

SupplyChain Management Using BlockChain

by

Tanzimul Haque

162014046

A project report submitted in partial fulfillment of the requirements for the degree of
Bachelor of Science in
Computer Science and Engineering

Supervised By:

Tangila Islam Tanni



Computer Science and Engineering
University of Liberal Arts Bangladesh
House 56, Road 4/A @ Satmosjid Road,
Dhanmondi, Dhaka-1209,
Bangladesh.

Date, June 2021

DECLARATION

This internship/project report is submitted to the Computer Science and Engineering, University of Liberal Arts Bangladesh in partial fulfillment of the requirements for the degree of Bachelor of Science. So, I hereby, declare that this internship/project report is based on the surveys found by me. Materials of work found by other researchers are mentioned by reference. This internship/project report, neither in whole, nor in part, has been previously submitted for any degree.

Tanzimul Haque

Student Name: Tanzimul Haque

ID: 162014046

Email Address: tanzimul.haque.cse@ulab.edu.bd

CERTIFICATE OF APPROVAL

The project/internship report entitled “Supply Chain management Using BlockChain” Is submitted to the **Computer Science and Engineering**, University of Liberal Arts Bangladesh, Dhaka in partial fulfillment of the requirements for the degree of Bachelor of Science.

Dated: June 2021

Head of Department: Dr. Syed Akhter Hossain

Computer Science and Engineering

University of Liberal Arts Bangladesh

Signature & Date

Supervisor Name: Tanjila Islam Tanni

Computer Science and Engineering

University of Liberal Arts Bangladesh



Signature & Date

Abstract

This is a Blockchain based application that helps to track every step of a product's life cycle, from its production to its end destination the consumer. This Blockchain data will be publicly available so anyone can validate the legitimacy of a product. A fake product won't have any data in this Blockchain so we can easily determine if it's worth buying or not. This system uses SHA-256 Algorithm to generate a hash that contains all the information of the product and the previous blocks hash. This link of blocks creates a chain of blocks that is immutable and easily accessible. This system also has authentication system to allow authorized personal to add data to the block. Everyone will have access to view data on the blockchain to see its origination and it can easily be determined if the product is from a secure source or not. This transparency in the Supply-Chain management system will ensure customer satisfaction and easily help companies identify counterfeit products.

TABLE OF CONTENTS

1. Abstract

2. Introduction

3. Review of Literature

- Objective
- Project Scope

4. Methodology

- Requirement Gathering and Analysis

- System Design
- Implementation
- Testers
- Justification of methodology

5. Analysis, Design, and Development

- System Study
- System Analysis
- Design
- Admins and another user

6. Feasibility Study

- Technical Feasibility
- Economic Feasibility
- Operational Feasibility

7. Conclusion

8. Appendixes:

- Flow Chart Diagram
- Class Diagram
- Entity Relation Diagram
- Use Case Diagram
- Gantt Chart

INTRODUCTION

Every day billions of dollars worth of products are being sold. Most of the time we get the right product but sometimes we get scammed online and have to a lot of money for a counterfeit or bad quality product. So how we really solve this? Do we just take the companies word that it's a good product and it was made in Europe instead of China? This is where Blockchains helps. This is a chain of networks where registered companies can add their product's manufacturing location, Batch number, production date, where it will be stored when it was shipped to the retail store ETC. Fundamentally it's a more transparent Supply-chain management tool that is shared by everyone and validated by everyone connected to the network. To understand blockchains first we have to get an idea about Markel tree. Markel tree is a data structure format that uses algorithms to link data sets together and make them a chain that can be validated by a system. Bitcoin and Ethereum is mostly known to use this technology. Distributing these data over thousands or millions of devices ensure that the network is secure and safe. Everyone will access to the ledger after synching with the network and authorized personal can add data to the network if they wish to. These data will be created as blocks and will also contain the hash of previous block. So in theory the last block added to the chain contains all the information of the previous blocks that can't be decoded. We are taking this concept and applying it to supply chain management system where the data can be transparent and can be validated by each customer using the network. The most important thing about this system it is managed by everyone so there is no singular governing body to manipulate the data.

Review of Literature

Objectives:

- To create a Blockchain network to store product data
- To provide needed information about the products to everyone connected to the network
- Validate the data in the network by ensuring that it is immutable
- User-friendly interface to make blockchains more understandable to the general public

Project Scope:

E-commerce infrastructure has been doing a major part in the last year alone because of covid-19. People have to order everything from daily necessities to even Eid dressed online. So, this whole system should be well maintained by a reliable entity. BlockChain can make things easier for customers and sellers. In the vast majority of cases, today's supply chains run at scale without the use of blockchain technology. Nonetheless, the technology has caught the interest of the IT and supply-chain industries. It's also sparked plenty of publications and encouraged big IT companies and startups to launch potential trial initiatives.

This system contains a huge database of products made by many different producers. The users will use this system to validate and handle transactions easily.

Methodology

Requirement Gathering and analysis: A JavaScript library name Bcrypty was used for the hashing function, express library was used for routing, and node JS for the backend part of the project. Basic HTML/CSS was used for the frontend and a library named passport used for authentication.

System Design: This phase examines the requirements specifications from the previous phase and prepares the system design. System design aids in designing overall system architecture as well as describing hardware and system requirements. The created blocks were linked to each other by their hashes. The Merkle tree/ hash tree formation made the whole system work and unique. After a user entered the product description it was permanently engraved into the blockchain network and anyone could view it contains.

Implementation: The system is initially constructed in a simple program, then developed and tested, using inputs from the system design.

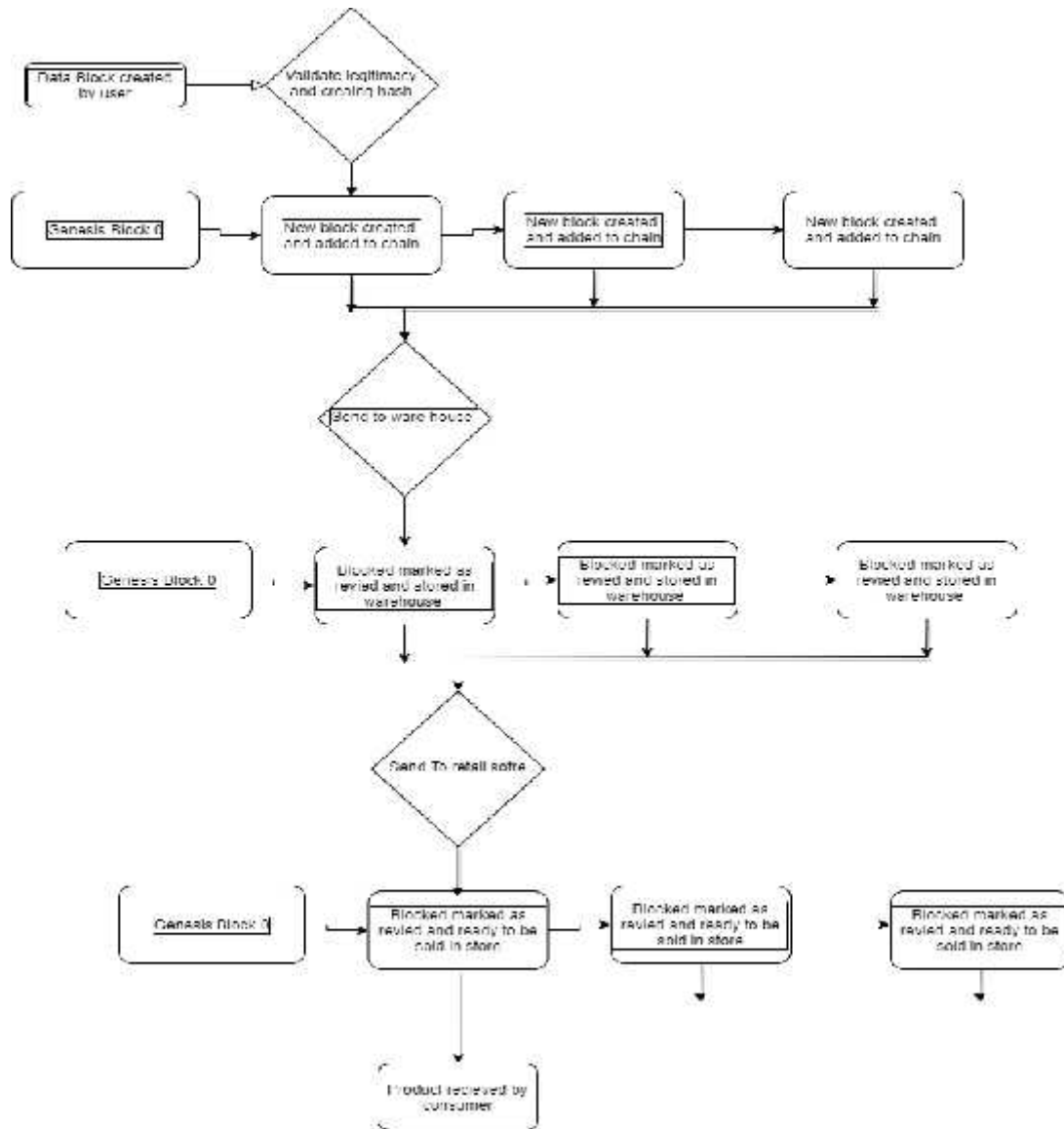
Testers: In order to obtain a precise list of the features and services that must reply in accordance with the specifications and diagrams presented, few products were added to the system to check if the system worked properly. after adding them we can validate their hashes by their hashing their product data and time stamp.

Justification of Methodology: Every software developed is different and requires a suitable SDLC approach to be followed based on the internal and external factors Appropriate are:

- Requirements are Clear and well defined
- Technology is continuously improving and stable
- The project is very complex to implement but use cases are very high
- Simple UI with a complex backend makes this work.
- Blocks are immutable and everlasting in the blockchain.

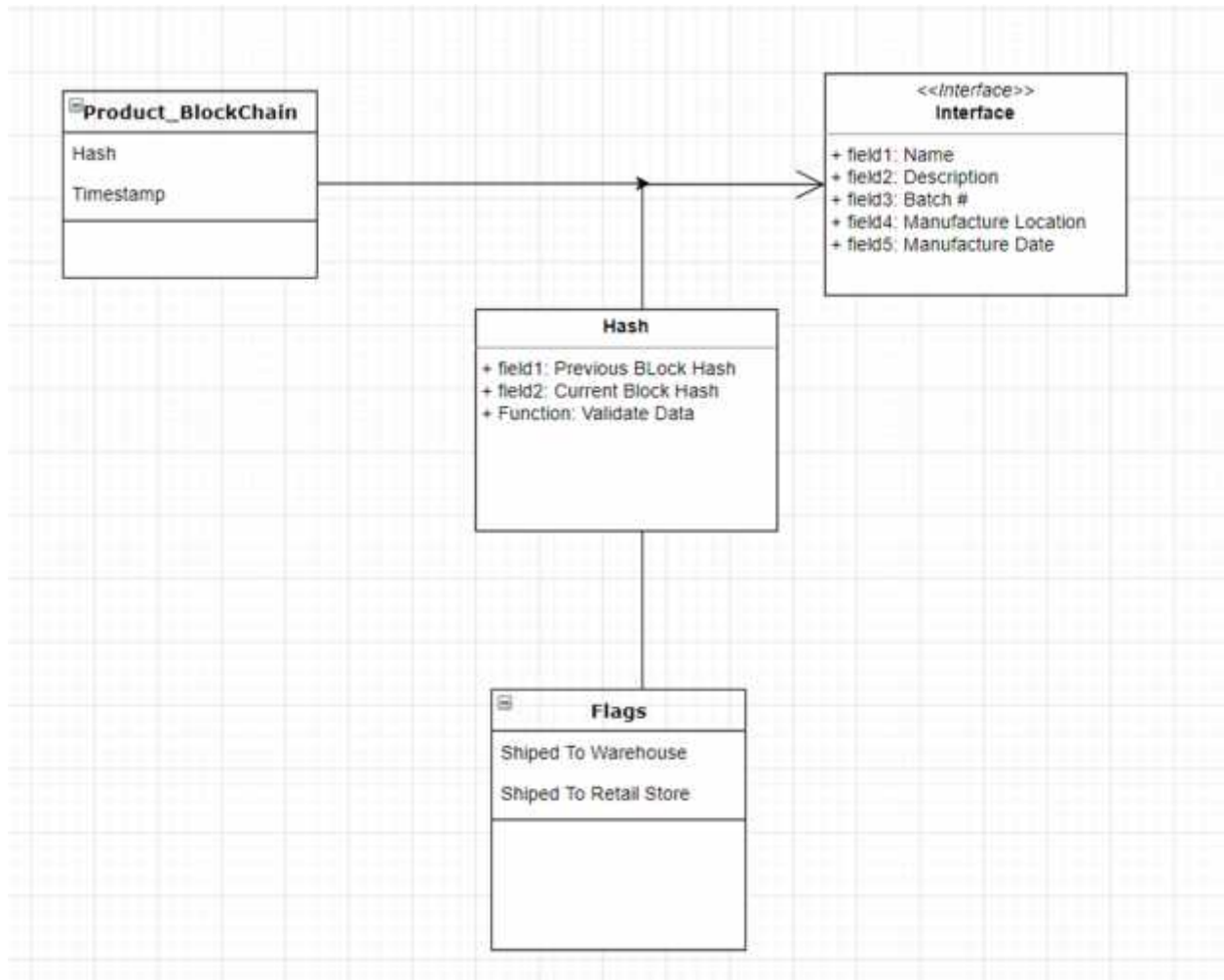
Diagrams

Flow Chart Diagram



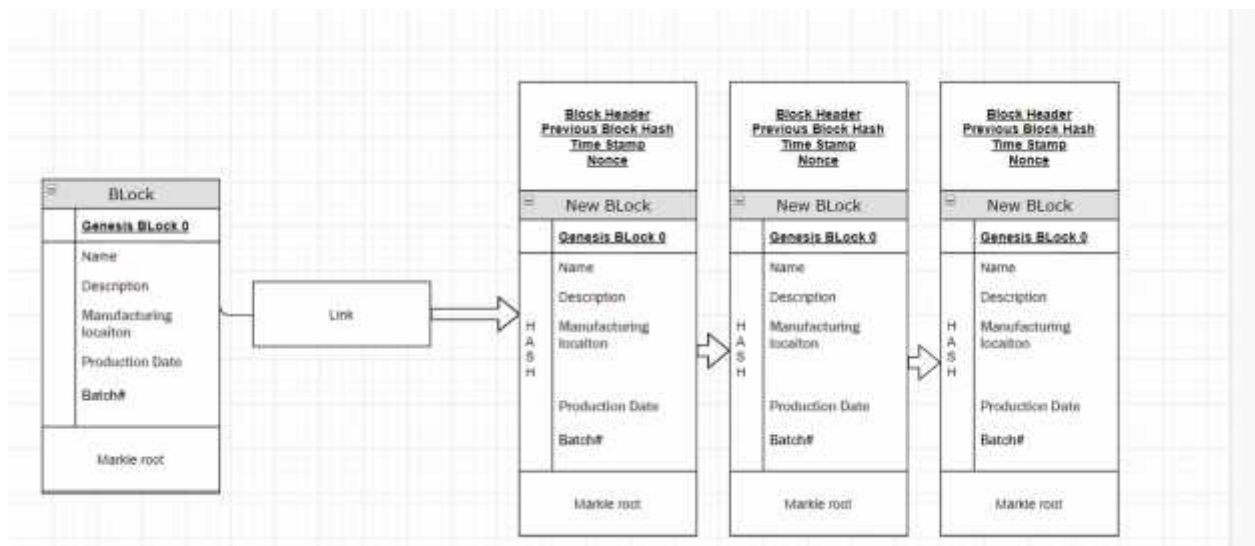
This is a diagram showing how a block is created in a factory system administrator then flagged for shipping. Then those blocks are ready to ship to warehouse and after that to retail store.

Class Diagram



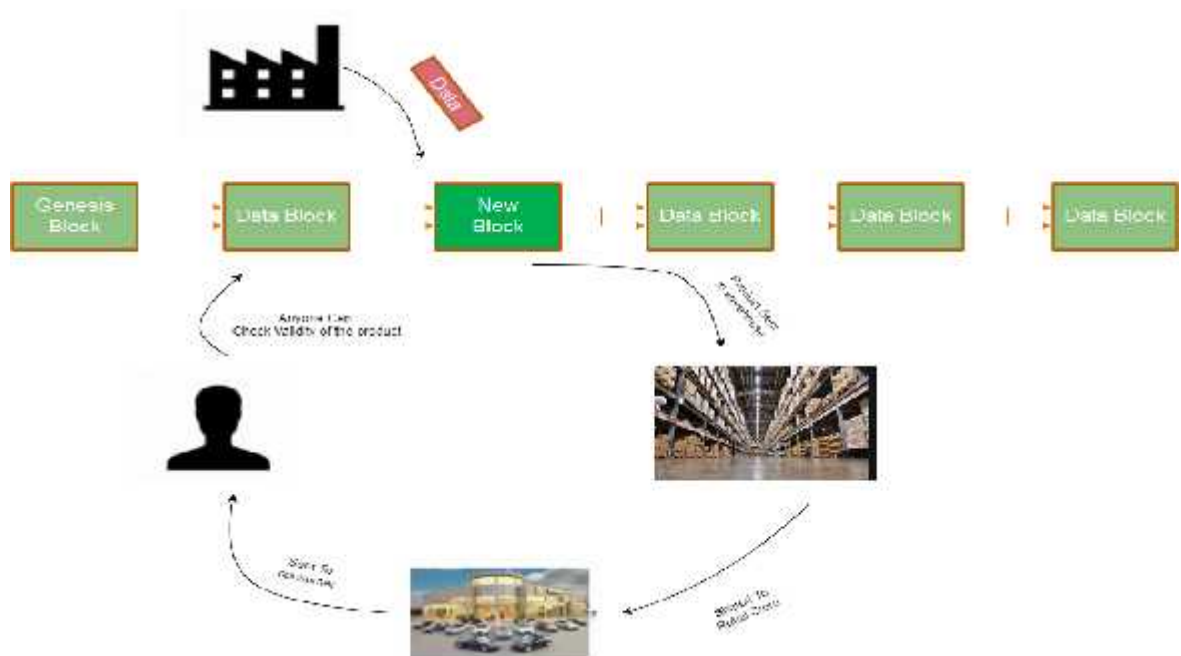
This system only has one class. That the blockchain class containing block structure and the genesis block 0. Every single block after that is built upon this class.

Entity Relation Diagram



The relation of the blocks are 1:2. Every block is connected to the previous block and the next block its linked to. Expect the genesis block that has no previous block and hash of 0.

Use Case Diagram



This diagram shows the use case of the system. How the blocks are created in a secure place and follows a products life cycle. And the end user can easily view these information's via a dash-board in web.

Gantt Chart



This diagram shows the timeline of the project. It took almost 3 months to develop the whole project. There was a lot of backend work for the network than front end UI for the users.

ANALYSIS, DESIGN, AND DEVELOPMENT

System Study: The study was carried out to create a decentralized network where authorized personals can add product data as blocks in the system. Every single block is unique and linked to its closest block via Hash. This makes the blockchain immutable after entering some data and it can be validated easily.

System Analysis: During the system study phase, requirements of what kind of hashing algorithm will be used were determined. Also, a login system and web interface were needed for the front end of the system.

Design: The outcome of the project will be a web-based system where we used the SHA-256 algorithm to generate hash and link blocks with each other. After entering product data, it is shipped to a warehouse where it can be flagged as delivered or damaged. The warehouse manager can verify the integrity of the product and send it to a retail store where it can be sold to the end

consumer. The end-user can easily search for the hash in the block-explorer and see the digital signature left by the product to validate its authenticity.

ADMINS AND OTHER USERS: only admins can add data to the block and these admins will be authorized retailers and producers of goods. They can help maintain the blockchain but won't be able to change any of the added data. Anyone can see products in the blockchain by searching their hash. This will show them a lot of information about that particular product like when it was produced, batch number, Manufacture location ETC.

BLOCK CREATION PAGE

A screenshot of a web page titled "Enter Product details to add it to System". The page has a green background. In the center, there is a white rectangular area containing five input fields stacked vertically. The labels for these fields are "ProductName", "Description", "Manufacture location", "Batch Number", and "Img URL". Below these fields is a blue button with the text "Submit" in white.

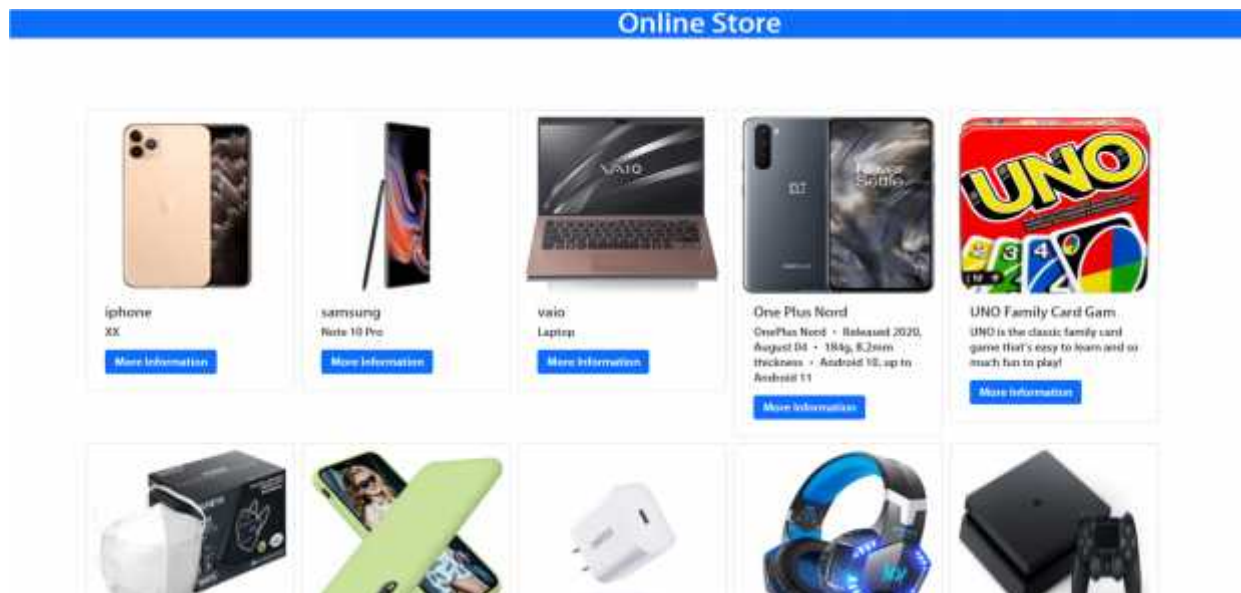
This is the page where the admin enters the block data and then system generated a hash with that data plus the previous blocks hash.

WAREHOUSE MANAGEMENT PAGE

WareHouse Inventory						
Hash	Name of product	Description	Manufacture Location	Send To location	Manufacture Date	Batch
2021f97b3f13c1d9559794edff724ac508ca36fa83d518ae9322f5cc7ba47758f	iphone	XX	china	Dhaka Shop To Store Damaged	2021-05-12	999
2021c66388c101413fa9a64b422c94f0ba357a8486a0c11c29518b3794ba494	samsung	Note 10 Pro	japan	Dhaka Shop To Store Damaged	2021-05-12	02
2021e1694bc3d8c41cc8b205d1113257d797cf15c9fab42125b3b3b6844c3	vaio	Laptop	India	Dhaka Shop To Store Damaged	2021-05-23	054
2021338fa70617815a81837d548c67ef834e5a4151a84ab07210eff3da88	One Plus Nord	OnePlus Nord - Released 2020, August 04 - 184g, 8.2mm thickness - Android 10, up to Android 11	China	Dhaka Shop To Store Damaged	2021-06-11	34254125
202171b6ba602b1401c09d08b2b03cc1fac74112eb0baa9528c38d2190	UNO Family Card Gam	UNO is the classic family card game that's easy to learn and so much fun to play!	Bangladesh	Dhaka Shop To Store Damaged	2021-06-12	234254

This interface is for the warehouse management team to evaluate the condition of the product then ship it to which retail store they like

ONLINE STORE PAGE



This is online store page where the consumer can search for their desired products and see the hash number and search it for in the dash-board to evaluate its legitimacy

Feasibility Study

To choose the optimal system that satisfies performance criteria, a feasibility study is conducted. The feasibility study's main purpose is to determine whether creating the product is financially and technically feasible. The goal of a feasibility study is to establish whether the problem is worth solving rather than solving it. It is the most crucial and fundamental aspect of the situation.

The feasibility study concentrated on the following areas:

- Technical feasibility
- Economic feasibility
- Operational feasibility

TECHNICAL FEASIBILITY: The technical aspects of making a blockchain network is really complicated. We need good hardware to generate the hash for every single block. And large storage is needed to maintain all the network if there are a lot of products. A good number of users need to participate in this network to maintain it 24/7. Everyone is required to have an active internet connection all the time to keep the ledger up to date. To make the search queries faster a traditional SQL database is needed.

Economic feasibility: The cost of software development is compared to the final revenues or advantages from the established system in an economic feasibility analysis. To create a blockchain-based supply chain management system there needs to a collaboration between a lot of manufacturers. Also, a few authorized personals need to evaluated to enter data into the blockchain. The startup cost will be high for this project but in the long run, it will create a foundation that will revolutionize the whole e-commerce platform and customer-consumer relation.

Operational Feasibility: This Blockchain-based supply chain management system will solve a lot of issues that we currently have. Like shipment tracking, fake goods can easily be identified, companies selling low-quality goods can be held accountable for their actions, and many more.

Conclusion

A Sustainable blockchain-based transparent supply chain management system is imperative in the current world. This kind of technology will revolutionize current e-commerce platforms. People will have more trust in the companies and companies can track their products easily after manufacturing them. Companies like Walmart, IBM are spending millions of dollars every year to make a system like this on a large scale. Traceability of every single product from daily ` to computer hardware needs to be transparent. These minor and major factors increased executive and customer demand for information, changes are already taking place. Furthermore, bolstering traceability provides value by reducing the high expenses of quality issues like recalls, reputational damage, and revenue loss from black or grey market items. Simplifying a complex supply chain opens up new options for revenue generation. In contrast, the parties in most supply chains are well-known and dependable. Furthermore, the supply-chain world is unlikely to adopt open access since its users do not want to divulge private information, such as demand, capacity, orders, prices, and margins, to unknown parties at all points in the value chain. As a result, the most of the supply-chain blockchains will need to be open with access controlled. In theory, this System allows public or private verification of each block. However, it is unlikely that we will ever see public verification of proposed blocks in the supply-chain world when all the parties are known. Currently, billions of transactions and data are being sent in real time throughout several supply chains. Many supply chains have challenges with data that is compartmentalized, disparately structured, difficult to access, or difficult to view or analyze in the context of big data since the systems aren't flawless. Nonetheless, well-managed central databases with effective data management, as well as supply-chain visualization, are essential.

References

- [1] Blockchain & supply chain: towards an innovative supply chain design Jérôme Verny, Ouail Oulmakki, Xavier Cabo, Damien Roussel Dans Projectics / Proyética / Projectique 2020/2 (n°26), pages 115 à 130
- [2] A systematic literature review of blockchain-based applications: Current status, classification and open issues
- [3] Blockchain technology for supply chains—A must or a maybe? www.mckinsey.com - September 12, 2017 | Article
- [4] CRYPTOCURRENCY BLOCKCHAIN Merkle Tree By JAKE FRANKENFIELD Updated Feb 18, 2020
- [5] Udemy - www.udemy.com/course/build-your-blockchain-az - Created by Hadelin de Ponteves, Kirill Eremenko,
- [6] Blockchain Learn Blockchain By Building Your Own In JavaScript - Created by Eric Traub