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Application of Blockchain Technology in Logistics and Supplychain Management

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Abstract: ***The technology which can be called as a distributedledger that records transactions between two parties is Blockchain. When we look into the current problems of threats pertaining to security and privacy in the process of logistics, it lacks supervision traceability. Application of Blockchain chain Technology in Logistics and Supply Chain proposes to resolve these problems using blockchain technology. Blockchain makes an application more efficient, reliable and transparent. It also optimizes the entire process. Traceability is an underlying characteristic of blockchain technology. For each event in logistics system, intelligent contract and a blockchain system is constructed to enhance the overall efficiency and supervision. Data collection becomes easier when we correlate the data belonging to same and different blockchain systems. Logistics system can be made more intelligent by constructing different storage and access mechanisms. This project provides a thought on developing a logistics and supplychain application based on blockchain technology.***
Keywords: Supplychain, Blockchain

I. INTRODUCTION

Blockchain records transaction history between two or more parties digitally for which it is called as distributed ledger. The recorded information will be stored in the form of data blocks which are chained together. Every data block added to a chain is unalterable as it is unique, encrypted, timeand date stamped. Information stored in a blockchain cannotbe hacked or misused and can be immediately trusted. The technology required by logistic companies to improve the efficiency of the logistics process is that the information should be clearly visible and entire end to end process should be trackable. Blockchain helps in distributing the informationevenly and in real-time. Data collected from the blockchain can be used to develop an efficient logistics system. At the end, blockchain helps in increasing the effectiveness of the logistics and supplychain process which in-turn reduces logistics costs. The project "Application of Blockchain technology in Logistics and Supply Chain Management" implements the advantages of blockchain like data complexity, application development complexity, updating inaccurate records and managing decentralization in the logistics and supply chain process to reduce the logistics costand ensure security, transparency in the whole process.

II. MOTIVATION

The main motivation behind the project is that blockchain allow recording and distributing of digital information but do not allow editing of the information. This ensures the formation of immutable ledgers which holds the transactions that cannot be changed. Blockchain will create a trusted, unalterable, uncensorable repository of data and information that is accessible worldwide. This ensures transparency of data for all the people no matter from where they are accessing. Blockchain is a leading technology which ensures transparency and security in any process. Applying of blockchain in the logistics and supplychain process ensures transparency of data so that same data is visible for everyone irrespective of form where the data is being accessed from. The project also prevents data leakage, data theft and unnecessary data accessing.

III. LITERATURE SURVEY

In [1] author highlights the different entities involved with an aim to create a model that is capable of reflecting the realworld use cases of applying blockchain technology in logistics and supplychain. Paper mainly focus on the performance aspects of the implemented model based on blockchain. [2] provides techniques to avoid problems of threats related to security and privacy of data in the logistics system. The research provides a framework of blockchain technology that is applied in logistics which resolves the problem of authentication, traceability and security of datain the logistics system. Author in [3] provided a new strategy for logistics information where false information cannot be uploaded and tampered after the data is being recorded on the chain. The paper gives a brief description ofthe consensus process of an algorithm and method of applying logistics information to a proposed strategy.

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In [4], author conducts detailed review of research that have been taken in the field of supply chain implemented using blockchain. The study has provided a tabulated review and citation analysis to obtain a better understanding about such technologies. [5] adopts a citation and a co-citation analysis.This article employs a bibliometric analysis method to present results. In [6], paper proposes to build a data storage protocol which aims to implement privacy by making use ofring signature and elliptic curve. Anonymity of the ring signature ensures security of data and user information privacy in applications based on blockchain. The paper integrates privacy aspect of ring signature and transparency aspect of blockchain technology. [7] builds a mechanism which rates performance of popular blockchain platforms for example Ethereum that can be used to evaluate the performance of smart contracts. Paper also helped in identifying technical aspects of smart contracts which are based on blockchain improve the capabilities which are already present. In [8], author proposes a blockchain- assisted secure storage system for data used in logistics. Theresearch is broken down into two parts where first part has data generation, data aggregation, session establishment, encryption and storage, where cloud storage is assisted by blockchain. Second part provides consensus algorithm to which improves the efficiency

IV. METHODOLOGY

Blockchain technology is a distributed ledger, where all thedata is stored in the blocks that are chained together by an encrypted chain. Blockchain is a decentralized application where data is distributed throughout the network and only a person with access can enter the network. Logistics is a coordinating process of moving any resources like people, materials, goods from storage location to the desired location. Supplychain is a process which involves all the people and process involved in the creation, manufacturing and sale of any particular goods or products. Smart Contracts are set of rules and conditions that are defined foran application and only if these conditions are met, thetransaction happens. Ganache is a platform which is used tosetup personal Ethereum blockchain and also provide private key for security purpose. Metamask is a cryptocurrency wallet required to perform transactions or execute smart contracts.

The methodology of the project is described below:

1) Create database to store login and registration details.
2) Create Metamask account.
3) Link the metamask account with ganache.
4) Write smart contracts in remix IDE.
5) Execute the smart contracts.
6) Copy the ABI address obtained after executing smartcontracts into project file.
7) Start the Xampp server.
8) Run the application

The first step in the application development is to create a database which stores all the login and registration details. After that two main entities in a blockchain network which are metamask and ganache account are created and linked together. Smart Contracts are written and executed which ensures all the transactions of data to be stored in the blockchain.

V. DESIGN

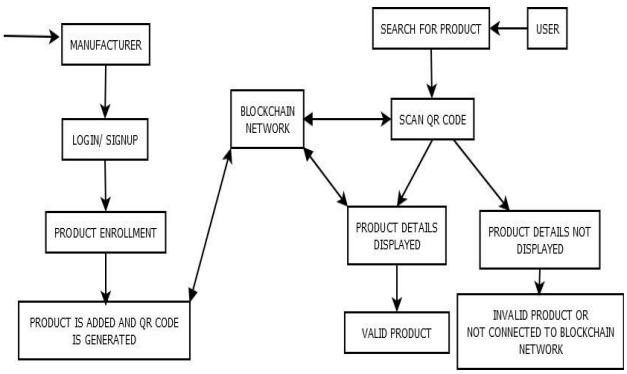


Fig 1: System Design

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1) First the user login into the application. After login, he c a n register the product.
2) When a product is registered, it get stored in the database. After storing, a unique product ID and QR code is generated.
3) The user can search the product directly by entering the product ID or by scanning the QR code.
4) If the searched product exists in the system, then the product is genuine.
5) When the owner login and register his product, product goes to the database and an unique product ID and QR code is generated for each of the registered product.
6) To verify the product, user can either enter the product ID or scan the QR code.

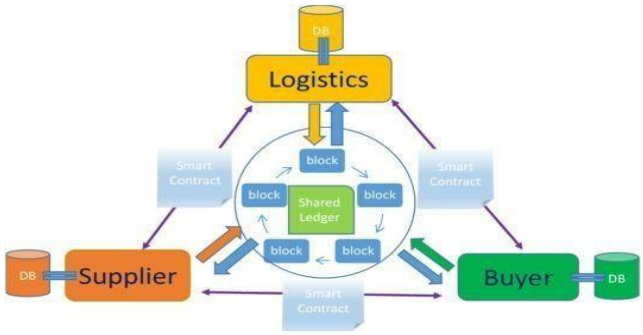


Fig 2: High level design

The methodology which is proposed utilizes blockchain through the usage of a smart contract. The proposed implementation design ensures encryption and transmission of data securely. Once a transaction is recorded on the blockchain, it cannot be changed. The main motto of thedecentralized application proposed is to allow users to book and track items on the blockchain network. To design adecentralized application, Solidity language is used to writesmart contract on the Ethereum framework and usingWeb3.js library, a user friendly interface is developed whichallow users to communicate with the written smart contract.The application implemented was validated by consideringvarious validation scenarios.

VI. IMPLEMENTATION

Smart Contracts are programs which consist some set of rules, where rules are the agreement between two parties. Fig 3 describes the smart contacts for the application. Smart contracts contain conditions that are checked before any transaction is happened. If the conditions are satisfied, then the contract is executed and transactions are recorded on the blockchain network. Every smart contract is associated with a blockchain address. PHP is a scripting language used in the design of interactive websites. It can be embedded into HTML, which makes adding functionality to web pages a easier task without a need to call any of the external files or the data. **Solidity** is an object-oriented programming language for Ethereum Network. It is used to construct smart contracts on Blockchain platform. It provides logic and generates chain of transaction records in the system. Fig 4 is a **Ganache** platform to develop personal blockchain for Ethereum based application development. Ganache can be used during the entire development cycle which enables development, deployment and testing of the decentralized applications in a safe environment. Ganache can be used as a local blockchain simulator.

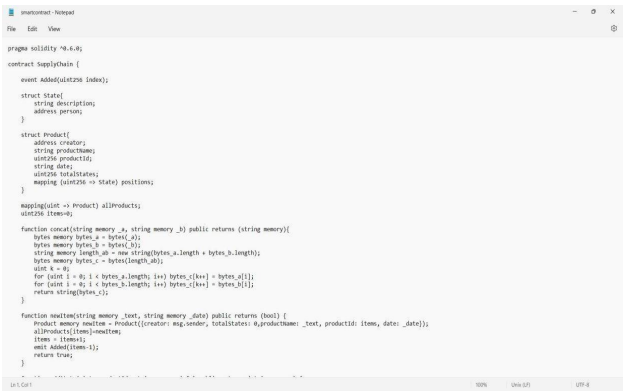


Fig 3: Smart Contracts

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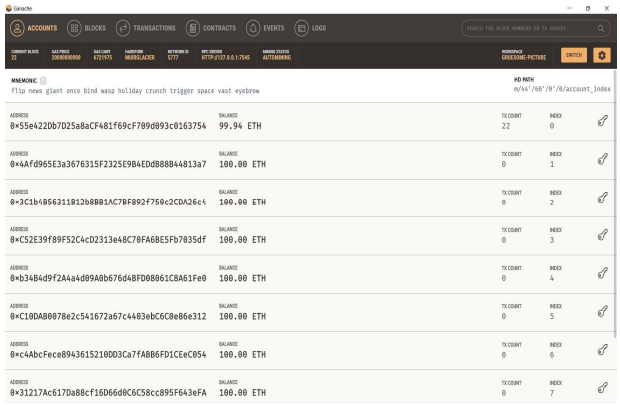


Fig 4: Ganache for getting private key

VII. RESULTS

In this application we have four modules like Manufacture, Retailer, Distributor and customer each person will generate block of data and connect then to chain using aprivate key and all the data is stored in the QR Code for the access of the customers.

Fig 5 displays the hom page of the application where user can shop the products and also track the ordered product. The application is integrated with the blockchain technology.In the application, the users can view the products as shown in Fig 6. Fig 7 describes the logistics application home page where manufacturer, retailer, wholesaler can login with their credentials amd perform activities like adding products, updating products, scanning shipment. User can track the status of the product by scanning the QR code or entering the product ID.

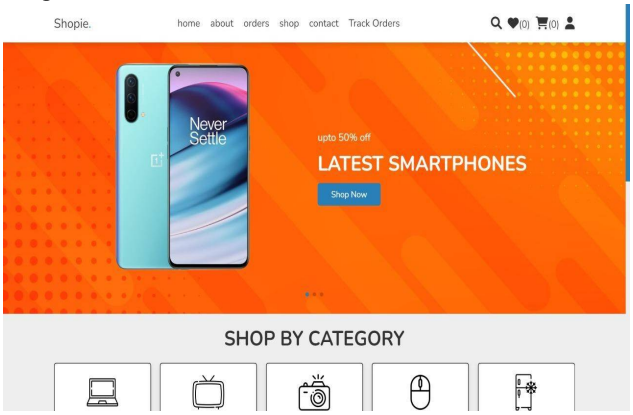


Fig 5: Home page of the entire application

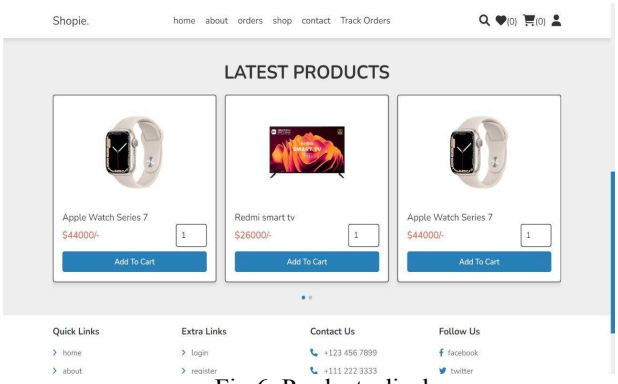


Fig 6: Products display

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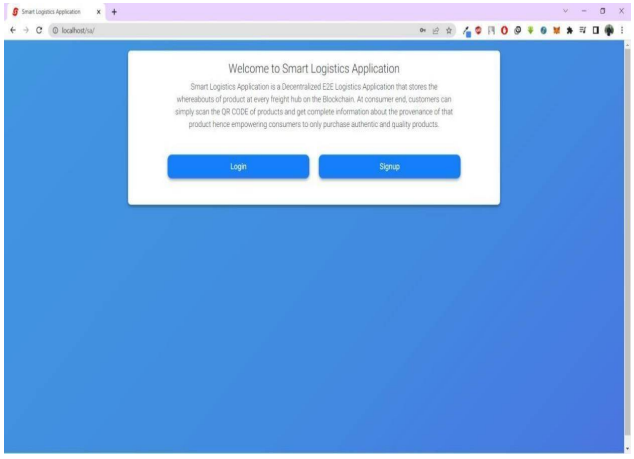


Fig 7: Home page of the logistics application

When user visits the application, views the product andorders it, order goes to the manufacturer and manufacturer adds the product to deliver it to the user. After the product isadded, unique QR code is generated as shown in Fig 8.

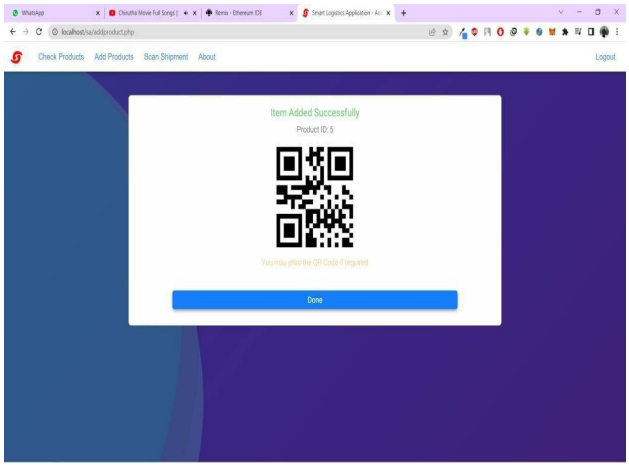


Fig 8: QR code generated when product is added

After successful order by user, manufacturer first gets the order and sets to deliver it. The product then reaches to the wholesaler and retailer where they update the status of the product delivery. When user track the product, the details shown in Fig 9 is displayed where all the updations done by each of the manufacturer, wholesaler and retailer is displayed.

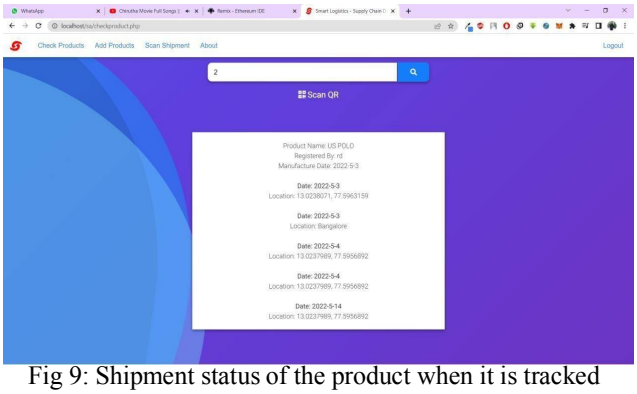


Fig 9: Shipment status of the product when it is tracked

VIII. CONCUSION

Blockchain is a leading technology which can be leveraged to the position of the logistics and supplychain process in the world of digital technologies. This project presents an implementation of a decentralized blockchain technology in the logistics and supplychain management to minimize the gaps between the on going process of logistics and supplychain and the traditional blockchain to obtain higher benefits and security. The proposed decentralized application was run and tested on the Ethereum framework and the results were analyzed. Based on the analysis, we may argue that any standard application can use blockchain technology to implement a secure application. Logistics and supplychain decentralized application was one of the implementation. Immutability of the information: Blockchain technology is not fully perfect, so even it is not free from the bugs. The feature of information being stored in the blocks which are unalterable presents the major problem in the case of these possible bugs, as the stored information cannot be changed or altered even if storedinformation is no in use. Storage: When number of users using the application grows, the transactions that will be stored into the blocks will also increase. This in turn increases the space required inside the computers and eventually exceeds the hard disk capacity. High implementation costs: Though the technology provides security for the users and user data, the implementationcosts are higher.

IX. FUTURE WORK

In the near future we plan to work on how to develop and implement the real-world applications that are frequently used by mostof the people and check the suitability of the blockchain system in the different application domains.

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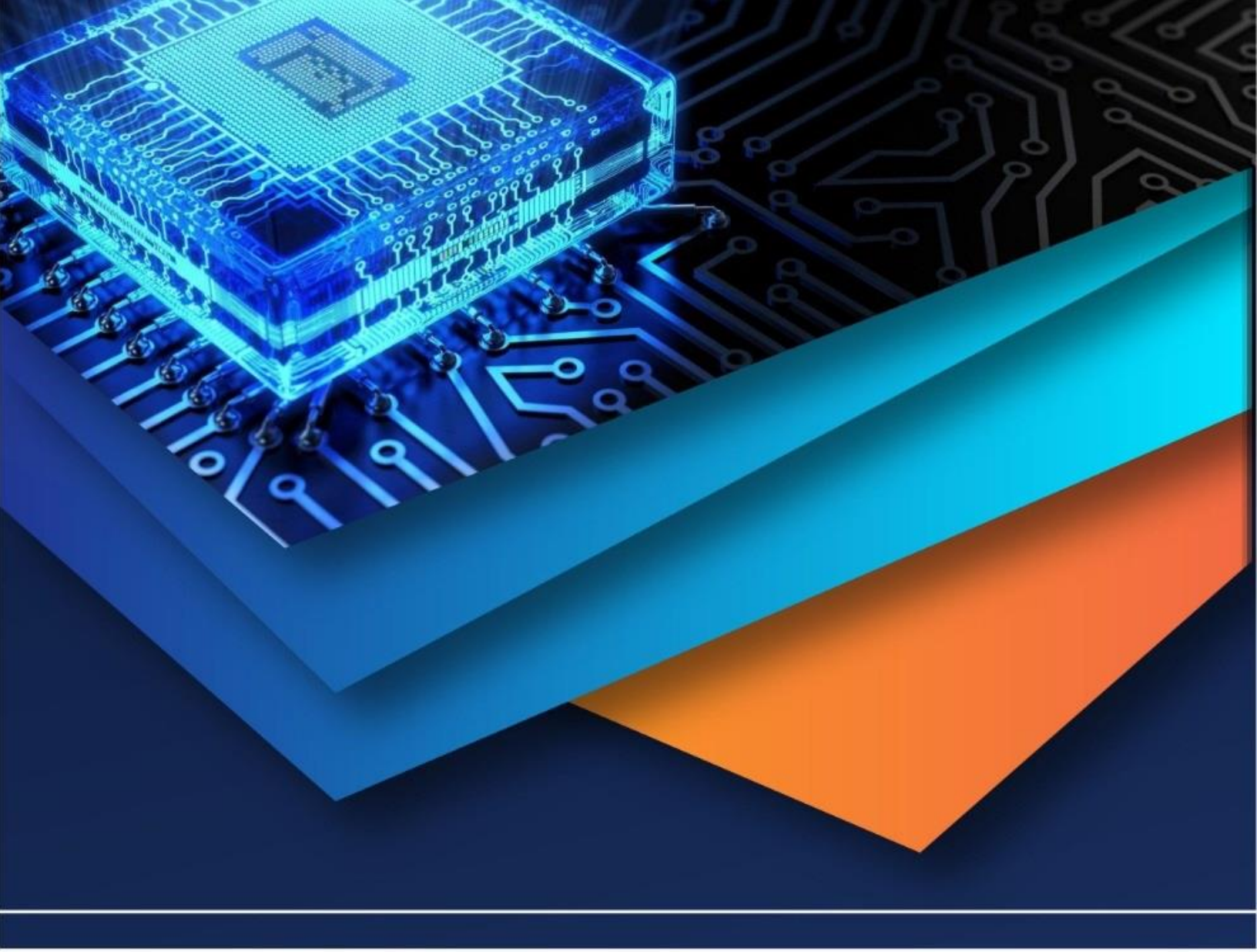
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