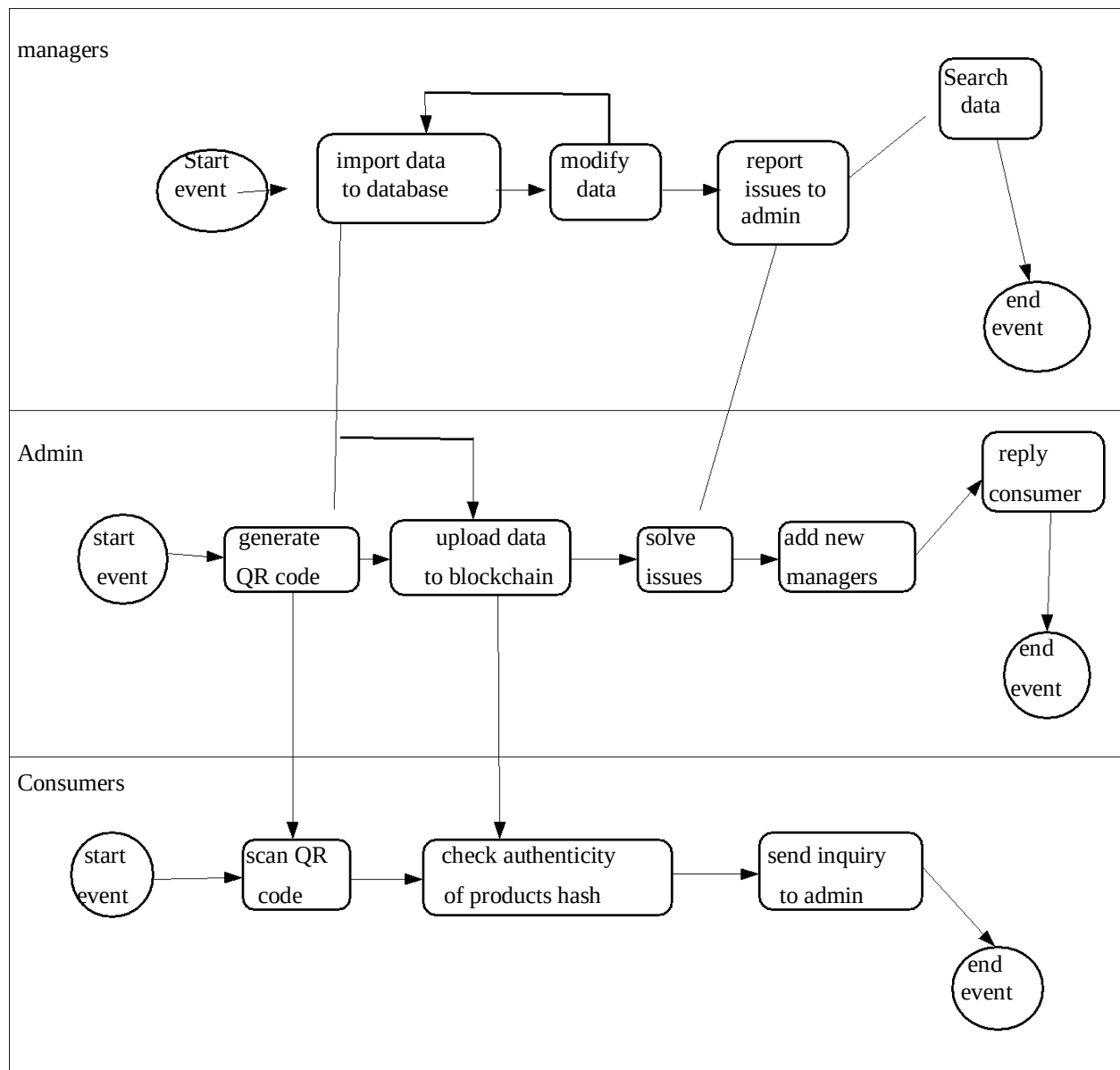


Figure 3.1: Business Process Modeling

Figure 3.1 describes business process modeling of our system. Any products that will sale from our super shop will passes through four phases. All the four phases are:

- Field phase
- Production phase
- Quality control phase.
- Transportation phase.

For maintaining all those fields we have several managers for that phases. They will verify that particular products and then upload that products required data. He can not access others phases data and he do not need to bother about all of those data. Finally any products passes above all phases then admin will verify that data and creates a QR code for every validated products and upload that products all the phases data to blockchain and reserve blockchain hash for that product. Finally consumers can know all the details that particular products gone through just by scanning QR code even they can also get all the phases information through **ProductID** search. Even they can find any misinformation by checking that products hash. Because we know that blockchain algorithm itself designed in a such way that whenever we upload something into blockcahin it can not be deleted and again every modification of that data it changes it's hash so by tracking that hash we can easily find that products previous history and modifications.

3.2 Requirement collection and analysis

Initial requirements

Initial requirements that must we need to function our system without that it's impossible to perform that. They are given below:

- We need an web based application with database storage capabilities (MongoDB).
- For building that application need some front end frameworks and back end frameworks.
- For Validations of the data need some advance database query so that they can validate any products information by querying among themself.
- Need some middle ware functionalities to secure that systems from attacks.

Managers requirements:

Previously we know that we have four phases and every phases has several managers. All those managers perform same task but works with different data. Their requirements are:

- Need to login into the systems which is provided by admin.
- After verifying the product for his phase need to upload accurate data.
- Can update and delete his phases data.

Admin requirements

Admin or super users perform most important task in the system. His requirements and roles of actions is given below:

- Admin also needs to login into the systems.
- Can generate QR code for every products by just entering that products ID.
- Upload any products data to blockchain.
- Solve issues that faces by various phase managers.
- Reply consumers inquiry.

Consumers requirements:

By using our systems consumers can know the detail journey of a product that we are purchasing from a super shop. Their requirements are given below:

- They need a smartphone with any kind of QR code reader.
- Need to scan the QR code that attached to the product that they are purchasing.
- Need internet connections to check the authenticity of the product by searching the products hash (that will get from QR code along Products all the phases data).

Software requirements:

- Nodejs (Server side scripting)
- Express (Javascript framework)
- Bootstrap (CSS framework)
- MongoDB (Back end data management)
- Sublime text (Code editor)
- Github and git (Version controlling)
- Trello board (Project management)

Hardware requirements:

- Internet accessible desktop or laptop.
- Smartphone with QR scanner.

3.3 Use case modeling and description

By using use case model it becomes easy to describe any systems. Use case describe a discrete unit of interaction between a user (user can be either a human or machine) and the system. The use case given below where we try to to define some methods to specify, identify and organize our system requirements that can facilitate a proper view of our entire system. It also specify various kinds of users goal and their boundaries.

Why use case model in our application?

We use use case model into our project report so that by viewing that a non technical person can also gets the idea what is going on and how the various functionalities of the systems works and interacts with each others.

- Smoother implementation of the project.
- Generate test cases.
- Context specification of the system.
- Differentiate various users role.

Use case model that we used into our system is:

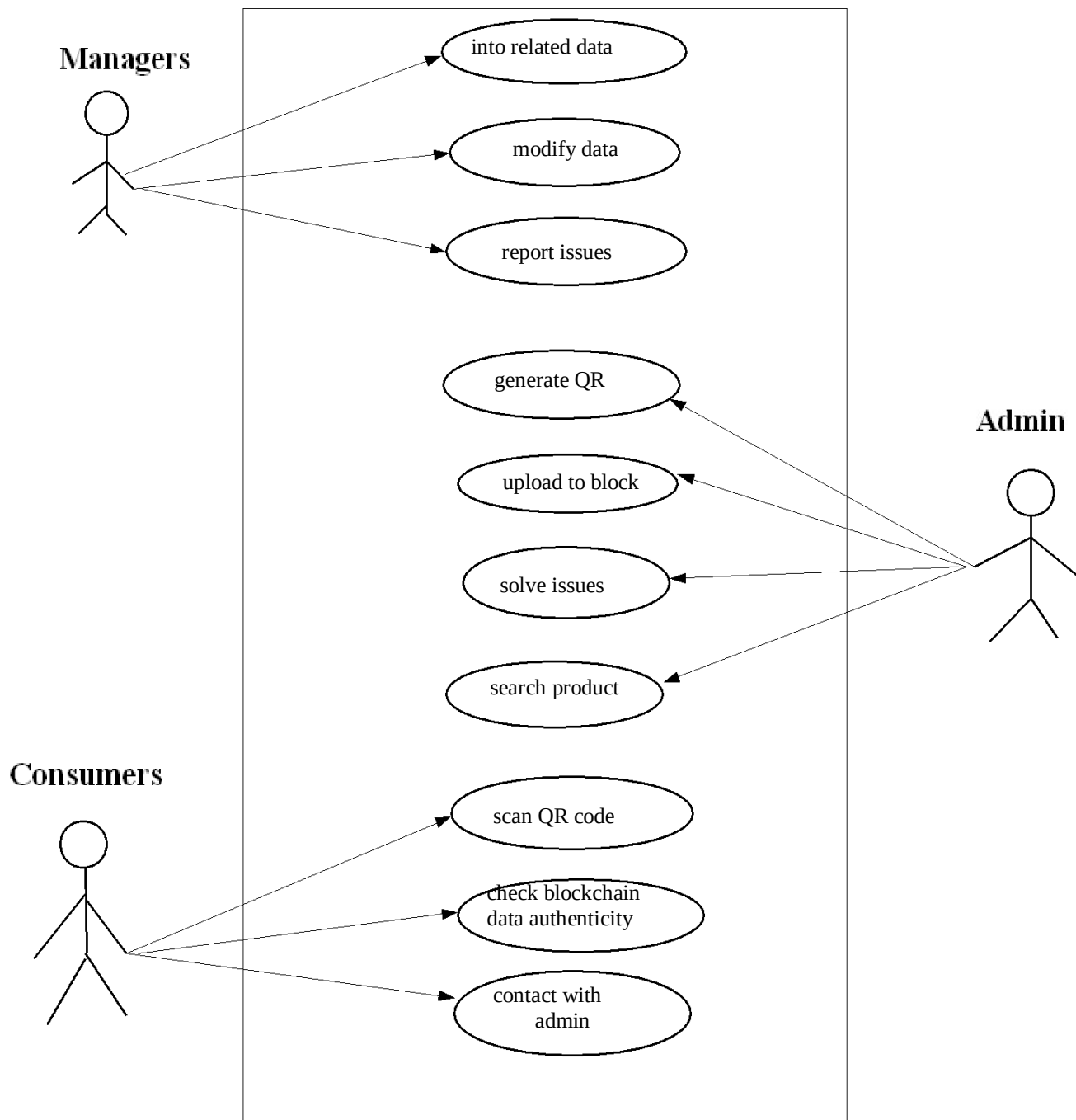


Figure 3.3: Use case model

In this figure 3.3 managers (field, production, quality control, transport) will upload their respective data from their portal after verifying the products. Then admin will generate QR code by using all the phases data and that QR will be attached to that products. Admin can also perform the task to upload any products details into blockchain and system will automatically stores that products hash code into database. Finally users can scan the QR code and will get all the details of that products which is uploaded at its various phase.

3.4 Data model

Logical data model we can also call it ERD, by viewing that we can understand that how all the data at the back end of the systems how they interacts with each others. Since we use **mongoDB** which is a **NOSQL** database so we do not have any relation with various tables of the database. Instead all of these here we have unique object id for each entries and also those data are formatted as **JSON** format. So, we can easily retrieve all the data from our collections (at mongodb Tables can be called as collections) through **API** request.

users
role(string)
name(string)
email(string) unique
password(string) encrypted

(a) Database model for users

(both admin and managers)

Field data
productID(string) unique
productName(string)
fieldLocation(string)
farmerName(string)
farmerNid(string) unique
farmerMobile(string)
date(iso format)

(b) Database model for field data

Production data
productID(string) unique
productName(string)
companyName(string)
companyLocation(string)
factoryLocation(string)
companyIsoNumber(string)
unique
comapnyContact(string)
date(iso format)

(c) Database model for production data

Quality Control Data
productID(string) unique
productName(string)
qcTests(string)
qcResult(string)
qcName(string)
qcNid(string) unique
qcMobile(string)
qcContact(string)
date(iso format)

(d) Database model for quality control data

Blockchain data
productID(string) unique
productName(string)
index(string)
timestamp(string)
preHash(string) encrypted
thisHash(string) encrypted
date(iso format)

(e) Database model for blockchain

Transport data
productID(string) unique
productName(string)
companyName(string)
companyLoacation(string)
companyConatct(string)
vehicleNumber(string)
driverName(string)
driverNid(string) unique
drivermobile(string)
driverContact(string)
date(iso format)

(f) Database model for transport data

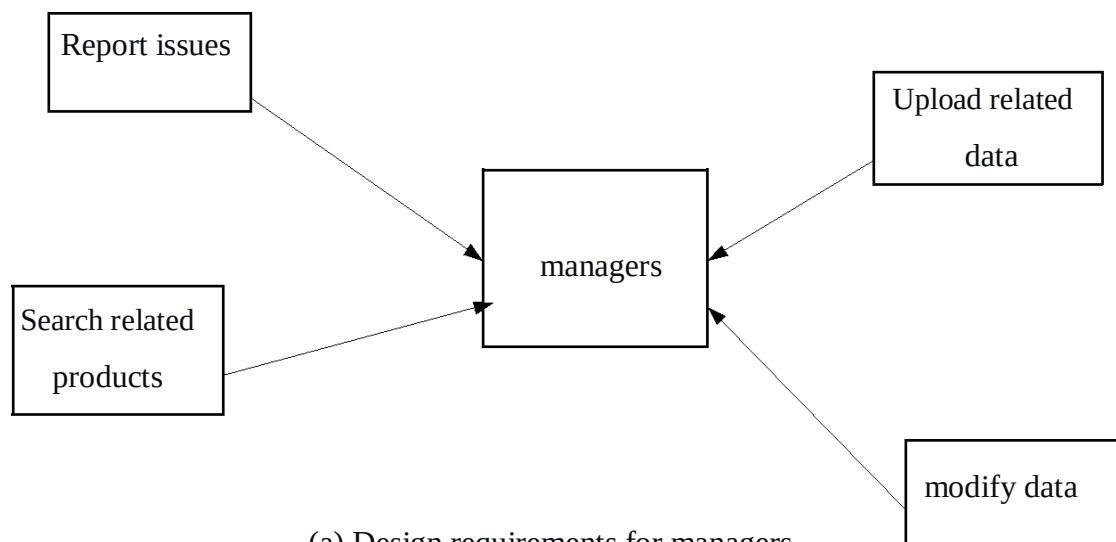
Figure 3.4 : Data model

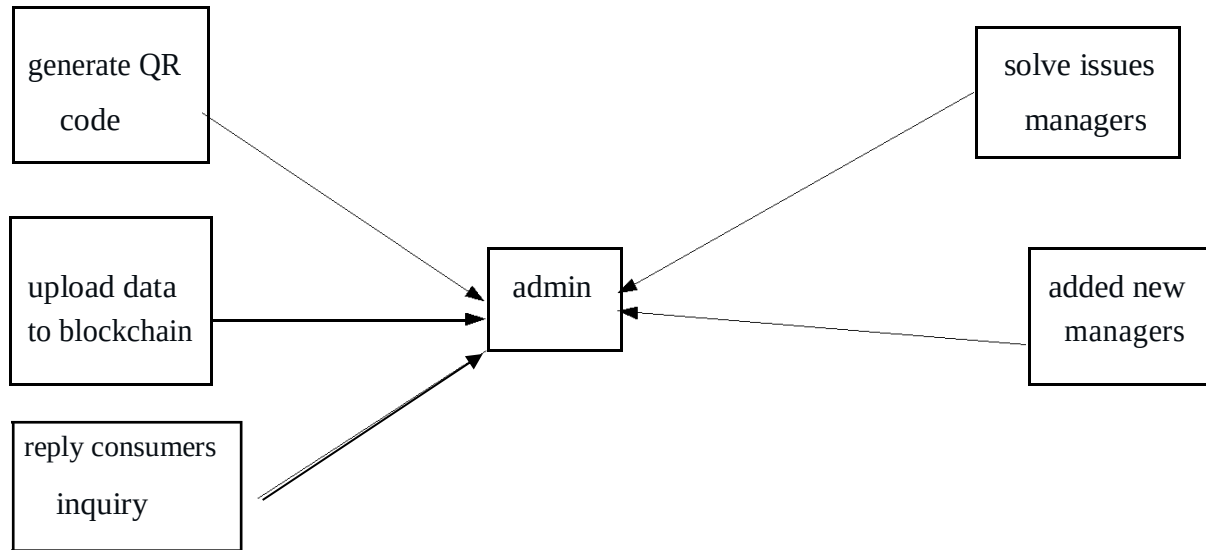
3.5 Design requirements

Design requirements is a vital player in between developing any systems or a applications. If we precisely follow design requirements then many others task becomes automatically easy to implement such as project management, technical development and system testing. In the figure 3.5 we will discuss about design requirements of our project.

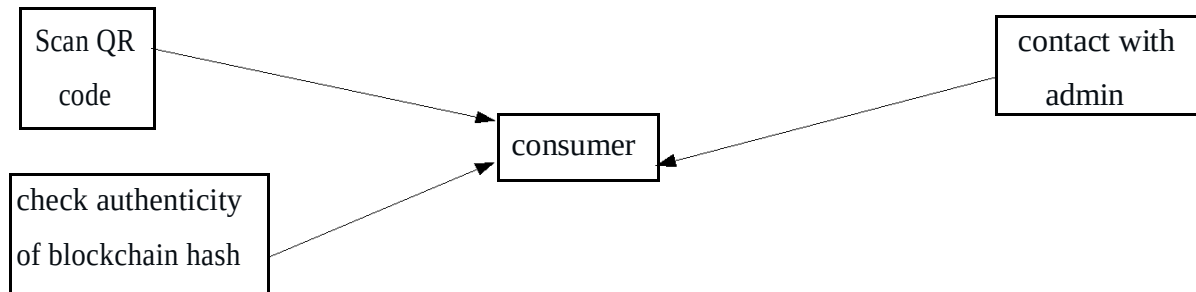
Why we use design requirements in our system?

Poor design requirements makes a good systems developing process very slow and hasslefull where as a proper design requirements makes a system developing faster than ever before. So for faster development and quick implementation of our system and quickly analyze any design related problem we used deign requirements.





(b) Design requirements for admin



(c) Design requirements for consumers

Figure 3.5: Design requirements

From figure 3.5 we said that three kinds of design requirements are followed for three kinds of specific users. Managers input their respective data into database and also can perform modification over their data. They can send any kind of issues they face to admin. Admin can generate QR code on the basis of data that various managers (field, production, quality control and transport) uploaded. Then admin can upload that data to blockchain, solve managers issues, reply consumer inquiry about that products. Consumers can use their mobile phone scanner to scan the QR code and gets all the phases information of that particular products that s/he is purchasing and also can check authenticity of the product that's data already uploaded to blockchain through the hash code generated at the time of uploading data into blockchain.

CHAPTER 4

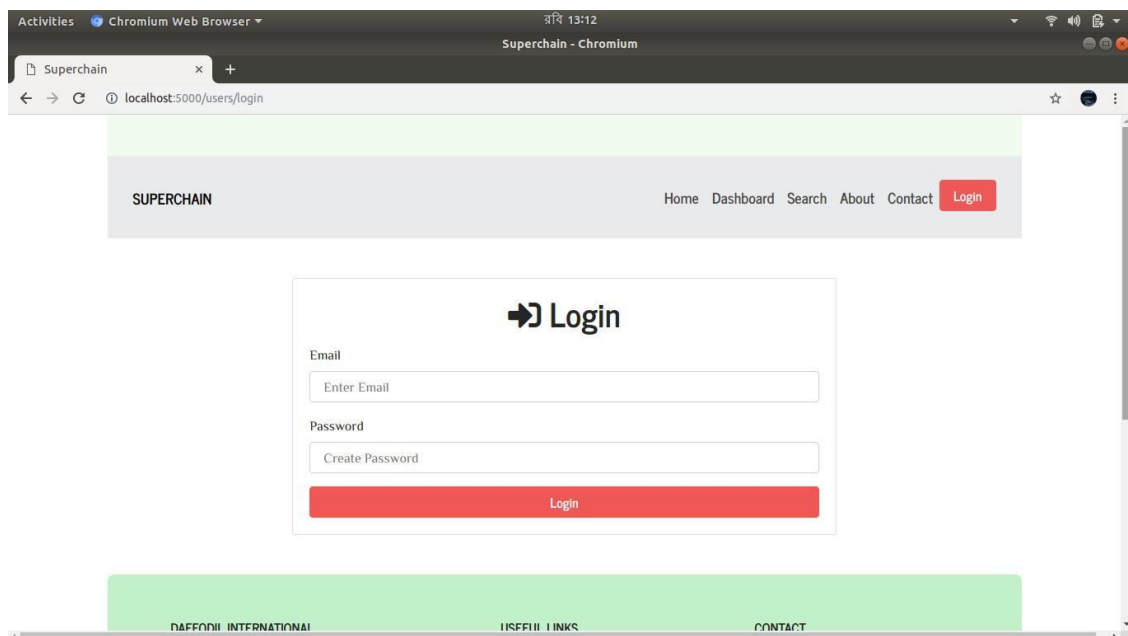
DESIGN SPECIFICATIONS

4.1 Front-End Design(UI)

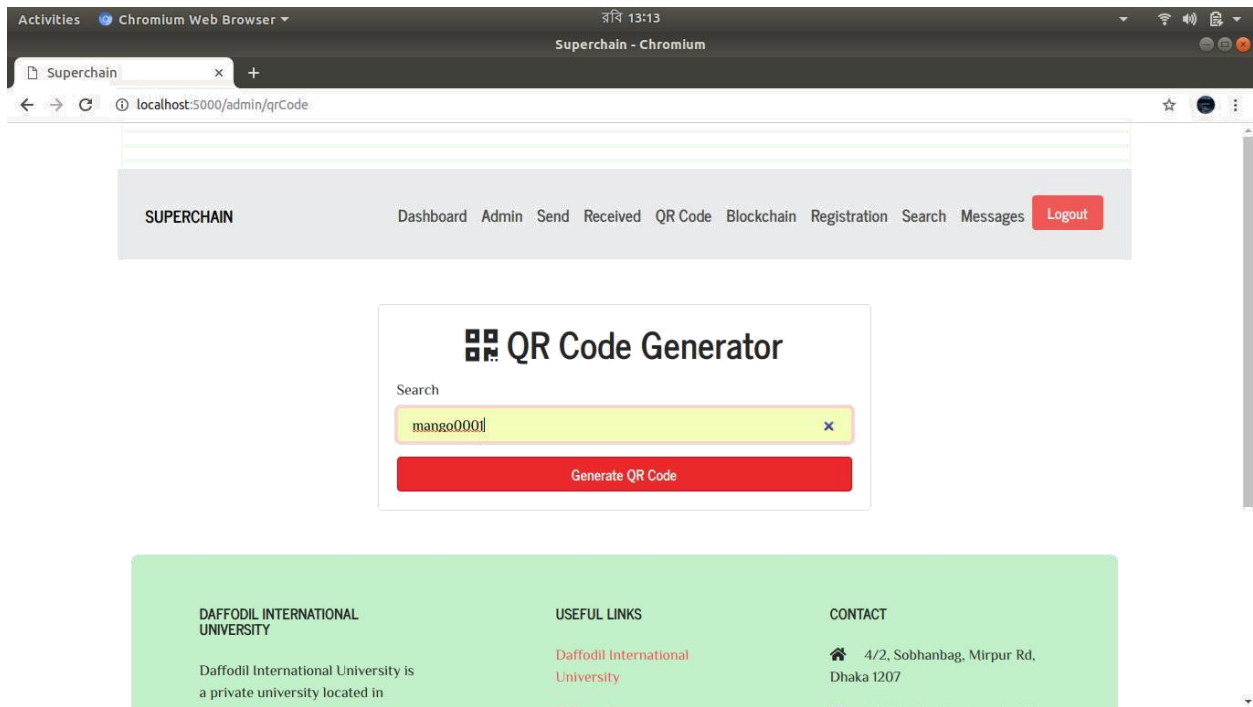
Front end is the part a users mainly direct interacts with that. Without good user interface design good application can become a bad application. So it is very important to take special cautions about front-end design. So that we also tried very hard to makes our applications front end look able, smooth and responsive. For better aesthetics we use various front end designing tools and technologies. We used bootstrap 4 for css framework besides we used raw javascript and various javascript libraries (jquery) for better aesthetics. Most of all we design very user friendly and well instructed design so that data input managers do not feel any hesitation where to input which data.

Is front end design makes the system user friendly?

Yes, front end design plays a vital role to make an application more user friendly. A good user friendly design (front-end) gives a positive impression about the system and attract the users. That's why we can said that front end is very important for any system or applications.



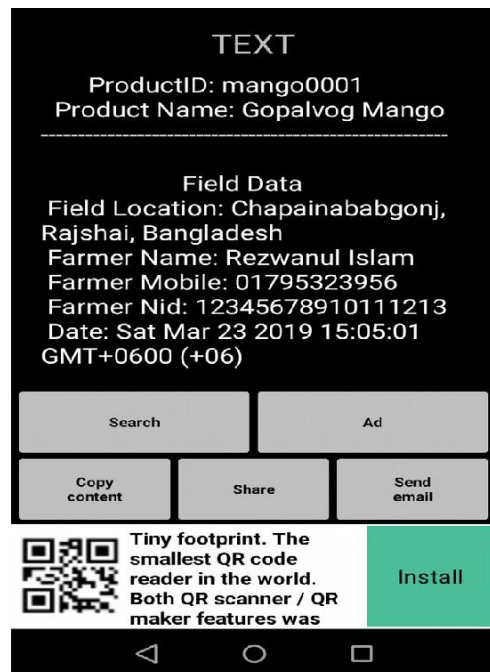
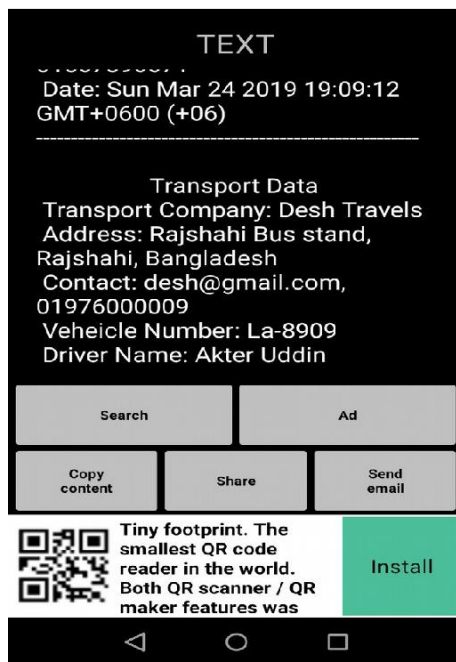
(a) Login page for all the managers (admin, field, production, quality control and transport)



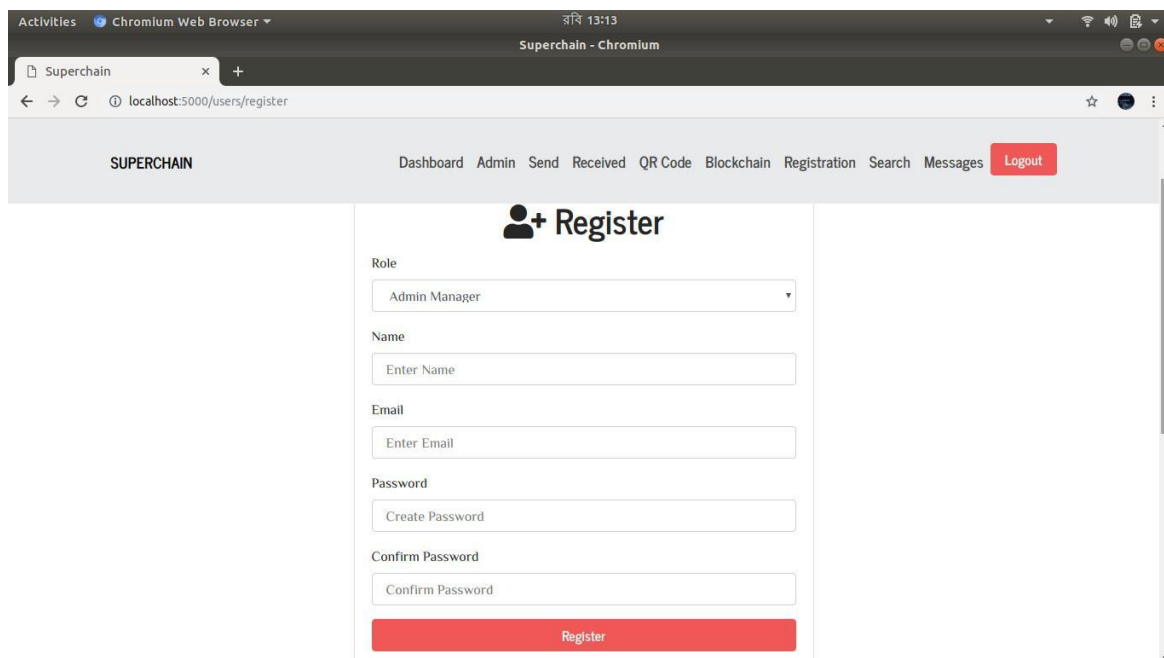
(b) Admin generating QR code for any particular products



(c) After generating QR code by admin



(d) after scanning QR code user getting all the information for the product



(e) Admin adding new managers

The screenshot shows a web browser window with the address bar displaying 'localhost:5000/dashboard'. The page header includes the 'SUPERCHAIN' logo and navigation links: 'Dashboard', 'Field', 'Issues', 'Search', 'Messages', and a 'Logout' button. The main content area is titled 'Field Data' and contains a table with the following data:

Product ID	Product Name	Field Location	Farmer Name	Farmer Mobile	Farmer NID	Date
potato0001	Red Potatoes	Fulbari, sherpur, Bogura, Bangladesh	Zahid Mia	01795456789	12345678910111213	Sun Mar 24 2019 19:14:45 GMT+0600 (+06)
chili0001	Red dry chili	sherpur, Bogura, Bangladesh	Zahid Mia	01795456789	12345678910111213	Sat Mar 23 2019 15:14:58 GMT+0600 (+06)
lichi0001	China3 Licchi	Parbatipur, Dinajpur, Bangladesh	Abu Naeem Nahid	01949699378	12345678910111213	Sat Mar 23 2019 15:10:21 GMT+0600 (+06)
mango0001	Gopalvog Mango	Chapainababgonj, Rajshai, Bangladesh	Rezwanul Islam	01795323956	12345678910111213	Sat Mar 23 2019 15:05:01 GMT+0600 (+06)

(f) Field managers dashboard from where field managers can check all the field related data. Like that we have also (production, quality control and transport managers) dashboard.

The screenshot shows a web browser window with the address bar displaying 'localhost:5000/field'. The page header includes the 'SUPERCHAIN' logo and navigation links: 'Dashboard', 'Field', 'Issues', 'Search', 'Messages', and a 'Logout' button. The main content area is titled 'Field' and contains a form with the following fields:

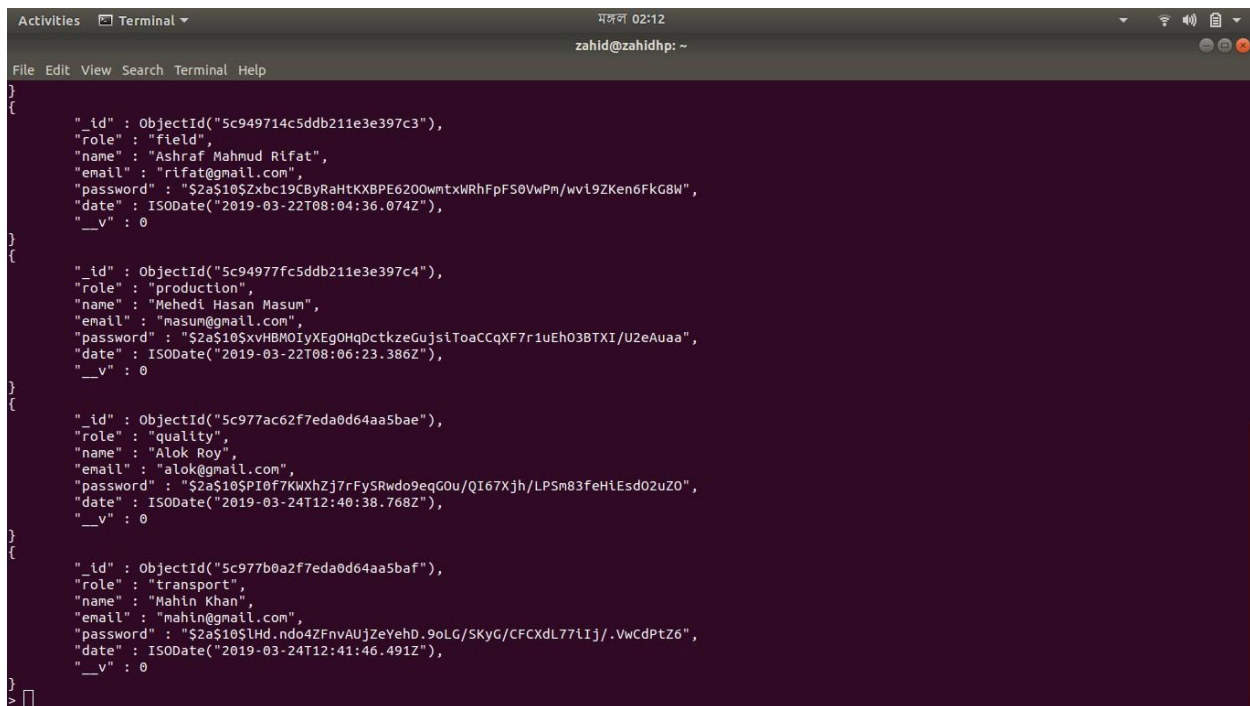
- Product ID:
- Product Name:
- Field Address:
- Farmer Name:
- Farmer Mobile Number:
- Farmer NID Number:

(g) Field managers from where field managers can upload all the field related databases. Like that we have also (production, quality control and transport managers) data input form.

Figure 4.1: Front end Design

4.2 Back-end design

What we generally can not see of any systems but that gives the system flexibility to function properly is back end. Without good back end design good and eye catchy front end design can become worthless. So we also have to take care both the back end and front end. We can compare front end as a face of any system and back end as a brain of that system. In figure 4.2 we will discuss about our back end technology that we used to add functionality of our system.



```

}
{
  "_id" : ObjectId("5c949714c5ddb211e3e397c3"),
  "role" : "field",
  "name" : "Ashraf Mahmud Rifat",
  "email" : "rifat@gmail.com",
  "password" : "$2a$10$Zx9c19CByRaHtKXBPE6200wmtxWRhFpFS0VwPm/wvl9ZKen6FkG8W",
  "date" : ISODate("2019-03-22T08:04:36.074Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c94977fc5ddb211e3e397c4"),
  "role" : "production",
  "name" : "Mehedi Hasan Masum",
  "email" : "masum@gmail.com",
  "password" : "$2a$10$XvHBM0IyXEg0HqDctkzeGujsiToaCCqXF7r1uEh03BTXI/U2eAuaa",
  "date" : ISODate("2019-03-22T08:06:23.386Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c977ac62f7eda0d64aa5bae"),
  "role" : "quality",
  "name" : "Alok Roy",
  "email" : "alok@gmail.com",
  "password" : "$2a$10$PI0f7KXhZj7rFySRwdo9eqG0u/QI67Xjh/LPSm83feHiEsd02uZ0",
  "date" : ISODate("2019-03-24T12:40:38.768Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c977b0a2f7eda0d64aa5baf"),
  "role" : "transport",
  "name" : "Mahin Khan",
  "email" : "mahin@gmail.com",
  "password" : "$2a$10$Lhd.ndo4ZFnvAUjZeYehD.9oLG/SKyG/CFCXdL77iIj/.VncdPtZ6",
  "date" : ISODate("2019-03-24T12:41:46.491Z"),
  "__v" : 0
}
>

```

(a) MongoDB collections for users

```
Activities Terminal ১২:১৩
zahid@zahidhp: ~
File Edit View Search Terminal Help
}
{
  "_id" : ObjectId("5c9781ee3bfb4a0fe177f70d"),
  "productID" : "licchi0001",
  "productName" : "China3 Licchi",
  "qcTests" : "Formalin, Texture, Freshness",
  "qcResult" : "good",
  "qcName" : "Dr. Shahidul Islam",
  "qcNidNumber" : "12345678910111213",
  "qcContact" : "shahidul@gmail.com, 01567890671",
  "date" : ISODate("2019-03-24T13:11:10.644Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c9784303bfb4a0fe177f710"),
  "productID" : "chilli0001",
  "productName" : "Red dry chilli",
  "qcTests" : "Texture, Dryness",
  "qcResult" : "average",
  "qcName" : "Dr. Ratan Kumar Ghosh",
  "qcNidNumber" : "12345678910111213",
  "qcContact" : "ratan@gmail.com, 01791000011",
  "date" : ISODate("2019-03-24T13:20:48.083Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c9787d4f1235411288551e0"),
  "productID" : "potato0001",
  "productName" : "Red Potatoes",
  "qcTests" : "Formalin, Texture, Freshness",
  "qcResult" : "good",
  "qcName" : "Dr. Ratan Kumar Ghosh",
  "qcNidNumber" : "12345678910111213",
  "qcContact" : "ratan@gmail.com, 01791000011",
  "date" : ISODate("2019-03-24T13:36:20.423Z"),
  "__v" : 0
}
>
```

(b) Mongoddb collections for quality control phase data

```
Activities Terminal ১২:১৩
zahid@zahidhp: ~
File Edit View Search Terminal Help
"qcTests" : "Formalin, Texture, Freshness",
"qcResult" : "good",
"qcName" : "Dr. Ratan Kumar Ghosh",
"qcNidNumber" : "12345678910111213",
"qcContact" : "ratan@gmail.com, 01791000011",
"date" : ISODate("2019-03-24T13:36:20.423Z"),
"__v" : 0
}
> db.transports.find().pretty();
{
  "_id" : ObjectId("5c97972f5dcd7514c5ba176b"),
  "productID" : "mango0001",
  "productName" : "Gopalvog Mango",
  "companyName" : "Desh Travels",
  "companyLocation" : "Rajshahi Bus stand, Rajshahi, Bangladesh",
  "companyContact" : "desh@gmail.com, 01976000009",
  "vehicleNumber" : "La-8909",
  "driverName" : "Akteer Uddin",
  "driverNidNumber" : "12345678910111213",
  "driverMobile" : "01678000080",
  "date" : ISODate("2019-03-24T14:41:51.180Z"),
  "__v" : 0
}
{
  "_id" : ObjectId("5c9fb05e45759f3fb33a3710"),
  "productID" : "licchi0001",
  "productName" : "China3 Licchi",
  "companyName" : "Arafat Travels",
  "companyLocation" : "Parbatipur Dinajpur, Bangladesh",
  "companyContact" : "arafattravels@gmail.com 01976543121",
  "vehicleNumber" : "La-9876",
  "driverName" : "Mostak Mia",
  "driverNidNumber" : "12345678910111213",
  "driverMobile" : "01785634521",
  "date" : ISODate("2019-03-30T18:07:26.154Z"),
  "__v" : 0
}
>
```

(c) Mongoddb collections for transport phase

data Figure 4.2: Back end design

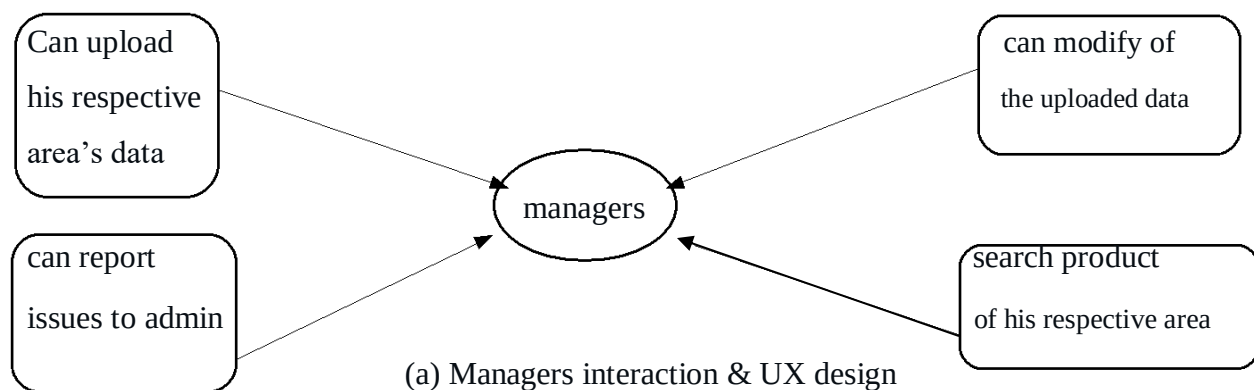
From figure 4.2 we can see that we used ubuntu terminal for maintaining our back end data. We used **mongoDB** as a database. Previously we said that mongoDB is a NOSQL database. That means we do not need any primary and foreign key to establish relationship among various tables. On the contrary mongoDB automatically creates a object id for every entries to its collections (at mongoDB we can call table as collection). And most important thing is that mongoDB formatted all the data in **JSON** format. That's why we can retrieve any kind of information that stores at mongoDB just through a **API** request and can also show that data into any other places through JSON responses.

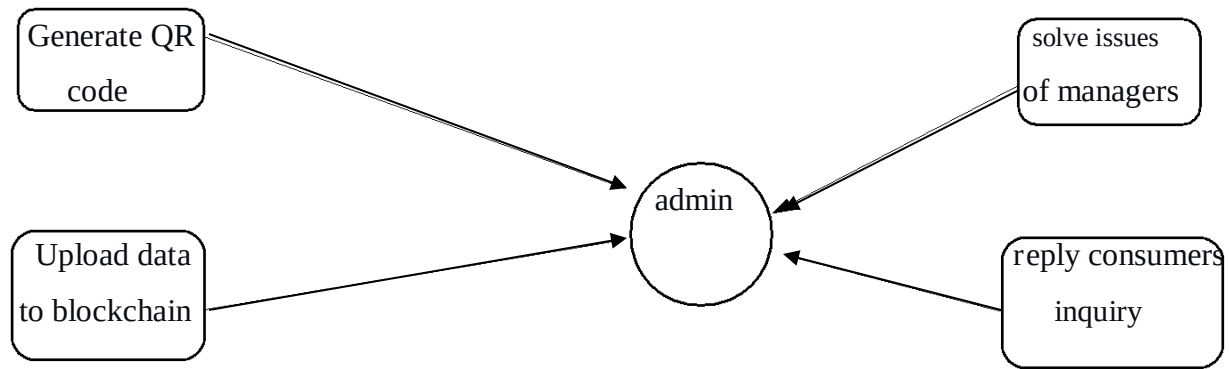
Technology or functionality used at back end side:

- MongoDB (Database management)
- Server side scripting (Javascript)
- Implement blockchain algorithm (Written in javascript)

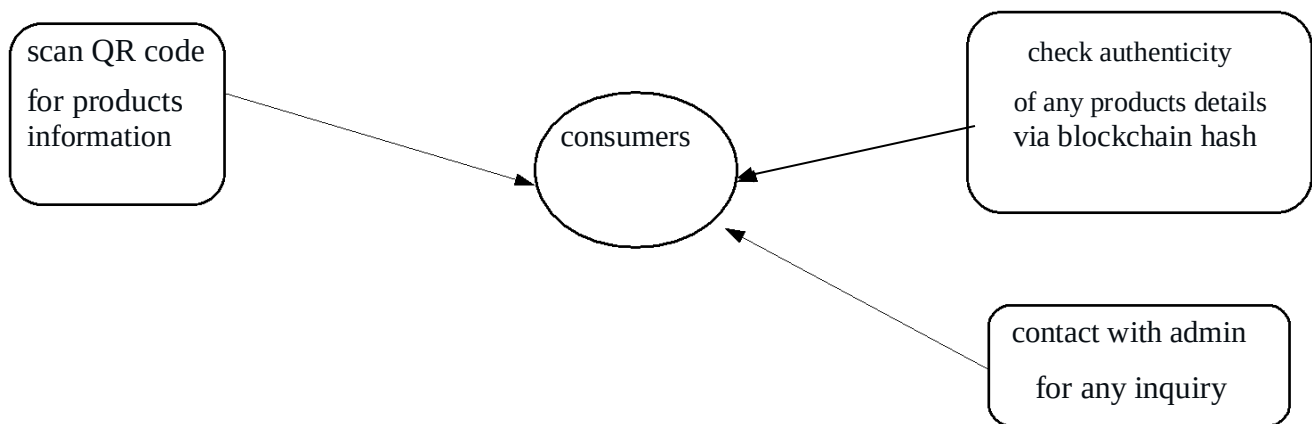
4.3 Interaction design and UX

There exists a correlation between interaction design and user experience design. Suppose we design a beautiful front end design with great performance and functionality of back end but target client or customers are unable to understand how to use our systems then we are already failed in the sector of our systems user experience design. On the other hand interaction design establish interaction between users and products. In this 4.3 section we will try to discuss about interaction design and user experience design of our systems.





(b) Admins interaction & UX design



(c) Consumers interaction & UX design

Figure 4.3: Interaction and UX design

Why we are using interaction design and user experience (UX) design in our application?

User experience describes any users feeling and experience about a system or application through a single diagram. By analyzing that diagram we can improve our systems performance and usability of our systems. So for our betterment and development of a great system we need to have used integration design and user experience design in our systems.

Processes that we used to design our systems interface design are given below:

- Analyzing of various kinds of users.
- Graphical interface design (GUI)
- Maintaining of the systems workflow (Conditional and Logical)

- Usability testing
- Prototyping of the system

4.4 Implementation requirements

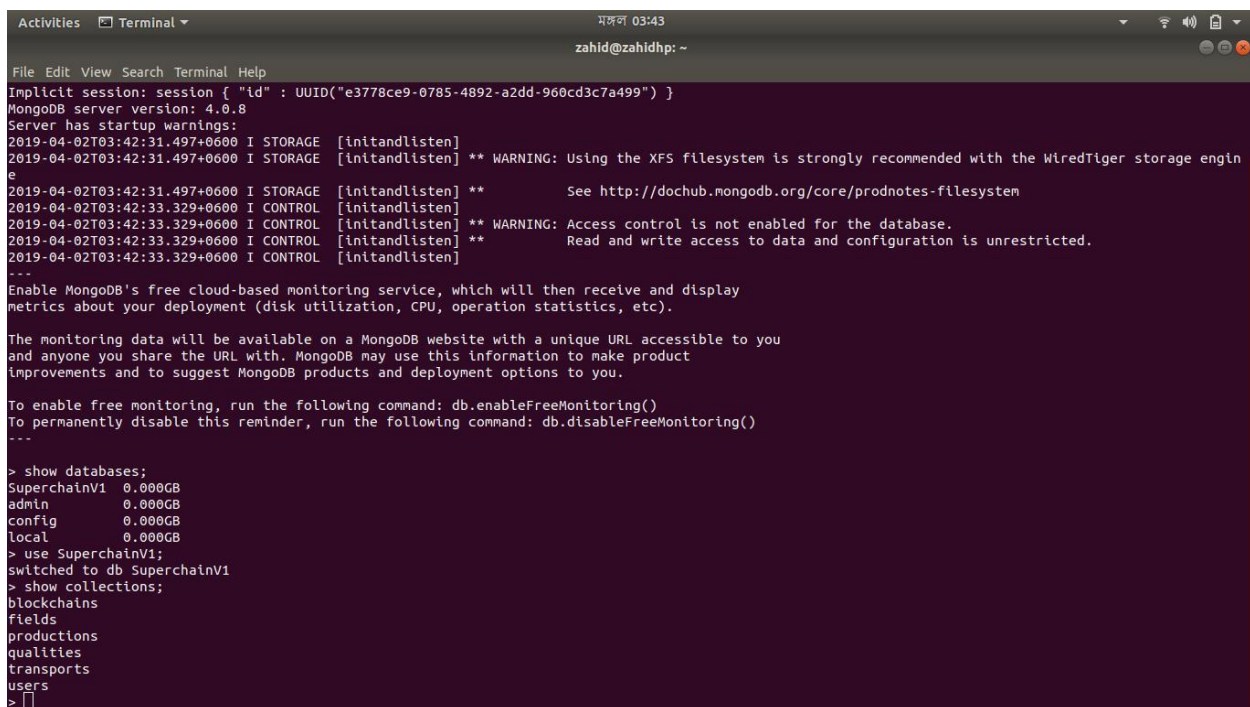
For implementing the project we read some research papers on supply chain managements, blockchain, decentralized applications. We try to understand how a supply chain be managed, pros and cons of supply chain management systems. Then technology and beautiful idea behind blockcahin, how to add cryptography to secure a chain, how hashes changes and tracks transactions. For building this system **we failed two times**. We tried various web technologies to build this systems. Firstly we used **php**, at the middle of our project we realized that we can not complete our project on this platform. Then we try **ruby on rails web framework** and its own blockcahin library **ruby-ethereum** but that was too complex for us and expensive so we abandon that. Finally we used nodejs and javascript write a code on the basis of the algorithm of blockchain that works for our project perfectly.

CHAPTER 5

IMPLEMENTATION AND TESTING

5.1 Implementation of back end database

For the implementation of back end database we used **mongoDB** which is a **NOSQL** database which treats everything as a object. It can store and view data into **JSON** format at anywhere thats the beauty of mongoDB.



```
Activities Terminal
mঙ্গল 03:43
zahid@zahidhp: ~

File Edit View Search Terminal Help
Implicit session: session { "id" : UUID("e3778ce9-0785-4892-a2dd-960cd3c7a499") }
MongoDB server version: 4.0.8
Server has startup warnings:
2019-04-02T03:42:31.497+0600 I STORAGE [initandlisten]
2019-04-02T03:42:31.497+0600 I STORAGE [initandlisten] ** WARNING: Using the XFS filesystem is strongly recommended with the WiredTiger storage engine
See http://dochub.mongodb.org/core/prodnotes-filesystem
2019-04-02T03:42:33.329+0600 I CONTROL [initandlisten]
2019-04-02T03:42:33.329+0600 I CONTROL [initandlisten] ** WARNING: Access control is not enabled for the database.
Read and write access to data and configuration is unrestricted.
2019-04-02T03:42:33.329+0600 I CONTROL [initandlisten]
---
Enable MongoDB's free cloud-based monitoring service, which will then receive and display
metrics about your deployment (disk utilization, CPU, operation statistics, etc).

The monitoring data will be available on a MongoDB website with a unique URL accessible to you
and anyone you share the URL with. MongoDB may use this information to make product
improvements and to suggest MongoDB products and deployment options to you.

To enable free monitoring, run the following command: db.enableFreeMonitoring()
To permanently disable this reminder, run the following command: db.disableFreeMonitoring()
---
> show databases;
SuperchainV1 0.000GB
admin         0.000GB
config        0.000GB
local         0.000GB
> use SuperchainV1;
switched to db SuperchainV1
> show collections;
blockchains
fields
productions
qualities
transports
users
>
```

Figure 5.1: Implementation of database

Installation requirements:

- Nodejs (Server side scripting language)
- Express (Javascript framework)
- NPM (Node package manager)
- MongoDB (Database)
- Mongoose (MongoDB database connector for nodejs)

5.2 Implementation of front end designed

For implementing front end design we mainly apply HTML, CSS, Javascript and other various web technologies. Some most used this that we used to developing ours system in given below:

- HTML5 (Hypertext markup language)
- CSS3 (Cascading Style Sheets)
- Bootstrap 4 (CSS framework)
- Javascript
- JQuery

5.3 Implementation of interactions

After implementing the front end design we added some blockchain algorithm to our system and observe that the system is working perfectly or not. We find that blockchain is working fine creating encrypted hash for every actions. On the other side we QR code to our systems and QR code also working perfectly. Finally we can said that implementation of interactions of our project quite successfully.

5.4 Testing implementation

Without testing we can not able to find out any systems bugs and errors. Sometimes there are no bugs and errors in the systems but there are some serious flows in logic and conditions. For the seek of finding that silly mistakes we need to test our systems. The more we test the system we the more will make our system great. Since we are dealing with some important data into our systems so we take some extra care about our projects security. We implemented three layers validations into ours data input forms. They are validated through front end, back end query, and nodejs middle ware. Finally blockchain gaives a extra protection layer on top of our systems because blockchain itself is one of the most secure technology so whenever it combines something automatically its security increases. At the end of day our systems basically use super shop employee and their consumers so designed our system according to them and we try to get some feedback on our systems.

5.5 Test results and reports

For measuring our system performance we conducted some testing. Test can be a vital element of lifting any systems performance dramatically. For measuring performance of our system we conduct some testing technique which are given below:

- Integration test
- System test

Integration test

Test case ID	Test case objective	Test case description	Expected outcome
1	Check the QR code giving correct details or not.	By scanning QR code gets all the phases data. (products details)	To get all the phases data. (Products details)
2	Products details uploaded to blockchain.	Entered productID and hit blockchain button immediately details uploaded to blockchain.	To upload details data to blockchain.
3	Generates new hash for every modification any products information.	Generates new hash if we modify any information previously which already in blockchain.	To generates new hashes for every modifications.

Table 5.5.1: Integration test

System test

Functions	Description	% Execute	% Passed	% Pending	Remarks
Data validation	Wrong formatted data will not accepted due to middle ware validation	100%	100 %	0	
Data input	Data input works perfectly for all the forms exists in the systems.	100%	100 %	0	
QR generate	QR code generates very fast and perfect conditions with high error corrections.	100%	100 %	0	QR image size is bigger than in general.
Data upload to blockchain	Data uploaded blockchain perfectly and result shown with hash into the console.	100%	100 %	0	
Search engine	Search engine works good and fast for any searching any products info through productID	100%	100 %	0	
Mailing system	Mail systems works and admin can communicate both consumers and mangers through mail.	100%	100 %	0	
JSON formatted data	Data stores at the database into JSON format and easily can retrieve it	100%	100 %	0	

Table 5.5.2: System test

CHAPTER 6

TOOLS & TECHNOLOGIES

6.1 Version controlling tool

Version controlling is a software systems that generally used for controls future updates of any software's, systems or even anythings. There are many kinds of version controlling systems exists, for our project's we have used **git**. Our project's **github repository** link is “<https://github.com/Zahid4960/SuperchainV1>” or “<https://github.com/RifatRaj/SuperchainProject>” and its screenshot is attached below:

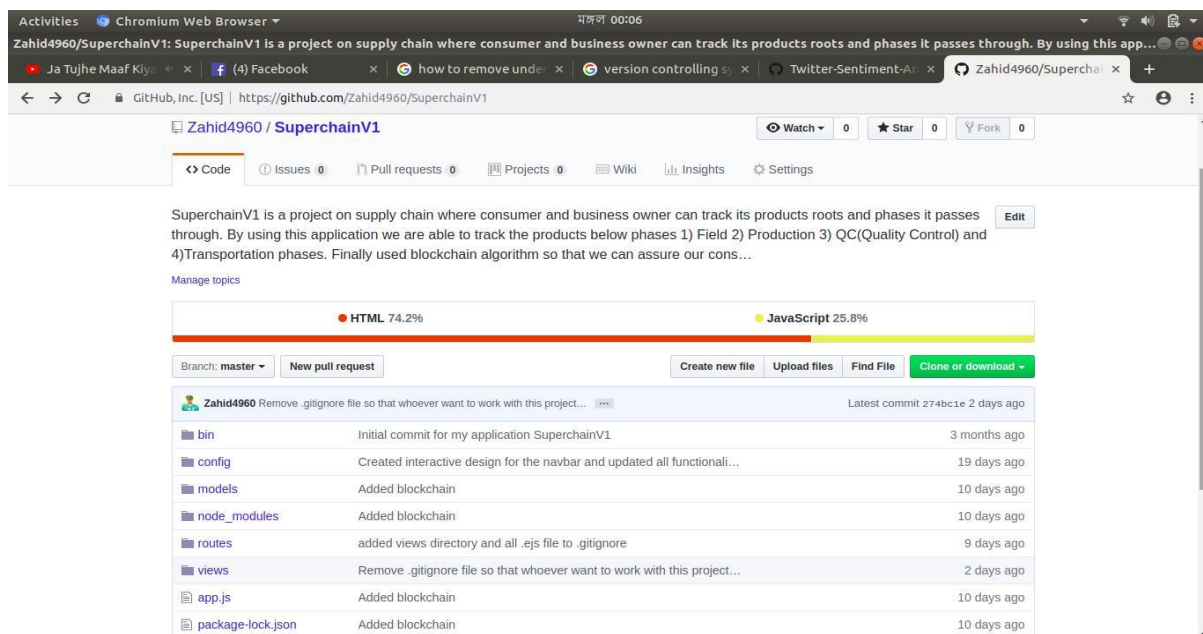


Figure 6.1: Project's github repository

6.2 Project management tool

Project management tools nowadays is an important things to manage any scale of project. By using project management tools we can very easily track our projects progress, drawbacks, issues which needs to be fixed, tasks that has already completed, tasks that are in testing phase etc. By adding members we can use it in our team project and every members of the project will get every updates of that project and can know which member is doing what on that particular time. We can add time to speed up our project's progress within a fixed time period. For project management we use **trelo** for our project. The screenshot of our projects trelo board is given below:

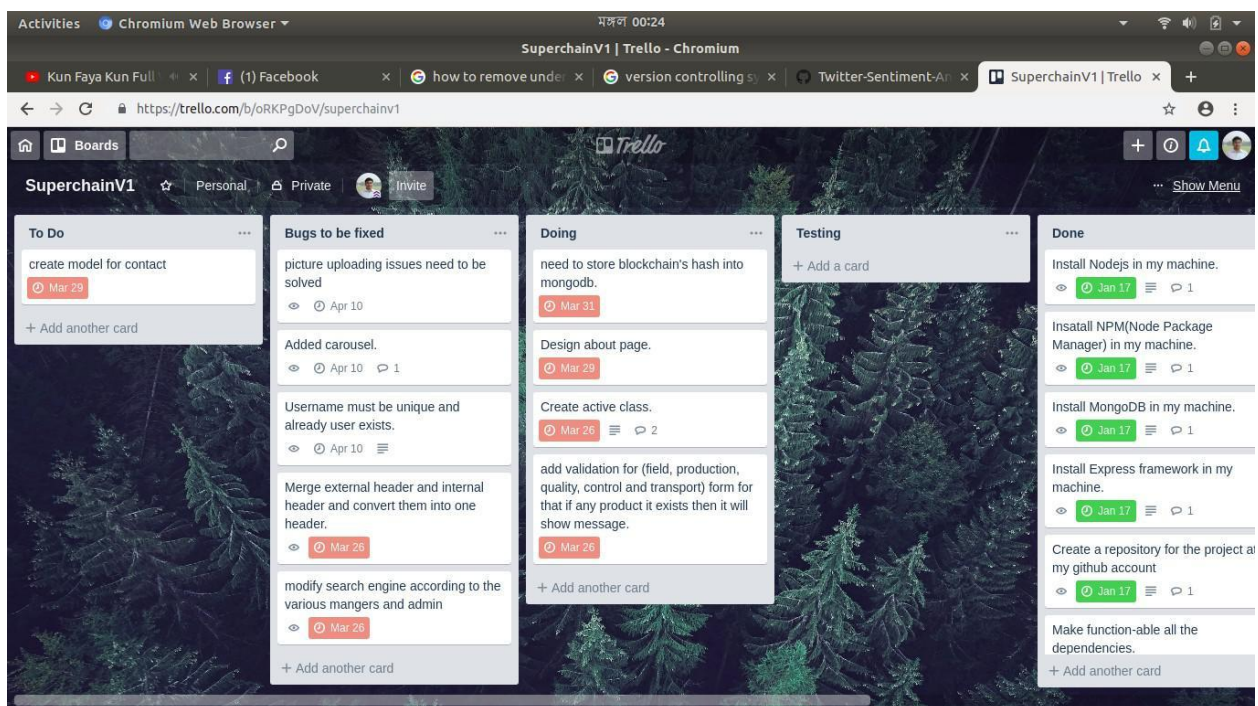


Figure 6.2: Projects trelo board

6.3 Text editing tool

Text editing tools is very very important for any software and system development. Without any text editor where we write our code. Nowadays there are many kinds of free and paid text editing tools available. For our project we used **sublime text 3** editor. The screenshot is attached below:

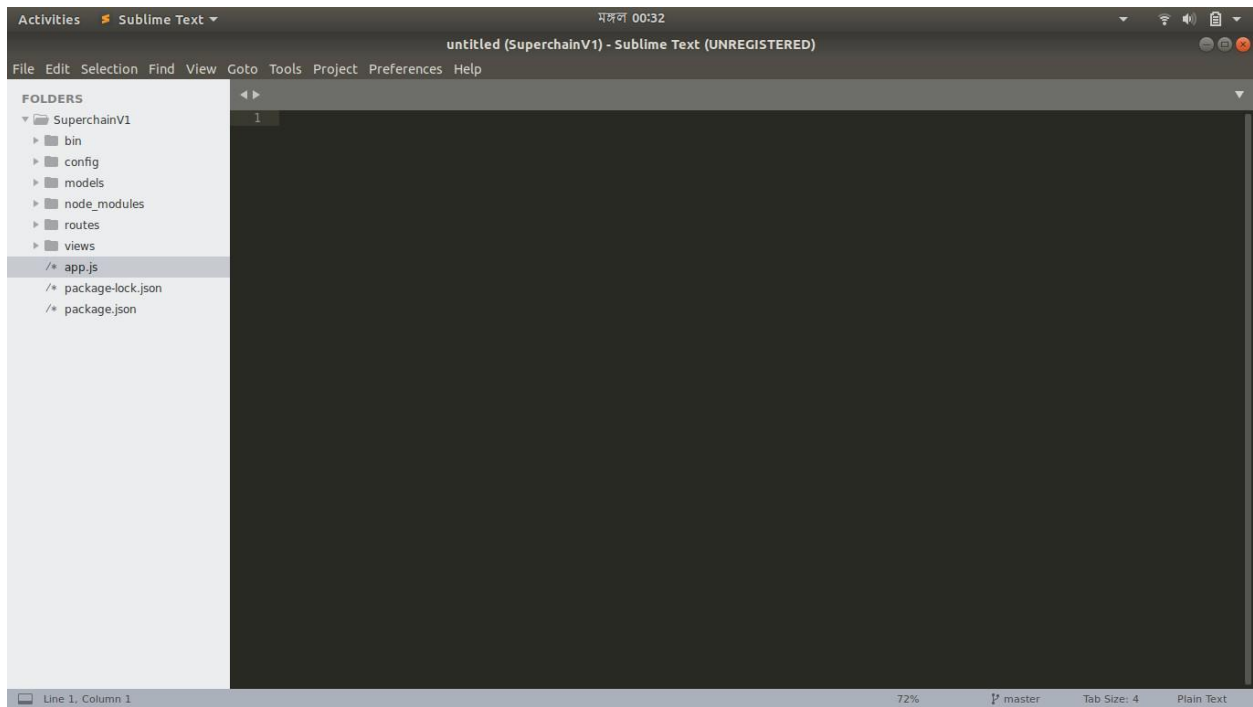


Figure 6.3: Text editor

CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 Discussion and conclusions

When we are preparing for our title defense we are determined that we will do a project on **Blockchain** though we know about that technology. But that time the hype of blockchain was beyond description. Then we reviewed some research papers on blockchains and their future applications. After analyzing our ability we come to a conclusions that we will do a project on supply chain management using blockchain. That time IBM and walmart was working that kind of project and even now they are still working on that project. At the time of developing our system we learn something new and beautiful technologies that can drives the modern technologies very fast. We also experience the beauty of decentralized applications. Our object was to find out any products root or full details that gone through our systems and for adding data transparency and decentralization we used blockchain. We think that it is our right to know about that particular product that we are purchasing from a super shop. Finally we can said that we are most of the cases successful and very proud of our work and hope that our supervisor also feel proud on our work. We tried something out of the box that makes us work hard but the final result is very sweet on the comparison of hard works.

7.2 Scope for further developments

Nowadays technologies are moving way faster than previous times so cope with that we always need to update. Since **Blockchain** itself is a new technology for Bangladesh and it also on various development and testing phase. We have also some ideas regarding to this project which we can implement in the future development.

- Developed a central system that runs under blockchain and monitored by government.
- By developing a central system for all super shops they can easily trace their lost product.
- Reduce time and supply complexity of a super shop by integrating blockchain for the whole system.
- Develop a cryptocurrency (ICO or initial coin offering) for the payment.

References

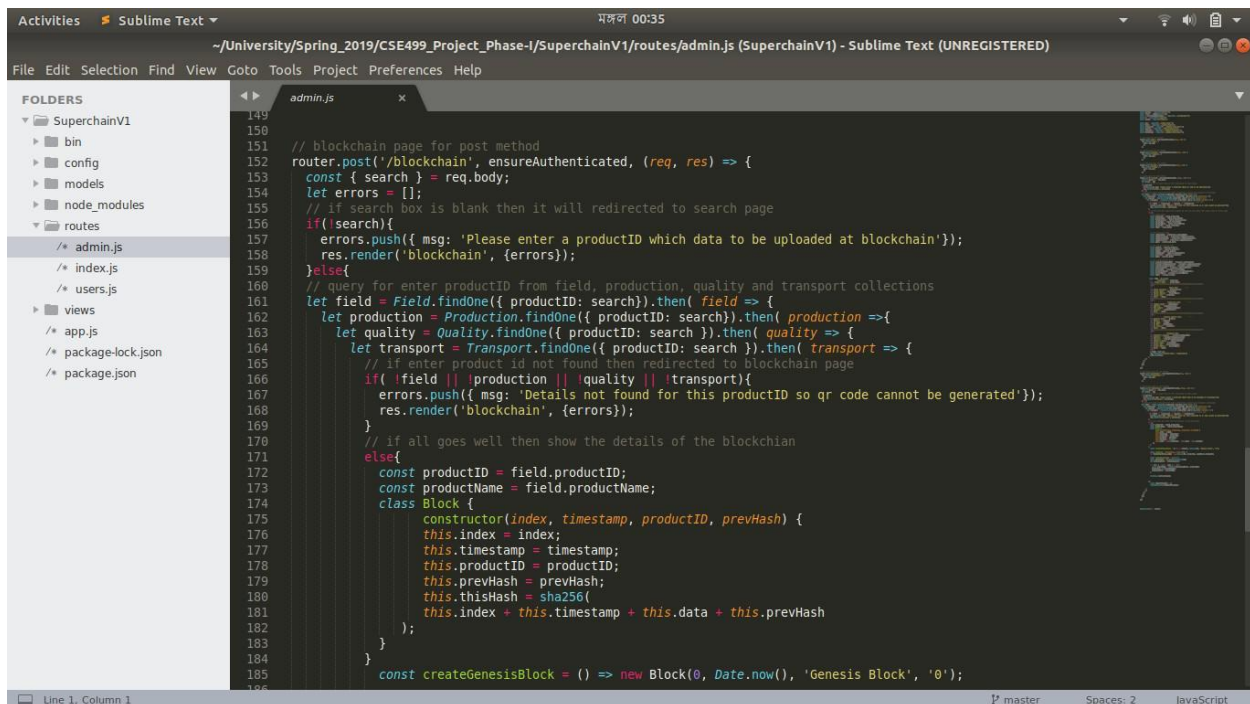
- [1] <https://www.zdnet.com/article/walmart-implements-ibms-blockchain-for-food-traceability/>, last accessed on 31st March 2019 at 11.00 AM.
- [2] http://www.worldresearchlibrary.org/up_proc/pdf/1121-151134311859-64.pdf, last accessed on 31st March 2019 at 11.00 AM.
- [3] Jamie Redman. (2016). Walmart & IBM Improves Food Safety WithBlockchain Tech. Bitcoin.com. Available:<https://news.bitcoin.com/walmart-ibm-food-safetyblockchain-tech/>, last accessed on 31st March 2019 11.10 AM.
- [4] CODEX Alimentarius. (2006). Principles for Traceability/product Tracing as a Tool Within a Food Inspection and Certification System. Last accessed on 31st March 2019 at 11.15 AM.
- [5] Pierro MD. 2017. "What Is the Blockchain?." Computing in Science & Engineering 19 (5): 92-95. doi: 10.1109/MCSE.2017.3421554. Last accessed on 31st March 2019 on 11.13 AM.
- [6] IBM. 2016. Hyperledger Architecture Working Group. Available from: https://www.hyperledger.org/wp-content/uploads/2017/08/Hyperledger_Arch_WG_Paper_1_Consensus.pdf. Last accessed on 31st March 2019 at 12.00 PM.
- [7] Provenance. From Shore to Plate: Tracking Tuna on the Blockchain. Available from: <https://www.provenance.org/tracking-tuna-on-the-blockchain>. Last accessed on 31st March 2019 at 11.45 AM.
- [8] The Economist. 2015. The Great Chain of Being Sure about Things. Available from: <https://www.economist.com/news/briefing/21677228-technology-behind-Bitcoin-lets-people-who-do-not-know-or-trust-each-other-build-dependable>. Last accessed on 31st March 2019 at 12.00 PM.

APPENDIX

Appendix: Project reflection

Appendix (project reflection) is used to provide an introduction to project reflection. Team project handling is a great way to understand real life software industry working structures and their project management techniques. We also tried to flow them. We used trello board for project management and github for version controlling.

The experience taught us that without proper planning and crafting development becomes slower as a result hectic for the project becomes high. In this positions the great efforts can not bring great result because of faulty systems, planning and project management. But by the grace of almighty **ALLAH** we overcome all the problems and developed our system **super shop supply chain management system using blockchain** and it is functioning properly.



```
149
150
151 // blockchain page for post method
152 router.post('/blockchain', ensureAuthenticated, (req, res) => {
153   const { search } = req.body;
154   let errors = [];
155   // if search box is blank then it will redirected to search page
156   if(!search){
157     errors.push({ msg: 'Please enter a productID which data to be uploaded at blockchain'}});
158     res.render('blockchain', {errors});
159   }else{
160     // query for enter productID from field, production, quality and transport collections
161     let field = Field.findOne({ productID: search}).then( field => {
162       let production = Production.findOne({ productID: search}).then( production => {
163         let quality = Quality.findOne({ productID: search }).then( quality => {
164           let transport = Transport.findOne({ productID: search }).then( transport => {
165             // if enter product id not found then redirected to blockchain page
166             if( !field || !production || !quality || !transport){
167               errors.push({ msg: 'Details not found for this productID so qr code cannot be generated'}});
168               res.render('blockchain', {errors});
169             }
170             // if all goes well then show the details of the blockchain
171             else{
172               const productID = field.productID;
173               const productName = field.productName;
174               class Block {
175                 constructor(index, timestamp, productID, prevHash) {
176                   this.index = index;
177                   this.timestamp = timestamp;
178                   this.productID = productID;
179                   this.prevHash = prevHash;
180                   this.thisHash = sha256(
181                     this.index + this.timestamp + this.data + this.prevHash
182                   );
183                 }
184               }
185               const createGenesisBlock = () => new Block(0, Date.now(), 'Genesis Block', '0');
```

Figure 7.1: Snippets of code

PLAGIARISM REPORT

Plagiarism report

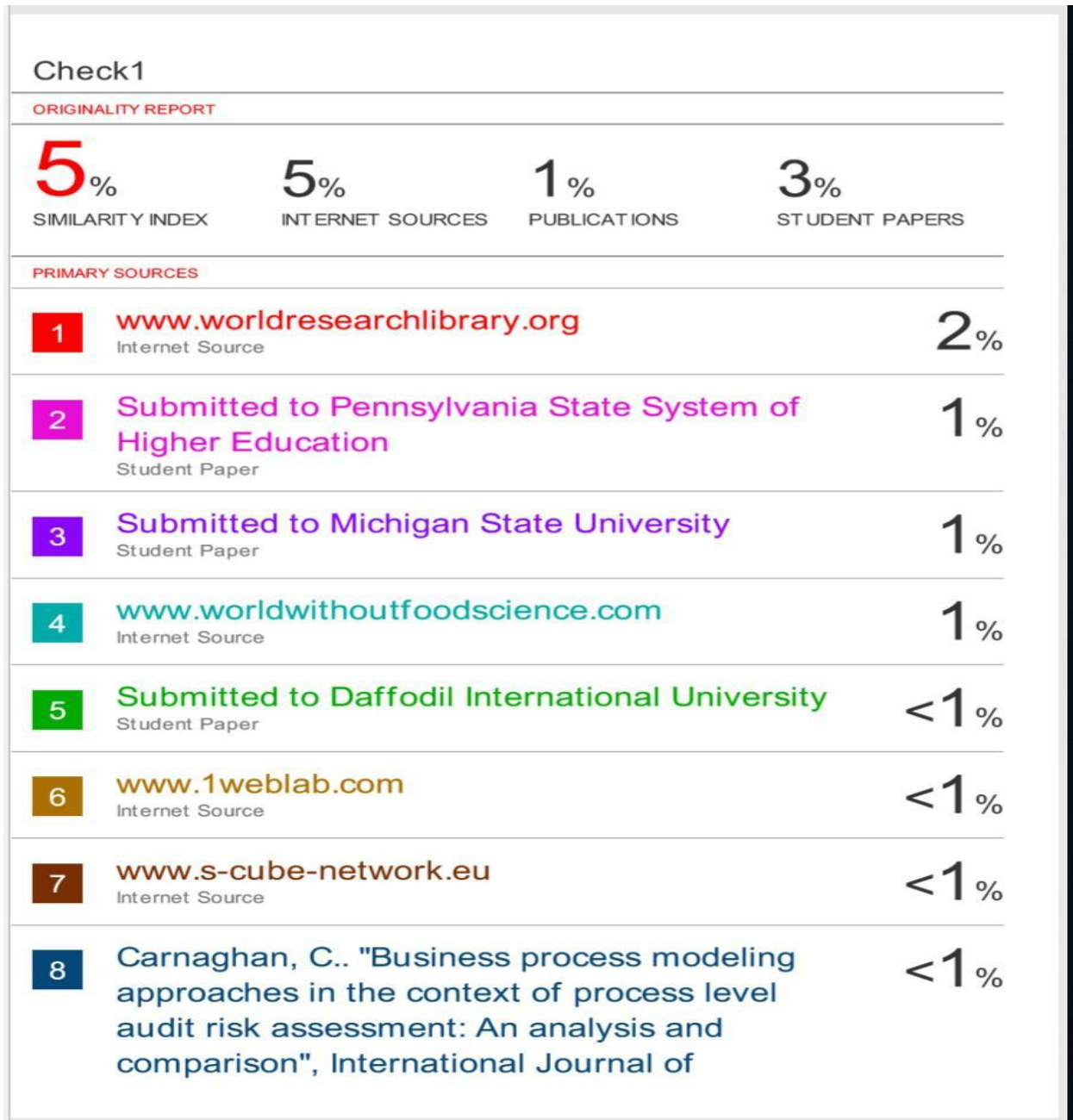


Figure 7.2: Plagiarism report