

# Blockchain based Novel Method to Identify Counterfeit Pharmacy Products

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## Abstract:

Shipping pharmaceuticals requires a high level of expertise to transport pharmaceuticals safely. From the factory to the point of delivery, the industry consists of multiple owners i.e. from manufacturers to suppliers, distributors, and wholesalers before it reaches the patients. Due to this, the supply chain becomes tremendously difficult to track drug's authenticity from beginning to end. There are chances for manipulating the medicines by creating bogus products containing small amounts of the active ingredients, or in wrong proportion that can ruin the brand name and also effects on patient health. In a blockchain and IoT based supply chain management, record keeping and provenance tracking become easy as the information can be accessed through the help of RFID tags and embedded sensors for monitoring the medicine box. The improved traceability facilitates the optimization of flows of goods and it allows for a comprehensive overview of the entire end to end process. Applying the proposed information the system supports the real-time tracing and supply chain management of all drugs in hospital, will alleviate counterfeit drugs and achieves supply chain compliance.

**Keywords —Blockchain, Counterfeit, Pharma, IoT, Supply chain.**

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## I. INTRODUCTION

The supply chain is a generic term that refers to the resources required to deliver goods or services to a customer or end user. Managing the supply chain in the healthcare industry is often a time-consuming and fragmented procedure. Obtaining resources, managing supplies, and delivering goods and services to healthcare professionals and patients are all part of the healthcare supply chain management process. [1]-[3]. In its most basic form, a blockchain is a time-stamped set of immutable records of data that is managed by a distributed network of computers that is not owned by any single company. With the help of cryptographic principles, each of these blocks of data (or block) is

protected and linked to the others.... On the conference website, you may find information about submitting your final paper for consideration. [4]-[6]. A block is created by one of the parties involved in a transaction to start the process. Upon verification, this block is added to a chain, which is then stored throughout the internet, resulting in not only a unique record, but a unique record with a unique history. The falsification of a single record would imply the falsification of the entire chain in millions of different cases. That is practically impossible to accomplish. Bitcoin makes use of this architecture for monetary transactions, but it can also be used in a variety of other applications [7–10]. Blockchain displays qualities such as a trust machine, decentralized governance, and traceability

of transactions, among others. Physical objects, automobiles, home appliances, and other items that have been embedded with electronics, software, sensors and actuators and are connected to one another through a wireless network and can be accessed digitally from any location are part of the Internet of Things (IoT). Due to the Internet of Things, objects can be sensed or controlled remotely across existing network infrastructure, opening the door to more direct integration of the physical world into computer-based systems and resulting in increased efficiency, accuracy, and economic benefit in addition to a reduction in the need for human intervention [11]. When the Internet of Things is enhanced with sensors and actuators, the technology is elevated to the level of a more general class of cyber-physical systems, which includes technologies such as smart grids, virtual power plants, smart homes, intelligent transportation, and smart cities, among other applications.

When the ownership of a drug consignment changes from the manufacturer to the distributor and subsequently to the wholesaler, no information is transmitted between the parties involved. Our inability to provide proper auditability and transparency regarding the original source of pharmaceuticals is related to the fact that the flow of drugs is directed from supplier to consumer, with numerous complicated exchanges and transformations occurring between the point of origin and the point of delivery. Consequences include counterfeit drug problem, inefficient recall process of the drugs and lack of trust. Most of the medicines are sensitive to temperature during shipping and they are heat sensitive and susceptible to contamination. Keeping the temperature-sensitive pharmaceuticals like vaccines at the proper temperature range by monitoring and protecting the integrity is a crucial part of the supply chain.

## **II. LITERATURE REVIEW**

Amit Kumar et al [12], has proposed a brief review on IoT applications in supply chain domain. The

study examines the role of the Internet of Things in providing a real-time update on delivery and data for material handling in supply chain management, as well as the role of the Internet of Things in the function of value addition that it brings to a project in the form of material management and communication. This document can be used as a template to easily comply with the conference paper formatting criteria. Simply type your text into the document to complete the task. In recent years, a diverse range of industrial Internet of Things applications has been created and deployed. As part of an attempt to comprehend the growth and development of the Internet of Things in industries [13], this article evaluates current research on the Internet of Things, important enabling technologies, major IoT applications in industries, and identifies research trends and obstacles.

Identification, conceptualization, analysis, and categorization of PSC models are accomplished by a critical synthesis of academic and practice literature [14], [15]. An operations research systems view is chosen from a theoretical perspective in order to bring insights into a broader range of OR activities, from conceptualization through mathematical modeling and model solving, and finally to implementation, among other things. The PSC's conceptual models indicate which phenomena are of relevance to the analyst, generally through the use of a graphical representation of the phenomenon. Specific to the process supply chain (PSC), Srari et al. deploy supply chain mapping methodologies to facilitate an end-to-end, entire system-level evaluation of PSC reconfiguration options offered by specific technological interventions [16], [17].

This study examines the potential for reconfiguration in Pharmaceutical Supply Chains (PSC) as a result of technological interventions in manufacturing and the introduction of new, more patient-centric delivery methods [18]. An important fundamental technology for the Internet of Things is radio frequency identification (RFID), which allows microchips to transmit identification information to a reader via wireless communication.

The use of RFID readers allows individuals to automatically identify, track, and monitor any things that have RFID tags attached to them [19]. Internet of Things (IoT) is a sophisticated cyber-physical system that includes a variety of devices that are equipped with sensing and identifying skills as well as processing and communication abilities. Sensors and actuators, in particular, are becoming increasingly powerful, less expensive, and smaller, allowing them to be used in a variety of applications. Developing industrial applications like as automated monitoring, control, administration, and maintenance are high on the priority list for industries looking to deploy Internet of Things devices. It is projected that the Internet of Things will be widely used in industries [20] – [23] as a result of the rapid advancements in technology and industrial infrastructure. In the last decade, food safety has emerged as a significant concern. As a result, the government is concentrating its efforts on ensuring public safety and the general welfare of the populace. The rapid development in the field of Internet of Things (IoT) will undoubtedly assist the relevant authorities in their efforts to concentrate on the same. This technique makes use of a variety of technological developments for observing nutrition and determining the nutritional value of the food material [24], [25].

### III. PROPOSED TECHNIQUE

An EDI system is a system that relies on Electronic Data Interchange (EDI), a process by which information is transferred from one computer system to another. This information transfer takes place without human intervention by relying on a standardized messaging format so computers can read and interpret the data easily. In this research we have developed a blockchain based system to weed out pharmaceutical counterfeits, which basically tells the medicine is an authenticated drug arising from authenticated source.

This system has two segments, the first segment is Hardware and Software is the second segment. In the hardware part we have two components. One

the IOT Sensors, two the Microcontroller. The IOT Sensors sense the changes specified like RFID Tag scanning, change in temperature, status of the lid and send these data to NodeMCU ESP8266 microcontroller. This NodeMCU ESP8266 Microcontroller is powered by a transformer and power supply unit which consists of a transformer which steps down the 230V AC current into 12V AC Current then this 12V AC Current is passed into a Bridge rectifier which converts the 12V AC into 5V DC and Powers the IOT Sensors, Microcontroller, and Buzzer. When the microcontroller is connected with Wifi the data is transmitted to the database where the hashing is done and the final transaction details can be viewed at the web application.

#### A. System Architecture

The entire system into four modules. First module is Recording of transactions and Second module is monitoring the temperature and Lid Status of the consignment. Tracking the GPS Location of the consignment is the third module. Hashing the data, storing it in the database and monitoring the transactions in the web application is the fourth module. Figure 1 provides the system architecture.

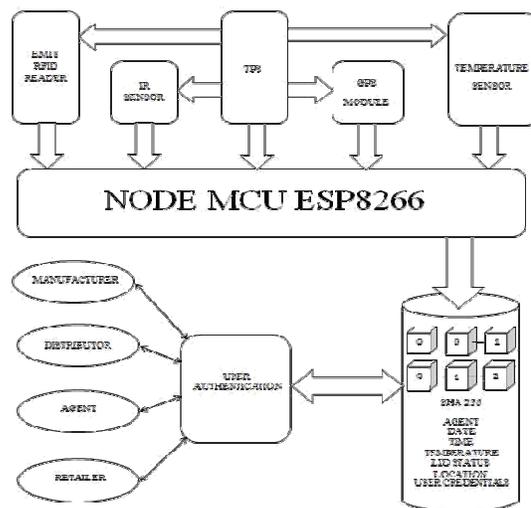


Fig. 1: System Architecture

The participants in the supply chain are verified and the manufacturer issues the RFID tag for the authenticated users. When there is any transaction between agents or entities of the supply chain the receiver scans their respective RFID Tag at the EM18 Reader module in the Consignment which sends the data to the NodeMCU ESP8266. Figure 2 provides the general flowchart of the operations.

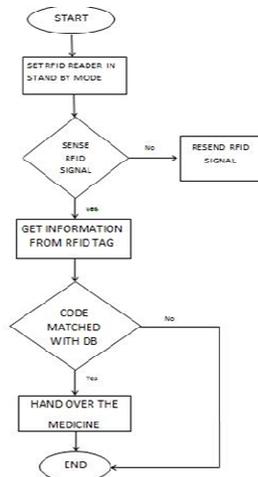


Fig. 2: Recording Transactions

**B. Modules Operations**

Temperature sensor named thermistor accurately measures the temperature, when it crosses the above or below optimum levels (15-25 deg C) it sends the data to the NodeMCU ESP8266. IR sensor is used to sense the status of the container lid by emitting infrared radiation if there are changes it is updated in NodeMCU ESP8266 and buzzer connected to NodeMCU ESP8266 raises alarm if the lid is open. If the temperature raises to optimum level (45 deg) buzzer alarms and data will be updated in the database. The GPS Location of the Consignment is tracked with the help of GPS Sensor attached to the consignment and is updated at NodeMCU ESP8266. At first, we check whether the GPS controller is powered up or not. Then read the GPS data and store the GPS data in the web server. The transactional data obtained from NodeMCU is transferred into fixed size values using the hash function SHA-256. Stored as a single

table of data in flat file database and are made tamper proof. The authenticated users are issued with login credentials who can view the details of the transaction in the web application. At first, user credentials are validated. If it is valid, it redirects to main page and displays transaction details. After viewing the details one can log out to end the session. Figure 3 provides the monitoring operation.

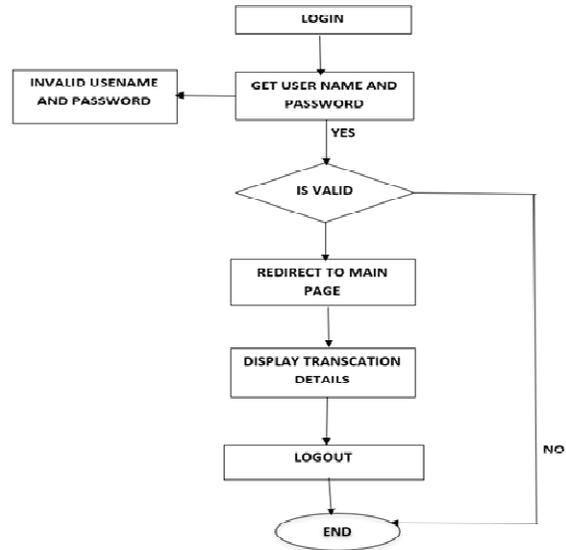


Fig. 3: Monitoring Operation

**IV. PERFORMANCE EVALUATION**

The system was designed and implemented successfully for monitoring the drugs throughout the supply chain using smart IOT devices and temperature is recorded using smart devices throughout the supply chain life-cycle. The environmental conditions within the supply chain may have a direct impact on the quality and efficacy of the drug. The proposed system allows to access accurate data specific to any product that has been manufactured through a blockchain enabled supply chain. The system set up constitutes the following: Node MCU, RFID Reader, GPS, IR Sensor, Thermistor, Buzzer and Power supply.



encoded onto individual RFID tags, radio waves can be used to capture the unique IDs at extremely high rates and at distances well in excess of 10 meters, without the need for direct line-of-sight contact. This can be used to improve supply chain visibility and inventory accuracy, and can be used to boost supply chain visibility and inventory accuracy. A GSM module, which is used to notify the conveyor of sensor details via mobile phones, can be included to make the system even more powerful.

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