Go-Win : COVID-19 Vaccine Supply Chain Smart Management System using BlockChain, IoT and Cloud Technologies

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Abstract: The COVID-19 disease is now a worldwide pandemic that created a global health crisis. A novel corona-virus (nCoV) is a large family of viruses that cause the common symptoms of fever, cold, cough, bone pain and breathing problems, and ultimately acute pneumonia may lead to death as per official information of WHO. Due to the rapid global spread of COVID-19, the entire world is battling with precautionary measures like wearing masks, washing hands, and social distancing. The ongoing medical care systems in all over the world are facing a problem in dealing with large number of patients with lack of resources. So in many countries, the healthcare providers preferred the self-quarantine or isolation of patients with fewer symptoms or non-critical conditions at their home.Currently, the only way to control and avoid the COVID-19 second wave is by potential vaccination.Most of the countries started to give vaccine for the people. Still, most people are hesitant to get vaccinated.This paper describes the COVID-19 Vaccine Supply Chain Smart Management System for effective authorized vaccine distribution, tracking covid-19 patients, post-vaccination safety, and creating awareness to overcome vaccine hesitancy and Covid-denial using BlockChain, IoT, and Cloud Technologies. Go-Win a web application developed with the slogan " Go for Vaccine to Win COVID-19"..

Keywords:

1. Introduction

Corona-virus is a pandemic and perceived in March 2020 by the World Health Organization. The flare-up was first recognized in Wuhan, later well-being specialists of WHO developed information on avoidance and control measures, and analysis and treatment of this sickness [1]. Though several different types of COVID-19 vaccines developed and most of them are in initial stage of implementation, still the world is battling only with effective precaution measures[2]. The normal manifestations of COVID-19 are Fever, Dry hack, Fatigue and Shortness of breath. COVID-19 will affect the people of all age groups. According to WHO COVID-19 Complications prompting passing may incorporate respiratory disappointment, acute respiratory distress syndrome (ARDS), sepsis and septic stun, thromboembolism, as well as multiorgan defect, including failure of the heart, liver, or kidneys [3]. This virus will spread easily human to human. According to the rules of well-being specialists', the hatching time of COVID-19 is 14 days. If a person tested as positive for COVID-19, then virus would spread to the people whom he was interacted. During this hatching period, before the associated individual starts encountering side effects, the individual could be infectious. Right now, the best way to control is to hinder its spread (staying away from second wave) by utilizing measures, for example, social separating, hand washing and face covers. Moreover, immunization assumes an essential part in forestalling COVID-19 spread[4,5].In this paper, we described the implementation of IoT Blockchain based smart management system for Covid-19 effective vaccine supply, tracking and monitoring of post-vaccination cases (45 days observation), and creating awareness to overcome vaccine hesitancy as well as Covid-denial. So the users can use this smart technology platform to get vaccinated in nearby centers and send their daily health symptoms and changes if any to doctors via their mobile phones integrated with IoT applications. Go-Win is an application developed using integrated technologies like AI/cognitive computing, cloud applications, IoT, and BlockChain for better supply chain operations and management solutions. Further, this technological trend provides improved quality of lifestyle with high-end security when it's integrated with innovative implementation strategies. The use of emerging smart technologies in conjunction with COVID-19 vaccine policies seems to have lowered the spread rate and resulted in low mortality rates.

2. Literature Review

Review of the works of literature used to study the uses of the Internet of Things (IoT), Blockchain technology in various health care systems. Wu et al. proposed a hybrid IoT safety and health monitoring system. The goal was to improve outdoor safety. The system consists of two layers: one is used to collect user data, and the other to aggregate the collected data over the Internet. Wearable devices were used to collect safety indicators from the surrounding environment, and health signs from the user [6]. Pedro et al, proposed a model for the detection of COVID-19 patterns in CT images, namely EffiecintCovidNet, is proposed along with a voting-based approach and a cross-dataset analysis. The proposed model presents comparable results to the state-of-the-art methods and the highest accuracy to date on both datasets [7]. Mohammed et al, the proposed an intelligent framework that uses the hybrid methodology of neutrosophic theory with TOPSIS results. The results showed an aided list for the

healthcare team to treat COVID-19 patients in the hospital, home quarantine, or identifying and treating with typical cold or flu [8].

In a smart healthcare setting, the IoT can help to provide a remote diagnosis prior to hospitals for more efficient treatment[9]. Castillejo et al. [10] develop an IoT e-health system based on Wireless Sensor Networks (WSN) for firefighters. For COVID-19, the patients with advanced cases often suffer from coughing, but it can also be a symptom of influenza and many other medical conditions [11]. Currently, many research groups are working on this idea to battle COVID-19 [12], including Coughvid from Ecole Polytechnique Federale de Lausanne (EPFL) [13], Breath for Science from NYU [14], CoughAgainstCovid from Wadhwani AI group in collaboration with Stanford University [15], and COVID Voice Detector from Carnegie Mellon University [16]. Imran et al. [11] have made an AI model to distinguish between coughs related to COVID-19 and coughs caused by other respiratory conditions. Raja, Khaled, et al.[17] presented the potential blockchain applications and high-level design of three blockchain-based systems to enable the governments and medical professionals to efficiently handle health emergencies caused by COVID-19. Rajani and Ashutosh et al.[18] described classic blockchain systems for IoT-based supply chain management, and implemented a smart healthcare ecosystem for the drug supply chain.

3.   Go-Win System Architecture

Go-Win is an application that provides a high-end healthcare system to maintain and manage COVID-19 emergencies using blockchain supply management systems and AI cloud techniques. Blockchain is a distributed technology, that provides decentralized, and immutable digital information storage for geologically distributed areas over the network. The immutability property of blockchain implies that data tampering would get undeniably more hard to happen. By implementing this blockchain technology we can monitor COVID-19 patients remotely with the help of doctors and store the digitally generated medical records with high confidence and data integrity. Go-Win application will provide high-end support to control COVID-19 by effective Vaccine distribution using supply chain management. Blockchain in Pharma Supply Chain can distribute and manage stock without any security issues. In the worldwide wellbeing area, associations like Red Cross, USAID, or the Global Fund intend to follow back the dissemination of gave drugs across various nations[19]. Nowadays medical and food industries increasingly utilizing the features of blockchain supply management to track the path and safety distribution of medicine throughout the supplier-to-client.

The internet of Things (IoT) is an embedded technology that connecting smart devices,

software, sensors, and other technologies over the internet to enable communication or exchange of data[20]. This enables clients to get brilliant administrations that will expand their personal satisfaction. Further, IoT can be implemented in many smart applications like Healthcare, smart cities, smart houses, agriculture, and power grids. Blockchain and cloud computing are the supporting technologies that we can integrate with IoT smart supply chain management systems in Gowin architecture. Gowin supports a decentralized architecture, storage and communication managed through the implementation of blockchain and cloud computing.
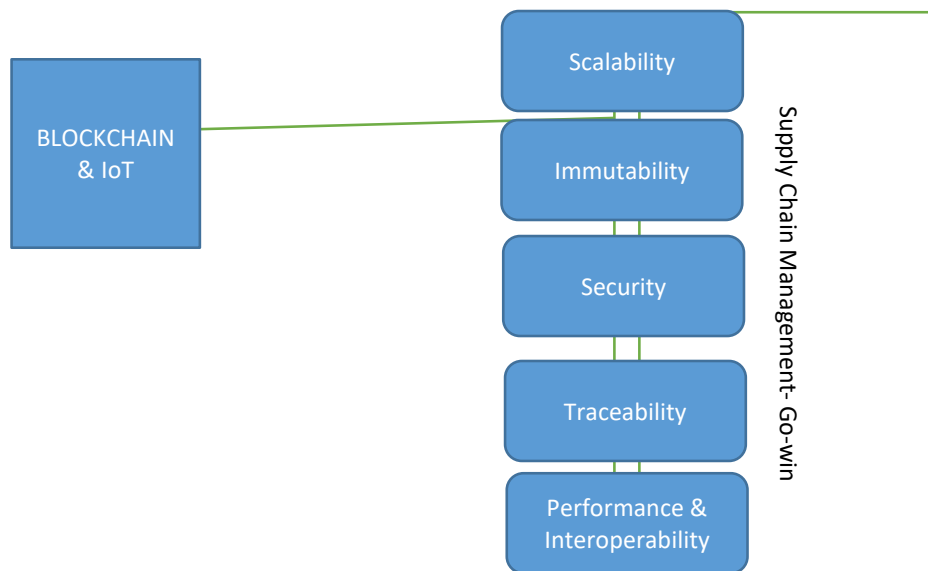

Figure 1: Advantages of integrating Blockchain & IoT

The reconciliation of Blockchain innovation with IoT gadgets propels inventory network computerization through supply chain management for effective distribution of the Covid-19 vaccine. So Go-win smart web inventory network the board framework gives protected and versatile storage of the Corona-virus antibody. And furthermore gives an improved Corona-virus patient global positioning framework to screen the post-inoculation impact by recording early indications or results with the assistance of medical specialists. The smart information can be recorded and prepared from smart gadgets/sources empowering a computerized production network that is consolidated in the Go-win framework engineering using cloud technology.
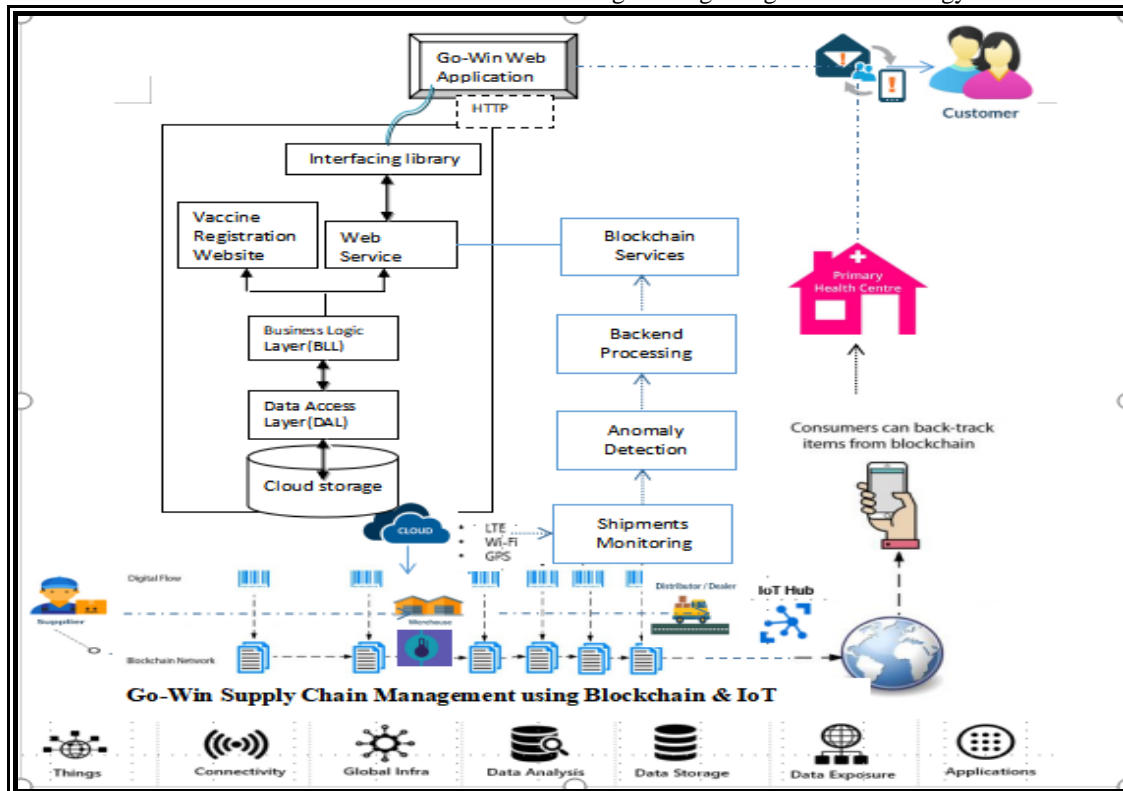

Figure 2 Go-Win System Architecture

4.   Go-Win System Implementation

Go-Win system implementation contains the following steps…

Step 1: Global authorized interaction with stakeholders on supply chain and distribution of Covid-19 vaccine.

Step 2: Integrated platform for the efficient and safe transformation of Vaccines from global sources to our country region.

Step 3: Implementing a location-based system (GPS) for tracking and also temperature sensor to record the covid-19 vaccine storage temperature in a warehouse during supply chain delivery.

Step4: A mobile integrated system for Clients (Health Centers and hospitals in India) to monitor the temperature and current location of the vaccine stock supply chain system.

Step 5: Mobile application interface for Covid-19 Vaccine Registration based on availability.

Step 6: Effective and safe distribution of Vaccines to the Health centers based on demand/registration as per the direction of the Government.

Step 7: Web-based cloud API analyses the real-time vaccine registration data and allot the slots for people to take immunization vaccines based on FCFS.

Step8: Gowin provides the facility to monitor the people's post-vaccination safety. Health Data Monitoring System in remote location includes Temperature, Heart Rate, Oxygen level (pulse rate), Blood pressure, cough rate, room temperature, and Maintaining Electronic Health Record (EHR).

Step 9: Virtual Communication and Data sharing to Health professionals using Wi-Fi-IoT Discovering Symptoms using smart wearable sensing devices decision-making process to cloud architecture.

Step 10: *Analysis of received Data and Compare with threshold values to find abnormality\normality condition by Doctor and health team in Datacenter.*

Step 11: *Follow up action and treatments based on finding in Virtual meetings.*

Step 12: *Gowin collects the Covid-19 patient's data from Health centers and offers a health monitoring system. And also sends awareness messages about the importance of Vaccination.*

Go-win system implemented with the help of IoT Healthcare system,smart sensory systems and wireless communication modules are connected to the web application model. Patient data is recorded and communicated over internet. The digital supply chain management system design is given below.
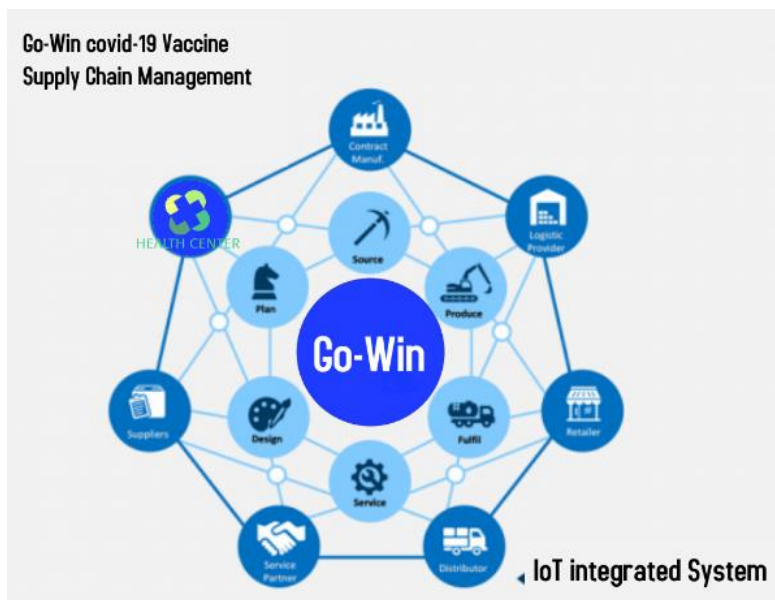

Figure 3 Go-Win Digital Blockchain Supply Management

5.   Conclusion

This paper proposed a Blockchain-based digital supply chain and IoT Healthcare Monitoring System for an effective COVID-19 Vaccine distribution and management system using cloud technologies. Authorized clients(Government) or health centers can monitor the digital supply and secure transformation of the Covid-19 vaccine using Wi-Fi sensors, Mobile Applications, and IoT Smart technologies. The system can constantly maintain the preserved temperature for vaccine storage and provide immutable distribution. The customers or people can register through the Go-Win application(based on nearby health center location) for vaccination. Post-vaccination abnormalities and side-effects are recorded as data (Electronic Health Report) which can be transmitted accurately to the health professionals through cloud architecture using a Wi-Fi Sensing app. Further, the doctor checks the patient's report to analyze and review the current condition. This system helps to reduce the massive pressure on hospitals and health teams to provide contactless medication. Several possible improvements can be implemented in the system in the future. Employing the state-art of the proposed digital vaccine distribution system could potentially reduce the impact of Covid-19 and mortality rates through Real-time remote monitoring systems.

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