



DECENTRALIZED MEDICINE SUPPLY CHAIN MANAGEMENT AND ELIMINATE COUNTERFEIT MEDICINE USING BLOCKCHAIN

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Abstract

The monetary area, production network the board, food industry, energy area, web of things, and medical care are utilising blockchain as a safe and dependable stage for secure information sharing. We break down existing exploration and applications for the store network framework utilising blockchain innovation in this review. Besides, this examination gives elective cycles to dealing with the medication inventory network using blockchain innovation to further develop information the board. Medication supply chains are intricate organisations that range numerous hierarchical and geographic limits, giving a central spine to administrations that are vital for day to day living. Contamination like mistaken data, absence of straightforwardness, and limited information provenance can be presented by the characteristic intricacy of such frameworks. Fake drugs are one of the results of such requirements in present stockpile chains, which imperils human well being as well as costs the drug area large chunk of change. Different clinical work processes including complex operations like putting away and recovering information have been planned and carried out utilising the Ethereum blockchain stage. The unlawful medication market contributes altogether to the creation of fake medications as its added substances and add polluted, inappropriately put away, and fake fixings. Getting to and keeping a huge measure of clinical information is likewise important for the gig. Every drug partner, including emergency clinics, drug stores, discount merchants, worldwide well being drives, and administrative bodies, are impacted by the worldwide fake medication exchange. The connected expense for this framework has been assessed for the execution of the work processes of the clinical brilliant agreement framework for production network the executives as far as a practicality study, which has been widely recorded in this article. This work would make it more straightforward for various partners in the drug framework to supply better meds and medications at less expensive costs.

Keywords: Ethereum, DApp, Blockchain, Medicine Supplychain Management, Eliminate Counterfeit Medicine.

1.INTRODUCTION

The biggest difficulties with drug safety in the counterfeit medicine supply chain are related to how the drugs are made in

the first place. Because tracing the proper and active pharmaceutical ingredients during manufacturing is a challenging task, recognising medications that do not contain the intended active ingredients can result in patient injury or even death. The advanced capabilities of blockchain make it capable of providing a foundation for complete drug traceability from manufacturer to end customer, as well as the ability to detect counterfeit pharmaceuticals. The smart contract ensures data provenance, removing the need for middlemen and providing all stakeholders with a safe, immutable history of transactions. Pharmaceutical counterfeiting poses a severe hazard to society. Counterfeit drugs have a negative impact on people's health and force legitimate pharmaceutical companies to lose money. This kind of record keeping was not secure with customary data sets, seriously endangering the patient's protection, yet with blockchain, the patient's information might be put away without sharing his confidential record. To address these issues, we built a decentralised database and a smart contract inside our dApp, which prevents the distribution of counterfeit medicines. One of the most compelling features of blockchain technology is its resistance to many forms of threats, including cyber attacks. Drug regulatory agencies do quality inspections and monitor pharmaceutical product quality, safety, and efficacy, as well as conduct post-market surveillance.

Supply chain and logistics blockchain technologies have lately gained interest due to their ability to record transactions between untrustworthy parties in an immutable and transparent manner. Drug traceability is being emphasised and mandated in a number of countries throughout the world (tracking and tracing). The drug inventory network follows a start to finish come nearer from acquiring dynamic medication fixings (source) through assembling the completed item (prescription) and conveying and conveying it to patients (end-clients).The pursuit of one often necessitates the sacrifice of the other.Blockchain is the greatest solution for the trade-off of ensuring the authenticity of publicly available data while keeping an entity's private data private and secureThe best solution for assuring the authenticity of publicly available data

while keeping private data secret and secure is blockchain.. One of the most compelling features of blockchain technology is its resistance to many forms of threats, including cyberattacks.

II.PROBLEMSTATEMENT

The complicated nature of a medicine supply chain is the key reason for counterfeit drugs reaching end-user markets. Medication can readily get through with little or no trail of information and verifiable documentation due to the complexity of the distribution mechanism.

Many of the pharmaceutical industry's problems may stem from a lack of insight into the supply chain. Drug scarcity. Counterfeits. Differences in methods or systems are at the root of medicine supply chain difficulties. Through distributors, a single drug or treatment can be distributed to hundreds of hospitals. It might be difficult to keep track of and meet the needs of each buyer. Poor compliance can result in millions of dollars in fines, jail for supply chain executives, and an increased risk of customer injury. A temperature-controlled supply chain is known as a cold chain. It usually entails maintaining consistent refrigeration of the product during its manufacture, shipping, handling, storage, and delivery.

III.LITERATURESURVEY

U. Padmavathi and N. Rajagopalan^[1],2021

Clinical hardware should go through thorough accreditation processes that vary in view of the medical services rules and affirmations in every country. This convoluted the inventory and conveyance of clinical gadgets and supplies, which are critically required. Through blockchain-based decentralised computerised fabricating, the broad and extensive testing methodology, as well as the huge distances that undermine recognizability, quick reaction, security, and trust, can be accomplished. In 2008, the idea of blockchain innovation was presented. Decentralisation, review, permanence, discernibility, security, and trust are one of a kind parts of blockchain. It is directed by bunches, which are gatherings of PC hubs that team up to approve and execute exchanges. Cryptography (hashes) and advanced marks are utilised in the innovation, with two keys public and private created from the Ethereum address.

Ekblaw, A.; Azaria, A.; Halamka, J.D.; Lippman, A^[2], 2016

One of the most progressive innovations representing things to come is blockchain. It records and communicates straightforward, secure, controlled, and shortcoming lenient information utilising disseminated record innovation. Blockchain can assist associations with becoming decentralised, straightforward, proficient, majority rule, and safe. Numerous blockchain stages have been proposed in the writing throughout the long term. Public Blockchain, Private Blockchain, and Consortium Blockchain are three kinds of blockchain applications that can be arranged. The Med Rec is a bitcoin-based arrangement pointed toward tending to difficulties like framework interoperability, languid admittance to clinical information, patient, organisation, and fracture, among others.

Patients have extensive admittance to clinical data and changeless logs across suppliers because of the progressive blockchain-based framework.

Francisco K and Swanson D^[3],2018 Every drug partner, including emergency clinics, drug stores, discount wholesalers, worldwide well being drives, and administrative bodies, are impacted by the worldwide fake medication exchange. As its entertainers add spoiled, insufficiently kept up with, and misrepresented substances, the unlawful medication market contributes fundamentally to the creation of fake and deceitful meds. Blockchain innovation considers the formation of a confidential consent network that might be utilised to follow and follow occasions in the drug inventory network while likewise giving time stepped records of every exchange. Execution and proprietor, time, exchange area, and which gatherings were involved are instances of events.

Lemieux, V.L^[4],2016 Heritage frameworks in the clinical and medical services handles frequently just offer medical services assets inside and are not very much viable with outside frameworks. In spite of this, proof proposes that joining these organisations for coordinated and further developed medical services enjoys different benefits, requiring network between various organisations for well being informatics specialists. Multi-hierarchical information trade is a central point of interest that requires clinical information assembled by a medical services supplier to be unreservedly open to different associations, for example, a doctor or examination establishment. Blockchain innovation is reclassifying information handling and administration in numerous medical care frameworks. This is because of its versatility and unparalleled division, security, and information and administration sharing. Blockchain innovation is at the front line of numerous contemporary advances in the medical services business.

Kumar, T.; Ramani, V.; Ahmad, I.; Braeken, A; Harjula, E; Ylianttila^[5],2018

Shrewd agreements and blockchain how savvy contracts in light of the blockchain can deal with a few medical services issues They went to a few early lengths to use blockchain innovation for different medical care use cases and recognised different obstacles in blockchain execution in their work. They proceeded to say that creating blockchain-based applications can all the more really address medical services difficulties, with security and protection parts of information and individual data the board supporting all blockchain executions. It is the value of information handling that is secure as in it can't be contorted. In this computerised age, admittance to individual information has turned into a worry, with security and protection issues to fight with. Due to hacking inspirations and protection infringement, computerised security is a not kidding concern. This is feasible in the eHealth field, where a patient's well being data the executives framework should comply with a few guidelines while remaining open to formally approved medical services professionals.

Medicalchain Whitepaper 2.1. Tech. Rep. Medicalchain^[6], 2018

MedicalChain tackles these issues by making a savvy medical care biological system by putting away clinical record exchanges on the

blockchain. A shrewd agreement is sent off in MedicalChain to give time-restricted admittance to a patient's electronic well being record. Specialists monitor their notes and output lab discoveries, which are then logged as exchanges. The drug store fills solutions and logs the exchange on the blockchain. The patient awards their safety net provider time-restricted admittance to check treatment and settle installments. The patient awards their guarantor time-restricted admittance to check treatment and settle installments. Patients can utilise shrewd agreements to permit specialists to survey clinical issues from a distance and give guidance or a subsequent assessment.

Schlegel, M.; Zavolokina, L.; Schwabe, G.^[7],2018 . Tokens can be utilised to raise assets for new drives and can be traded for items, administrations, or money. A few blockchain-based firms have raised huge number of dollars through symbolic deals, including Starbase. Trading land is extreme these days because of an absence of receptiveness and errors in openly available reports. Blockchain innovation is additionally utilised in the housing business sector to keep records secure, straightforward, and to accelerate the trading system. The decentralised conveyed record gives report accuracy, following, proprietorship check, and property deed moves. Pervasiveness is a safe stage for land records-keeping that utilises blockchain innovation rather than an inheritance framework.

Zhang, A; Lin, X.;^[8] 2018, To guarantee right recognisable proof, following, following, and provenance, blockchain innovation gives a proficient and practical arrangement that supports different medicine detect ability undertakings and methodology. Information is currently safer than ever in light of the fact that to the approach of blockchain innovation. In spite of the way that the blockchain record is shared, the information is scrambled and validated utilising progressed cryptography techniques. This cryptography calculation guards information from robbery while at the same time keeping up with its respectability. Clinical scientists, medical care experts, and people can all profit from blockchain innovation. The making of a solitary stockpiling site for all well being information, ongoing following of customised information, and granular information access consents will help both exploration and customised care.

BLOCKCHAIN MINING

Blockchain mining is the process of adding transactions to an existing blockchain ledger that is shared among all users. While mining is most commonly linked with bitcoin, it is also used in other blockchain-based technologies. Mining entails generating a hash of a block of transactions that is difficult to counterfeit,

ensuring the integrity of the entire blockchain without the use of a central system.

Mining needs a fast CPU, as well as more electricity and heat generation than conventional computer operations, it is frequently done on a separate computer. The primary incentive for mining is that users who choose to mine using a computer are compensated. In the case of bitcoin, each hash is worth 25 bitcoins. That's why



some hackers utilise machines they steal into to mine bitcoins, forcing an unwary victim to foot the bill while reaping no rewards.

Fig.1 Top 8 Mined coins

From above Fig.1, table ,We can observe that the entire yearly economic value run rate (extrapolated from recent average daily values) is around \$8.6 billion across all pools, not just the Top 50. Bitcoin production accounts for over 2/3 of the economic value created, with about \$15 million being produced every day recently. At approximately \$4 million every day, Ethereum is around a quarter of that. The next six coins will bring an additional \$4 million per day. Overall, all pools are currently mining roughly \$24 million per day.

Top mining pools can be found all around the world. The top 50 pools are hosted in China, the United States, and Hong Kong, with China, the United States, and Hong Kong accounting for 70% of the top 50 pools and nearly all of the top 10 operators. China accounts for over half of the total annual value generated by the Top 50 pools. Mixed countries include diverse combinations of the United States, China, the European Union, Russia, and other Asian or European countries. As a result of government efforts to restrict cryptocurrency mining in China, Chinese operators have begun to shift to other regions, giving rise to this category.

IV.OUR METHODOLOGY

The new's framework will probably incorporate blockchain innovation's qualities and carry discernibility and security to the meds production network, as well as to give makers and medication administrative specialists perceivability into the SUPPLY CHAIN MANAGEMENT framework..

1.To Increase Trust and Transparency:
Clients and makers will trust one another in the event that they can follow restorative items along the store network.

Coin	Hardware class	Algorithm	Block count / day	Hash Rate	Block size	Price \$/BTC/2019 USD	Economic Production per Day \$/Minn \$	Estimated Annual Production \$/Minn \$
Bitcoin	ASIC	SHA256	1800	47.1 Tera	1 MB	6701	15,682	5,717
Ethereum	ASIC	Ethash	14,000	172 Tera	20K	284	3,992	1,410
Litecoin	ASIC	Scrypt	14,000	362 Tera	1 MB	117.6	1,703	626
Bitcoin Cash	ASIC	SHA256	1800	1.38 Tera	2 MB	389	5,264	200
Zcash	ASIC	Equihash	7000	8 Tera	1 MB	86.9	0,626	228
Bitcoin SV	ASIC	SHA256	1800	2.03 Tera	1 MB	220	3,433	126
Dash	ASIC	X11	1800	1.68 Tera	1 MB	170.2	0,292	107
Marsden	GPU	CrypsNight	1800	200 Mega	1 MB	86.1	0,184	67
Totals							29.01	8,819

2. Detectability:

When an item is made, the maker will enroll it on the blockchain, and the drugs will be checked, followed, and approved along their outing. The responsibility for drugs will be moved on the blockchain network as the actual responsibility for drugs changes. Drug creators will actually want to follow their items' advancement from assembling through packagers and afterwards to merchants whenever.

3. Add Visibility and Protect Privacy:

Perceivability and protection are in some cases entirely went against, and acquiring one commonly implies forfeiting the other. Blockchain is the best answer for the compromise that can ensure the innovation of material that is made freely accessible while keeping quiet and without compromising protection.

4. Broadened Security:

Blockchain is generally viewed as one of the world's most safe record frameworks. Blockchain is a permanent information base, and that implies that information saved money on it can't be changed or taken out.

5. Data set for Future Statistics:

This sort of record keeping was not secure with conventional data sets, jeopardizing the patient's protection, however with blockchain, the patient's information might be put away without sharing his confidential record.

V. WORKING PRINCIPLE: PROJECT EXPLANATION

The Medical Supply Chain Management System in Action (fig.2). Storing the user's necessary details is the initial step. In the Medbloc Application, the Manufacturer, Supplier, and Consumer provide their information and complete the registration process. The data is collected and saved in a cloud storage system. Once a product is manufactured, it is registered on the blockchain, and the pharmaceuticals are then monitored, traced, and authenticated at each stage of their trip. The ownership of the pharmaceuticals will be transferred on the blockchain network as the physical ownership of the drugs changes. Drug makers will be able to track their products' progress from manufacturing through packagers and then to distributors at any time.

FIG.2. Working Flow

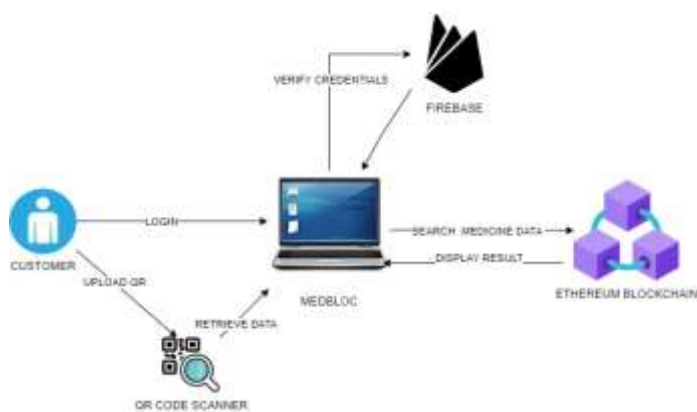
The user enters their login credentials into the application, which verifies the information and stores it in Firebase, resulting in the creation of a user account. The user may then log in to the application using their email address and password. The Manufacturer logs into MEDBLOC and verifies the credentials before storing the pharmaceutical information. This transaction is recorded on the Ethereum Blockchain. For the medicine

details stored in the blockchain, the manufacturer creates a QR code. The supplier logs onto the blockchain to verify the stock's legitimacy before completing the transaction on the network. QR codes are used to identify products that are available for download. The Medbloc obtains medical data from the Blockchain and saves the verification information. After the authentication process is completed, the Supplier distributes the drug to the Consumer. By scanning or uploading the QR code and checking the details in the blockchain network, the consumer can purchase the drug and verify its legitimacy. MEDBLOC uses blockchain technology to offer traceability and security to the pharmaceuticals supply chain, as well as visibility to manufacturers and medication regulatory authorities.

VI. PROJECT MODULES

User Details Registration:

This module represents the User details registration process. In this module there is a sequence of steps. First step indicates, Storing the necessary details of the user. The Manufacturer, The



Supplier, The Consumer give their information and complete the registration process in the Medbloc Application. The information is gathered and stored in the cloud storage.

User Account Creation:

This module explains how the user creates an account in the MEDBLOC Application. The user fills the login credentials the application, then the application verifies the user account details and stores in the Firebase and the User account is created, then the user can login in the application using email ID and Password.

Add Medicine details:

In this module we are going to add medicine details of the products created by the registered Manufacturer. The Manufacturer Login into the MEDBLOC by verifying the credentials and store the medicine details, this transaction is recorded in the Ethereum Blockchain. The manufacturer generates QR code for the medicine details stored in the blockchain. Then the manufacturer uploads the QR code to the Supplier which is further used to access the Medicine details.

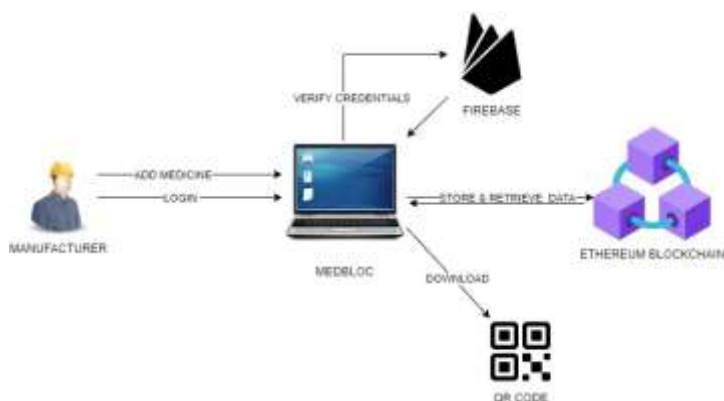


FIG.3 Add Medicine details

Verify Medicine details:

In this Module, The Supplier logs in the application by verifying the login credentials and scans the QR code uploaded by the Manufacturer and retrieve data from the Medbloc application. The Medbloc retrieve the Medicine data from the Blockchain and stores the verification details in the Blockchain. The Supplier distribute the medicine to the



Consumer after completion of the authentication process.

FIG.4. Verify Medicine details

Check Medicine details:

In this module, the Consumer login in the Medbloc application using the login credentials, the application verifies the consumer details in stored in Firebase. The Consumer upload the QR code of the medicine purchased from the Supplier in the application. Medbloc retrieve medicine details

from the Blockchain and displays the result in the application, then the Consumer check the result whether the medicine purchased is original or counterfeit.

FIG.5. Check Medicine details

VII. RESULTS & DISCUSSION

The goal of MEDBLOC is to use block chain technology to bring traceability and security to the medication supply chain, as well as to give manufacturers and drug regulatory authorities visibility into the supply chain management system. The distributed ledger system keeps track of all network transactions, logs, and history in an immutable and transparent manner. Customers and manufacturers will trust each other if they can trace medicinal products along the supply chain. Once a product is created, the manufacturer will register it on the blockchain, and the pharmaceuticals will be monitored, traced, and validated along their trip. The ownership of the pharmaceuticals will be transferred on the block chain network as the physical ownership of the drugs changes Drug makers will be able to track their products' progress from manufacturing through packagers and then to distributors at any time. Blockchain is the finest solution for the trade-off that can guarantee the originality of a piece of data that is made public while keeping an entity's private data secret and without sacrificing privacy. The supplier logs into the blockchain to verify the stock's authenticity, and then the transaction is completed in the blockchain network. QR codes are used to identify products that can be downloaded by users. By scanning or uploading the QR code and checking the details in the blockchain network, the consumer can purchase the drug and verify its legitimacy.

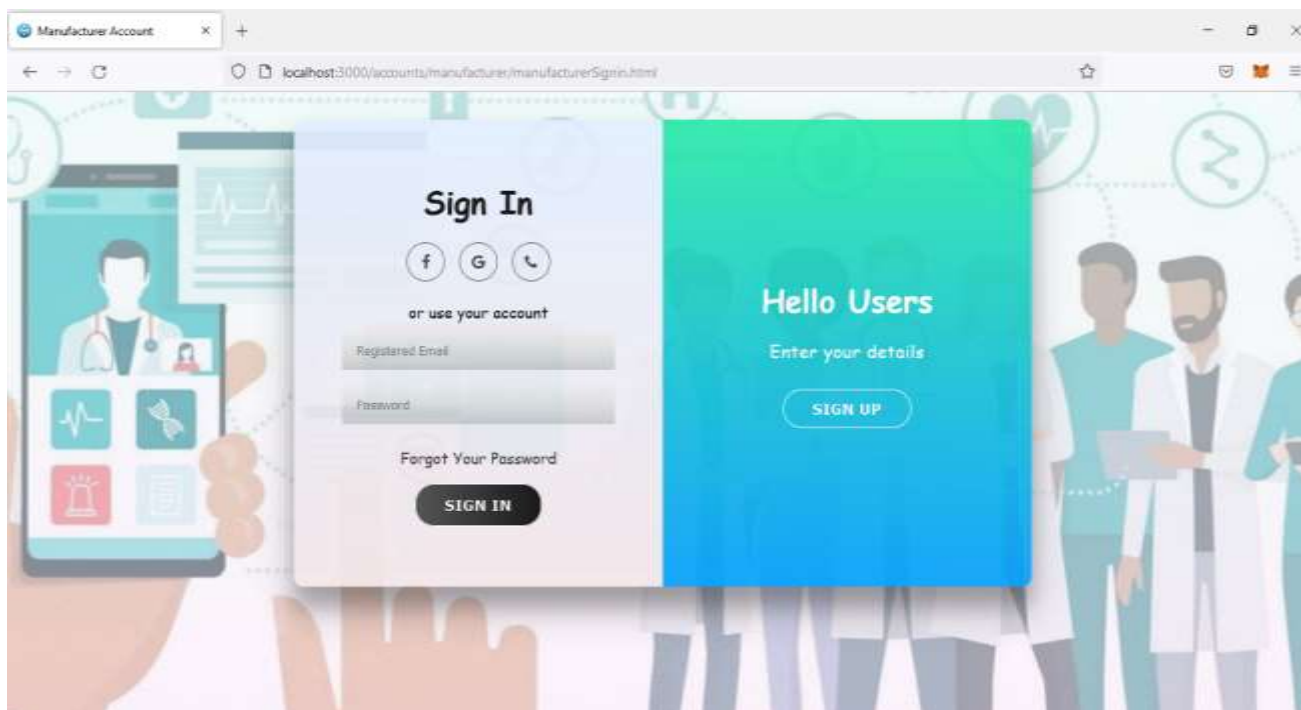


FIG.6 Screenshot of account login page

In this page (Fig.6), Manufacturer login into the Medbloc application and record the medicine details. The Supplier receives the medicine and login in Medbloc application and authenticate it using the QR Code. The Consumer login Medbloc application and verify its authenticity. All these activities are performed by accessing into the Medbloc login page.



FIG.7 Screenshot of manufacturer entered medicine details in blockchain

In this page (Fig.7), Manufacturer records the medicine details and generates the QR Code for the medicine and uploaded it. The Supplier will authenticate the QR code uploaded by the Manufacturer and authenticate the details of the medicine in the Blockchain. The Consumer purchase the Medicine from the Supplier and Scan the QR code to Check the details of Medicine from the Ethereum Blockchain. All these transactions are recorded and processed automatically into the Blockchain in the MEDBLOC application.

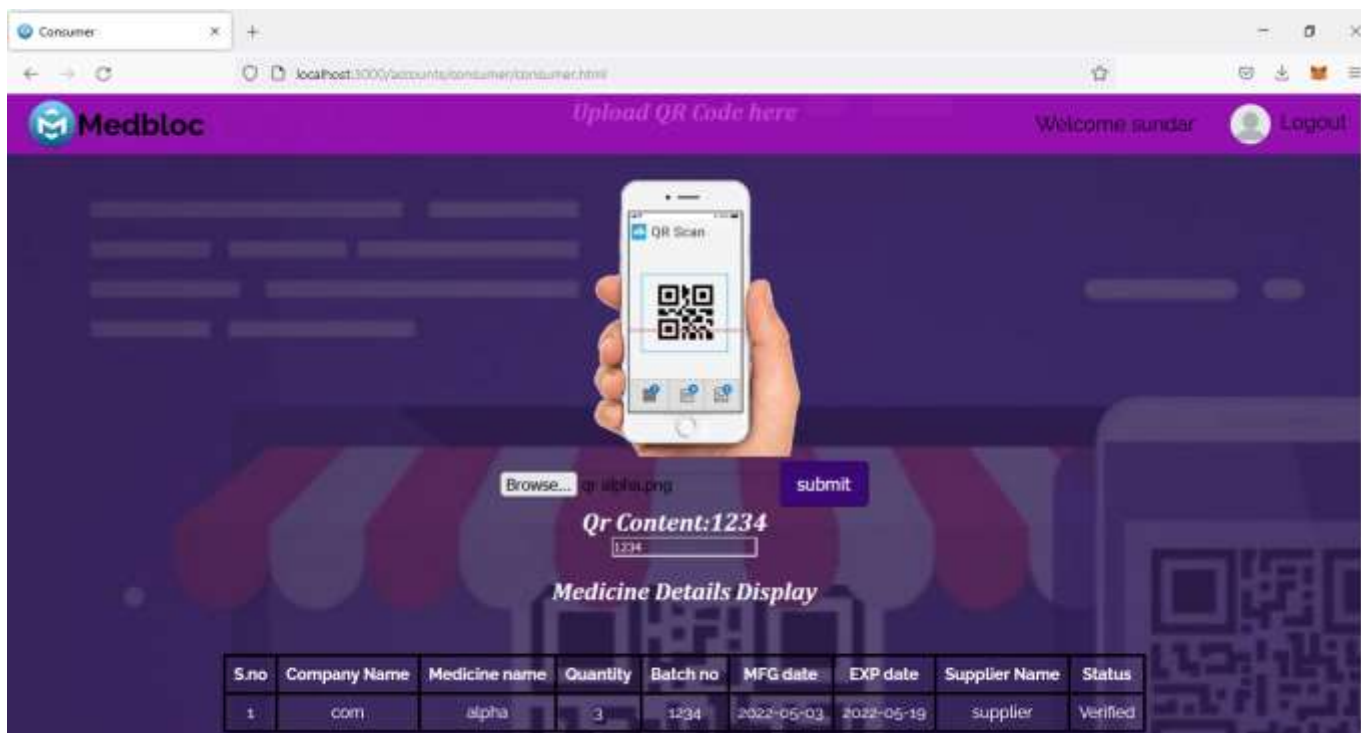


FIG.8 Screenshot of consumer page to check a medicine

In this page (Fig.8), Consumer upload the QR code of the medicine purchased from the Supplier in the application. Medbloc retrieve medicine details from the Blockchain and displays the result in the application, then the Consumer check the result whether

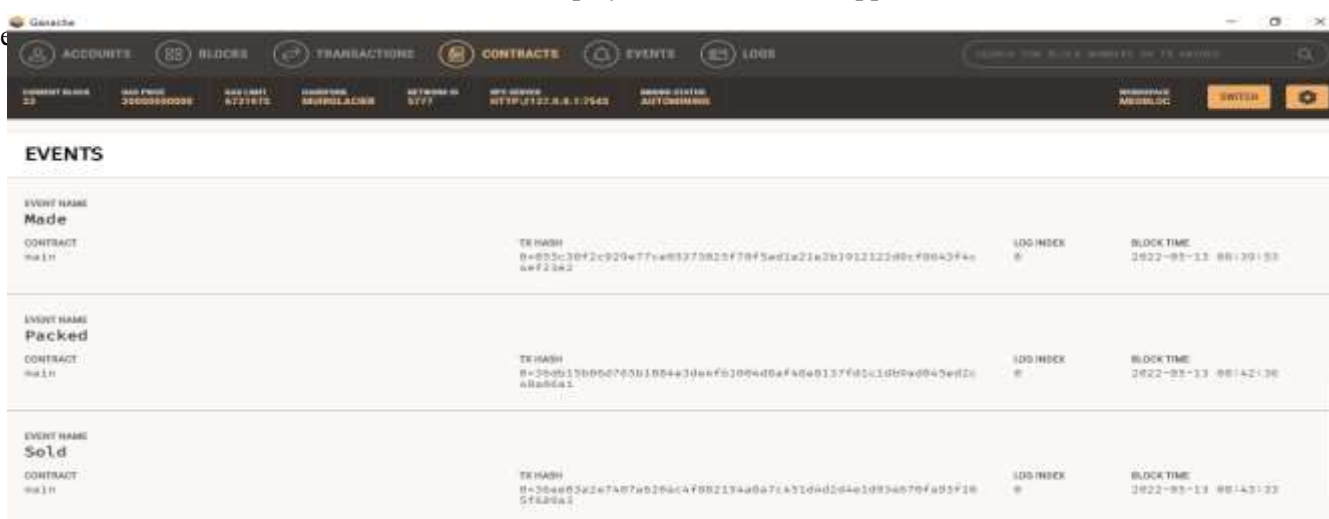


FIG.9 Screenshot of medicine details entered in blockchain

In this page (Fig.9), The Manufacturer, The Supplier, The Consumer performed their tasks in the Medbloc Application. The information is gathered and stored in the cloud in the block chain. Once the manufacturer produces a product, he will register it on the blockchain, and here after the drugs will be tracked, traced and authenticated at each stage of their journey.

IX.CONCLUSION:

Thus, this project has many advantages and provides a scope of improvement in the future product supply chain field. One of the most compelling features of blockchain technology is its resistance to many forms of threats, including cyberattacks. Drug regulatory agencies do quality inspections and monitor pharmaceutical product quality, safety, and efficacy, as well as conduct post-market surveillance. The major goal of the project is for the producer and customers to be able to follow pharmaceutical products along the supply chain and trust one other. The current concept could be expanded to include healthcare, e-commerce, and other activities that require an Automated Decentralized Application Management System.

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X.FUTURE ENHANCEMENT:

The Medbloc application is a single platform web application. we can create Android application for Medbloc and integrated different platform users together and improve accessibility. We can implement Medbloc for other blockchain applications. We can implement decentralized application into larger and diverse platforms. We can change to a different blockchain which offers cheaper gas price. Decentralized application can be implemented in healthcare, Banking, Ecommerce and other area which required more transparency and high security.

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