Blockchain NFT project (Group 1)

Supply Chain Management using Blockchain and NFT

*Increasing Transparency & Traceability*

<table>
<thead>
<tr>
<th>Group Member</th>
<th>UID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agarwal, Siddharth</td>
<td>3035555482</td>
</tr>
<tr>
<td>Bera, Navoneel</td>
<td>303551735</td>
</tr>
<tr>
<td>Lohia, Suyash</td>
<td>303550406</td>
</tr>
</tbody>
</table>

Supervisor: Dr. Yuen, John
Table of Contents

Table of Contents 1

Background 2
    Market Introduction 2
    Supply Chain: Solutions and Problems 2

Objective 4

Methodology 5
    Workflow 5
    Deliverables 6
    Technology Implementation 6
    Feasibility 6

Challenges and Risks 9

Tentative Schedule 10

References 11
Background

Market Introduction

Due to extensive globalisation and rapid growth of the world economy, millions of businesses operating across different regions or countries are now highly interconnected. This interconnection requires extremely smooth and efficient coordination between entities to ensure that business and economies function successfully. This need for coordination has led to the rise of supply chain management solutions and a market which is responsible for the transitioning of goods and services across multiple economies. The expansion of international trade and the rapid demand for innovative technology based supply chain management solutions has led to the entire industry growing by more than twice in the past decade. In 2020, the global supply chain management market was worth approximately 16 billion U.S. Dollars. (Mazareanu, 2021)

To automate supply chains and ensure that businesses operate in a cost and time effective manner, many Enterprise Resource Planning (ERP) softwares have been developed to cater to it. Companies such as Microsoft, Oracle, SAP, Blue Yonder etc. have been innovating on various different technologies to solve the core issues like procurement, demand forecasting, tracking and authentication.

Supply Chain: Solutions and Problems

In this project we shall be focusing on one of the core tasks in the supply chain and logistics management industry, which is the tracking and authentication of goods from the origin to its final destination. One of the biggest issues faced in the supply chain industry is the amount of value lost in stolen and tampered goods across its transit. It has been reported that more than 20% of stock is lost out due to these inefficiencies. (Lemma, 2020)

The entire process, from sourcing, manufacturing goods to shipping them across the world to retail sellers and then to consumers requires the exchange of these goods across multiple stakeholders and third party organizations.

The exchange of the goods is either documented using physical paper- contracts or through rudimentary technological solutions which include tracking and transferring the bill of lading agreement (a receipt issued to the shipper including details such as size, weight, count of the shipments used to denote legal responsibility of the goods) (Tarver, 2021) . There are many issues with the current system of tracking goods, because of which the process becomes complicated, time consuming and expensive. One of the biggest issues is the lack of a
standardized system, due to which stakeholders implement different technologies to collect, process and share their data. Moreover, the data gathered is not easily accessible which leads to many manual back office tasks.

To solve this problem, many organizations have utilised the benefits of blockchain technology and incorporated it into their solutions. Blockchain is a technology that allows authenticated and secure communication between users on its network without the presence of a centralised authority. It is essentially a database of records, capable of storing data of different formats which is publicly shared between all users. For additions to this database, there is a verification mechanism which requires a majority consensus or 50% of its users to confirm the records. Due to the structure of this technology, all data are secured, immutable and decentralised in nature.

Due to the above mentioned features of blockchain, each stakeholder in the network can interact with each other for information exchange. With transactions being traceable, and real time in nature, blockchain can help stakeholders reduce their losses from counterfeiting, increase transparency of the entire supply network, and improve visibility, compliance over outsourced contract manufacturing. It can further reduce paperwork and administrative costs (Laaper, 2021). Technology giant IBM is using the above features of blockchain to provide users with IBM Blockchain Transparent Supply which is a much more effective tool.

There are two problems with the implementation of blockchain technology. Firstly, even though the database is decentralized and immutable, the information posted onto it could be non-credible in nature. During an exchange, false information could be easily reported and fed into the immutable database which could lead to potential issues. The second issue is that all exchanges and transactions in the blockchain network are implemented using smart contracts. These smart contracts are traceable, however, are difficult to access due to its extensivity and lack of user friendliness.

To address the above problems and make the process more reliable and efficient we shall be using Non Fungible Tokens (NFT). NFT is a unit of any type of data which is unique in nature and cannot be modified. NFTs are stored on the blockchain and are used to represent and certify digital assets. One of it’s biggest advantages is that it is extremely easy to transfer, track and access as compared to other entities on the blockchain.

Using NFT’s, the entire process could be made more reliable, efficient and user friendly. The information on every single good shall be trustworthy and easily accessible, with even end-users acquiring all knowledge about the products. We are motivated to truly democratize the entire tracking, authentication process in the supply chain industry and make information decentralized and easily accessible to the general public.
Objective

This project aims to develop a substitute for the current supply chain management systems which provides traceability and transparency, not only to the companies involved but also to the consumers. This will be a blockchain-based application that will utilise NFTs for tracking the goods being transferred in the supply chain. A web application will be developed to serve the companies specifically as well as a mobile application to cater to the needs of both consumers and companies.

From the perspective of the companies, the application will provide a one-stop shop to improve logistics. The management can track each and every product with each good being an NFT and present on the blockchain. Whenever there is any loss of goods, the application will flag the shipment of that product which can then be manually inspected. Due to the immutable nature of blockchain, the system will be transparent and efficient (Chod et al., 2020). Furthermore, the application will also help the consumers gain more knowledge about each product thereby increasing their trust in the company.

Once the products reach the final step of the blockchain, for example, a retail store, the consumer can choose to view the products in that store through the mobile application. This will increase their trust and will help them to do two things: first, trace the origin of items so as to confirm ethical sourcing practices are met and second, confirm the authenticity of luxury goods so as to combat the circulation of counterfeit goods in the supply chain.

With a mobile and web application based on blockchain which utilises NFT for certified exchange of goods, the project will provide a trusted alternative to all stakeholders of the supply chain which is transparent and reliable. Although the scope of this project will be to complete these requirements, the team’s vision is to provide the same as a SaaS (Software As A Service) platform which can help revolutionize the supply chain.
Methodology

Workflow

A web interface will be created for the management to input all the goods required by the company on our database. These goods can be based on different units (weight, quantity) dependent on the needs of the company. During the transfer of goods, the first stakeholder needs to select the goods being transferred on the mobile application. The application linked to the blockchain will tokenize these goods into an NFT. In the entire supply chain, as physical goods are transferred, the relevant stakeholders will need to transfer or accept the NFT through the application, thereby relieving or taking ownership of the goods. If there is any loss of goods, the stakeholder can refuse to accept the NFT and the company is immediately informed regarding this event. Consequently, the company will be aware of the loss of goods at the actual step of the supply chain. Additionally, the transfer of NFT will allow the companies to track the goods through the web application (Fig. 1).

*Fig 1.* High level overview of the product workflow.

**Step 1:** Company Management enters product information on the web interface; **Step 2:** First point of contact in supply chain selects items and adds data about items in order to tokenize them; **Step 3:** The transfer of ownership is a repeating process between all intermediaries of the supply chain until the item is received at the store. **Step 4:** Goods reach the final step of the supply chain; **Step 5:** All products at the store can be tracked by end consumers through the application; **Step 6:** If at any point during the transfer of ownership the consignment is deemed unfit, the item is flagged; **Step 7:** Manual supply chain processes take over to handle the processing of flagged items.
**Deliverables**

1. An implementation of the blockchain so that tokenization and transfer of goods becomes possible.

2. Create an easy to use web interface:
   a. Allow the companies to input and edit information regarding their goods
   b. Provide tracking of the goods by utilizing the blockchain developed.

3. Develop a user friendly mobile application:
   a. Companies: Can select the goods for transport; transfer and accept goods; achieve tracking of goods; in case of fault with goods, refuse the transfer which will lead to manual inspection.
   b. Consumers: Able to trace the origin of items before purchase.

**Technology Implementation**

1. Currently, we have decided to use the Ethereum blockchain (due to the ease of working with NFTs), but are constantly researching if there are more suitable options available in terms of gas fees which would otherwise drive up the price of each transaction.

2. We will be using Solidity, which is an OOP style language, since it is specifically designed for Ethereum. As we will be storing just metadata in the form of tokens, an external storage solution such as an interplanetary file system shall not be required.

3. We will be using node.js to set up our backend which will be the interface between the blockchain and the applications. Node.js is an open source and robust back-end javascript framework that is extensible via libraries, is cross platform, lightweight and allows for highly asynchronous code.

4. We will be using React Native to develop this application so that it is cross platform which means that all apps run from the same unified code base regardless of platform. We will also be building a web app using React for these purposes as it has various useful features such as state management, reusable components as well as a very strong developer community to support it.

**Feasibility**

The feasibility of our deliverables can be analysed by breaking down the product into the following parts:
1) **The blockchain:**
   a) The blockchain forms the backbone of the whole system and will be the first step of the development process.
   b) The Ethereum community is large and growing so we expect the set up of the blockchain to be streamlined.

2) **Tokenizing real world assets:**
   a) After setting up the blockchain, the next step would be to tokenize the items.
   b) We will be storing metadata about the items such as type, count etc. All this data will be made into an NFT for each of the items to be shipped. Homogenous items can also be grouped together into one NFT thereby saving gas fee.
   c) Tokenizing will happen at the first point of contact in the supply chain (For example: factory or a farm). Since these NFTs are on the blockchain, the transfer and tracking of the goods becomes easy and reliable.

3) **Backend for application(s):**
   a) This part of the project will be relatively easy and fast to implement due to the extensive developer community behind node.js as well as a vast amount of both first and third party libraries built for the framework.

4) **Application for supply chain clients:**
   a) A web application which will allow companies to input information regarding their goods in a CRUD (Create, Read, Update, Delete) manner. It will also provide additional features of tracking of packages and goods.
   b) A user-friendly app will be made for the entire process in such a way that the detailed working of the underlying blockchain technology will be abstracted away from the end user. This is intended for use by intermediaries in the supply chain for functions such as tokenization and transferring ownership of goods, and reporting problems with the goods.
   c) This part of the project might be time consuming because it requires prototyping the various components of the applications and further requires integration with our backend system in a frictionless way so as to guarantee a seamless user experience. However, due to the complementing nature of React, React Native and node.js, the challenges related to application development are limited.

5) **Setting up interface for consumers:**
   a) We shall have another interface on the mobile application for consumers which will help them to trace the origin and/or confirm the authenticity of items. We’re planning on tackling this using two approaches.
      i) We plan to keep a record of all the items that end up at a particular store so that the consumer can easily browse this list and see the origin of items
before buying them. This is done under the crucial assumption that homogenous items (such as two boxes of the same cereal) have the same origin.

ii) The second way (which doesn’t require any assumptions on the origin of the items) is to use QR codes on each item that can be scanned in-app to see the origin and trace the path of the item.

b) Further research needs to be conducted in order to decide between these two methods based on their advantages and drawbacks.
Challenges and Risks

There are a few technical and business risks associated with the project:

1) The biggest risk is the carbon footprint associated with minting and subsequent transferring of NFTs on the Ethereum blockchain. It is estimated that minting of a single NFT uses the same amount of electricity as used by an average U.S household over a day and a half (A. T. R. E. Hub, 2021). However, with the release of eth2 blockchain in the near future, this footprint is estimated to be cut down by ~99.5% (Beekhuizen, 2021)

2) Human error/misuse is also a risk. Errors can be corrected, however misuse like quoting the wrong count or selecting the wrong products is hard to counteract and is not in the scope of this product.

3) Loss of goods due to external factors cannot be accounted for even though the application will be able to detect the loss.

4) Traceability of homogenous goods coming from different locations in retail stores is challenging, which we are trying to solve by researching different solutions.
# Tentative Schedule

For an efficient research and development process, we plan on following an iterative process using an agile methodology.

<table>
<thead>
<tr>
<th>Stages</th>
<th>Task</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1</td>
<td>Research on the feasibility of different blockchains with respect to throughput and gas fees and further study on various NFT standards</td>
<td>4th - 29th October</td>
</tr>
<tr>
<td>Stage 2</td>
<td>Develop a module to tokenize goods based on information</td>
<td>1st - 15th Nov</td>
</tr>
<tr>
<td>Stage 3</td>
<td>Develop a pipeline to create and transfer NFTs across a blockchain network</td>
<td>16th Nov - 30th Dec</td>
</tr>
<tr>
<td>Stage 4</td>
<td>Develop a web and mobile interface which allows the initialization, transfer and tracking of NFTs</td>
<td>3rd Jan - 14th Feb</td>
</tr>
<tr>
<td>Stage 5</td>
<td>Build interface for consumers using which the origin can be tracked and the authenticity can be verified.</td>
<td>15th Feb - 14th March</td>
</tr>
<tr>
<td>Stage 6</td>
<td>Test the entire product in iterative sprints and improve the UI/UX of interfaces.</td>
<td>15th March - 15th April</td>
</tr>
</tbody>
</table>
References


