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Design and actualization of Blockchain and IoT based Logistics system

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Abstract: Logistics is a global supply chain network, it involves many stakeholders such as brokers, raw materials providers and so on, complicating the end-to-end visibility. In the present system, Security is the biggest challenge faced by Internet of Things. In logistics system, when the parcels are delivered from one warehouse to another warehouse the code is entered manually by the data entry operators, it is time consuming and it may lead to any fraud activities. And if there is any delay in the delivery of parcels by the truck due to breakdown both the company and the client will not have any knowledge about the delay.

Inorder to overcome this, in the proposed system, Blockchain and IoT are combined together which help to enhance the reliability and traceability of the network. This helps the customers and the logistics company to get the exact information of the product. As Block Chain is decentralized, it helps in reducing the bottlenecks as we don't need any certification from the third parties . The concept of IOT is used whose components are applications, gateways, processors and sensors. From the collected data, application block is utilized and for sending processed data to appropriate location gateways are used. And sensors are used to share data to its nearby actuators. Integrating block chain or distributed ledger provides security for the Internet of Things. The major elements of this project are the QR code or barcode scanner Arduino board, Impact sensor, and the GPS module. All this information is stored on cloud database and is retrieved as and when required from the admin monitoring application.

This project presents an attempt to implement Blockchain, Iot and Cloud computing technology to reduce the risk in regard to fraud or to deliver right products by live Monitoring of products by using QR code or Barcode details on products in carrier to ensure security of the products.

Keywords: IoT, Cloud Computing, Blockchain, Decentralization, Immutable data.

I. INTRODUCTION

With millions or billions of devices linked together, and the security is most important feature in today's world. Before giving accommodating direction and reference for future research work. First we should make an attempt to know about Internet of Things, it is a system where all the interrelated devices are connected to the internet to transfer and receive data from one device to the other device and can be monitored remotely. Finally, integrating block chain or distributed ledger provides security for the Internet of Things. In the proposed system, the concept of IOT is used whose components are applications, gateways, processors and sensors. From the collected data, application block is utilized and for sending processed data to appropriate location gateways are used. We used sensors in this project to measure the physical attributes of the freight used for transportation. And these sensors are connected to the microcontroller and further the data will be sent to the cloud via Node MCU.

Nowadays as IoT is being used extensively to lessen the burden on humans, it is shap ing the way we live our lives, and helping us to get a better insight into the working of things around us. A Hacker will not be able to alter the data in the Blockchain because each user has a copy of the ledger and the data within the blocks are encrypted by complex algorithms. Logistics is a global supply chain network involves many stakeholders such as brokers, raw materials providers and so on, complicating the end-to-end visibility. Block chain and IoT combined can help enhance the reliability and traceability of the network. This helps the customers to get the exact information of the product. When the truck from a company reaches the warehouse the code on the parcel is scanned by the bar code scanner. Then the message is sent directly to the admin. When there is a breakdown or delay of the truck while reaching the warehouse Impact sensor is used to track the breakdown or delay. The location of the truck is tracked by using the GPS module.

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Now and then when the data is required it is fetched from the cloud database.

II. RELATED WORK

Huma pervez, Irfan UI Haq [1], proposed that logistics can be made cost effective for the small scale companies to provide service to its customers. It can be done using IoT environment and blockchain technology. Smart contracts are the scripts stored on block chain that are equivalent to stored procedures in relational database management system. Arduino, Geosensor, temperature sensor, space sensor. Geo sensor generate trigger of delivery of package to destination. Temperature sensor can guarantee the freshness of vegetables.[1]

Guido Perboli [2], proposed that to create a certified and distributed data center ledger, which collects data and tracks batches of products from the producer to final customer. MQTT Protocol, Arduino, sensors, GSM for GPRS are part of IoT environment and AWS or Azure cloud services for storing data. During the parcel delivery the truck is tracked there by reducing the delay of service.[2]

Madhu sudan Singh [3], proposed that Combination of ethereum and Block chain based smart contracts systems with vehicle ad-hoc network.Block chain consists of technically unlimited number of blocks which are chained together cryptographically in chronological order. [3] In intelligent vehicles communication networks more feasible algorithm is proof of driving which verify and validates the vehicles.

III. EXISTING SYSTEM

In the present world of logistics industries, high scale companies can have access to more effective and costly services and can provide quality services to its customers, where our project as it is cost effective and can be used by the low scale companies to enhance the quality of service and reaching out to customers in effective way

Physically storing the data of the goods may lead to fraudulent activities and as the companies main focus is to keep the products data safe, in such cases outsider can easily access the products data and can cheat and exchange the products data for his beneficiaries. Another important aspect is to maintain a good health of the truck while transporting, if any unusual accidents or fire take place then it is very difficult to track the exact location of the truck to safeguard .

IV. PROPOSED SYSTEM

In the proposed system, the concept of IOT is used and components of IOT are applications, gateways, processors and sensors. From the collected data, application block is utilized and for sending processed data to appropriate location gateways are used. For providing security of data processors are used, which is captured by the sensors. The sensors used in this project used to share data to its nearby actuators. The four-layer architecture of the Internet of Things (IoT)are Application layer implements the final management of data, Management Layer will supports device modeling, configuration, performance, Network Construction Layer supports data Transfer over wired and wireless networks. Sensing and Identification or Device Layer consists of sensors and wireless sensors networks or Integration with Hardware such as sensors, actuators, camera, GPS, RFID tags lie in this layer.

The major elements of Block Chain and IoT based disruption in logistics are the QR code or barcode scanner Arduino board, Impact sensor, and the GPS module. Truck from a company reaches the warehouse the code on the parcel is scanned by the bar code scanner. Then the message is sent directly to the customer. When there is a breakdown or delay of the truck while reaching the warehouse Impact sensor is used to track the breakdown or delay. The location of the truck is tracked by using the GPS module. This proposed system has several advantages over existing system such as truck's location is monitored using GPS to detect breakdowns. Accuracy and Efficiency of data is maintained by Blockchain.

V. OBJECTIVES AND SCOPE

- The objectives of this application is to ensure the security of the vehicles in logistics industries.
- To give the chances to track products from place of origin to the end user.
- To reduce risk in regard to fraud or fake goods by Real time Monitoring of goods.
- To empower monitoring, tracking and tracing transports.
- Getting the Right product, in the Right quantity, in the Right condition, at the Right place, at the Right time.

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VI. SYSTEM ARCHITECTURE

Architecture mainly focuses on looking at a system as an amalgamation of many different components, and how they interact with one another to produce the required result. Focus is on identifying components and how they are connected. In other words, the focus is on what major components are needed. Logistics company system architecture comprises of IoT environment which includes Arduino board to sense the data from the sensors.

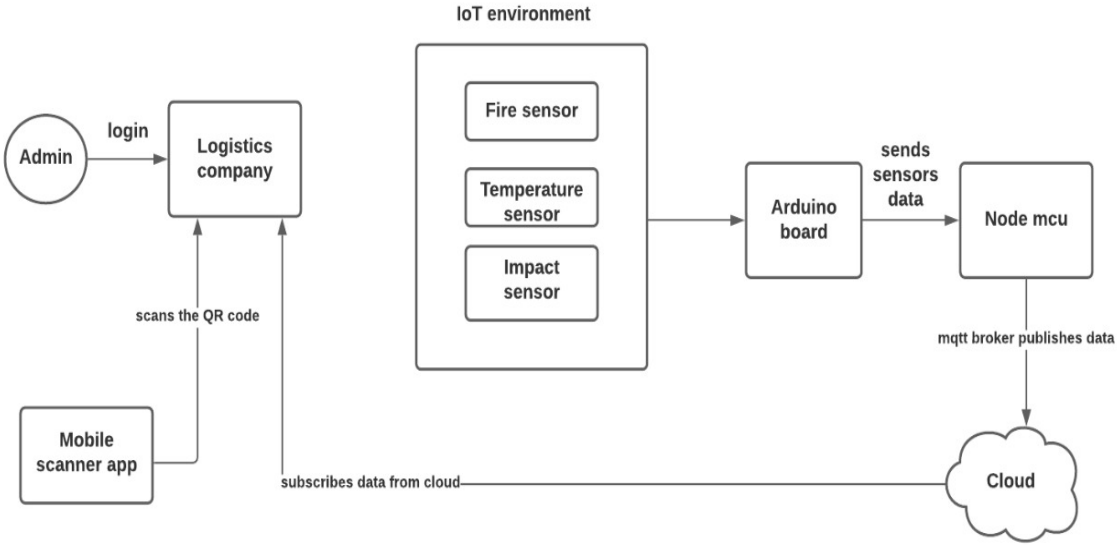

Fig . System Architecture

VII. APPLICATION OF IoT

- **Vehicle tracking for Reliability**: Internet of Things (IoT) devices such as sensors, actuators help businesses to find the most economical routes and track the location of all vehicles.
- **Monitoring employee**: Admin of logisitics company can monitor the physical safety of the employee using IoT devices and sensors. With the Internet of Things, company can protect its employees from exposure to toxic elements and alert drivers if they aren't following safety guidelines.
- **Anti-product theft and control of vehicle conditions**: There are IoT and logistics anti-theft devices, such as sensors for real-time device tracking, alarm systems. Company managers can find IoT logisitics solutions that provide protection against fraud, product theft and tampering.

VIII. APPLICATION OF BLOCKCHAIN

Blockchain is encrypted, distributed computer filing system designed to allow the creation of tamper-proof, real time records. Blockchain has three pillars they are Decentralization, Transparency and Immutability. The motivation in doing this project was primarily an interest in Blockchain and IoT technology. For logistics application we maintain two ledgers to recover data if it is modified by an outsider. Using blockchain technology we compare generated data with the one stored previously and recover the data if it is modified by data hacking. If it is manipulated then we fetch original data from the ledgers. Adler 32 algorithm generates hashcode for all the data. The latest hashcode generated is compared to the stored hashcode if it is same then nothing is manipulated else something is modified and we recover old data from ledgers.

IX. SYSTEM DESIGN

Software is designed using SQL server as database, frontend code is written using C# and winforms for desktop application and java for android app.

Process flow diagram is a graphical way of describing a process, its sequences and tasks. It displays the relationship between major processes.

In the below Process flow diagram first the Admin logs in to the logisitics company. Admin can login only if the credentials are valid. He generates QR code for the parcel. This QR code is used at intermediate stations for updating database with the information of inward or outward. The next process is IoT where we continuously monitor the asset and the vehicle using IoT devices such as sensors and actuators. IoT process includes NodeMCU which creates a MQTT broker and publishes data onto the cloud. The data is Subscribed from the cloud by the desktop application. Desktop

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application is front-end application for live monitoring of vehicle. Live monitoring states real-time vehicle tracking for tracking parcel, Identifying location of the vehicle, Identifying Accidents with the help of impact sensor also the locations where the impacts have occurred will be displayed in the desktop application. Sends alert with alarm if any accidents or fire occurs.

- Track parcel: Live monitoring of the parcel.
- Identify location: We use latitude and longitude to identify the present location of the vehicle.
- Identify Accidents: With the use of Impact sensor we identify accidents if ever happened.
- Send alert with alarm: Alert signals are sent if any accidents or smoke occurs.

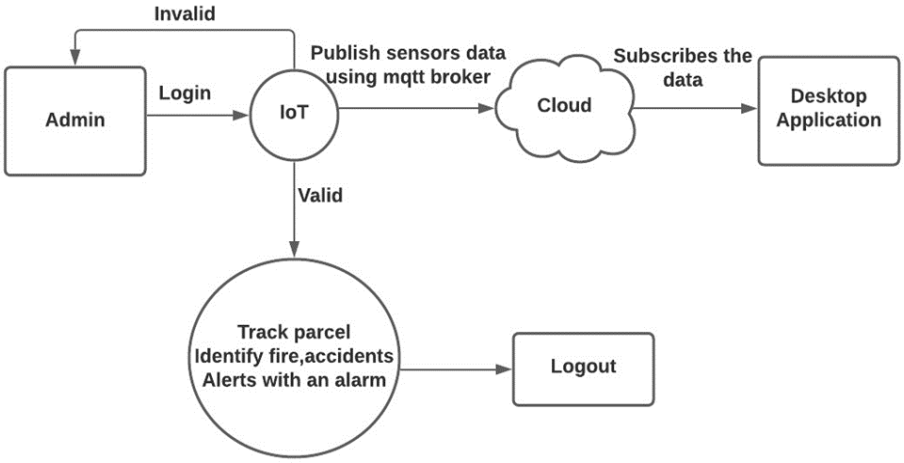

Fig: Process flow diagram for Logistics Company.

X. CONCLUSION

The proposed system is beneficial for monitoring, tracking and tracing transports by using GPS module. Reduces risk in regard to fraud or fake goods by Real time Monitoring of goods by using QR code or Barcode details on goods or item in carrier for purpose security. This system helps the users with the ease to access the information of item, service, supplier and carrier by providing Logisctics Company with the provenance of data and cargo route. Therefore, blockchain technology is responsible for maintaining the integrity of the valuable product being transported, but also create an immutable, secure record of all documentation throughout the transportation process.

Keeping in mind the fact that global shipments often undergo numerous checkpoints and are handled by a variety of components along the way, having this type of data on a secure, accurate record becomes a huge advantage for the logistics company. IoT has allowed logistics companies to automate warehouse operations, enhance freight transportation and ensure the delivery of the right products.

XI. SCOPE FOR FUTURE ENHANCEMENTS

In future, the system can be enhanced for shipped products from commercial stores can be tracked and traced using IOT and block chain technology. It can be further applied in monitoring all the stages of item manufacturing and supply to the shops. In the mere future, IoT can be expected to witness tremendous growth in transportation and logistics verticals. Fleet managers and operators will have more access to remote information at their fingertips and will use this information to reduce cost, mitigate human errors, boost supply chain productivity and automate end-to-end logistic processes. Along with the capabilities of cloud computing and big data, IoT can also be used predict bottlenecks that result in efficient operations in a logistics business.

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