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BLOCKCHAIN TECHNOLOGY AN IMPROVED AGRO-FOOD (POULTRY) ONTOLOGY TRACKING ORIGIN

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ABSTRACT:

The launch of a product for human consumption requires end users to identify and track the disadvantages of a product, developing a unique branding, identity and certification process. Many researchers are considering blockchain-based solutions. Blockchain-based solutions are used in finance, banking, education, e-commerce, hardware, agriculture and other sectors. In Nigeria, many researchers and companies are interested in implementing blockchain technology. A blockchain-based system is being developed for analyzing the origins and records of poultry products. The system includes parts of the blockchain, such as gateway, block, newsletter, authentication, cryptography, transparency, etc. This system will be implemented and tested in poultry in Nigeria. Participants include veterinary pharmaceutical companies, retailers, wholesalers, Nigerian veterinary companies, food health and conservation, etc. The results of the initial experiment will be positive and positive, and many farmers and practitioners are happy to participate in the experiment. The expected operating system uses the Python-based Flask web system as well as the SQLite database type. Mobile application systems used as front end tracking.

Keywords: Blockchain, Technology, Agro-food, Poultry and Ontology Tracking.

Introduction:

The movement of poultry products from the farm to whole sealers to retailer and consumer require a distribution traceability model to identify the movement of product to the end users and synchronized with an institution that control and regulate poultry products. Universally, regardless of the level of economic development, humans are constantly transferring value. The transfer of value is a fundamental human activity enabling people to trade goods and services, and accumulate productive capital and savings for their wellbeing.

In order to lower uncertainty during the exchange of value, institutions are used to ensure trust and mitigate risk between buyers and sellers. The institutions that intermediate the exchange of value use centralized electronic ledgers to track assets and store data. Since those intermediaries often rely on manual inputs and may be vulnerable to fraud, value transfers tend to impose a high cost on buyers and sellers, which drastically increases the burdens of doing business. High transaction costs are a major deterrent to economic development. In addition, cash transactions (in both the formal and informal economy) lack traceability, which ultimately hinders the ability of micro, small and medium-sized enterprises (MSMEs), particularly in developing countries, to access credit and new markets and to grow.

Blockchain as solution to lack poultry product traceability. Blockchain has emerged as a possible solution to implement traceability by creating an information trail while ensuring security and data immutability. Blockchain-based traceability enables secured information sharing, facilitates poultry product quality monitoring and control, operation monitoring and control, real-time data acquisition, transparency and visibility throughout the supply chain (Azzi et al., 2019, Frizzo-Barker et al., 2020). It is understandable that building trust among supply chain partners – especially those located at different parts of the globe, is a slow and challenging process. Besides, the role of third party supply chain auditors' in documentation and reporting the violation of codes-of-conduct are often questioned thus remain untrustworthy (Short, Toffel, & Hugill, 2016). Collaboration would require accurate information sharing over long periods of time, a feat that is hard to achieve with the existing information systems. Operating on a decentralized network structure, with its data immutability feature, the implementation of blockchain is an appropriate solution to provide better visibility with information sharing that can build technology-based trust among the supply chain stakeholders

Ontology tracking origin of agro-food traceability demands a large volume of data that needs to be collected across the supply chain within the blockchain identifiers. Very early tracking and traceability systems used workers to record the information on the field and then manually transfer them on handbooks or into a computer system. This method entails risks, such as faulty information recording as well as indecent resource usage. In the last recent decades, there is a rapid development of automated processes and products, as well as in communication technologies, resulting in the so-called Internet of Things (IoT) paradigm. This rapid evolution of IoT and sensor technology favors the data gathering procedure by ordering fast and reliable methods. These methods include technology for product identification, ingredient analysis, transportation, storage, as well as information capture throughout the overall system integration. Methods such as barcodes, QR codes, RFID, wireless sensor networks (WSNs) are the most widespread and well-known among supply chains.

Related Work

The research work BLOCKCHAIN TECHNOLOGY AN IMPROVED AGRI-FOOD (POULTRY) Ontology TRACKING ORIGIN is an enhance control security system design with a blockchain technology. This control the transaction flow of the entire poultry process from the day old supplied to final consumption by the end user, the customer. This chapter actually make a review on literature related to the project work. The project work is smart technology to uniquely provide opportunity to bring greater efficiency, transparency and traceability to the exchange of value and information in the poultry product distribution. The poultry products like broiler, the blockchain is generate a transaction on any point interaction, this keep the origin to consumer endpoint transaction. Blockchain is a way of storing digital data. The data can literally be string length most time limited. For poultry birds, it's the transactions (transfers of poultry birds details from one account to another account), but it can even be files; it doesn't matter. The data is stored in the form of blocks, which are chained together using hashes. Hence the name "blockchain." All of the magic lies in the way this data is added and stored in the blockchain, which yields some highly desirable characteristics

Distributed ledger technologies (DLTs) with advance technology blockchain build smart poultry record management that provide a unique opportunity to bring greater efficiency, transparency and traceability to the exchange of value and information . This project aims to facilitate a better understanding of the opportunities, benefits and applications of DLTs in agro-foods specifically for poultry product. It also identifies technical limits and possible institutional barriers to their adoption. By utilizing digital records, cryptography and the disintermediation of transaction processing and data storage, DLTs can improve both agricultural supply chains and rural development interventions in a number of ways. The ability of the technology to trace a product's provenance, carry detailed attributes for the product in each transaction and ensure its authenticity brings vast improvements in traceability with positive impact on food safety, quality and sustainability.

BLOCKCHAIN IN AGRICULTURE AND FOOD SUPPLY CHAIN

While the blockchain technology gains success and proves its functionality in many crypto currencies, various organizations and other entities aim at harnessing its transparency and fault tolerance in order to solve problems in scenarios where numerous untrusted actors get involved in the distribution of some resource Theo and Andreas (1983), Hazard and Hardjono (2016). Two important, highly relevant areas are agriculture and food supply chain. Agriculture and food supply chains are well interlinked, since the products of agriculture almost always are used as inputs in some multi-actor distributed supply chain, where the consumer is usually the final client Martin Holland, Christopher and Josip (2017). As a successful example, in December 2016, the company AgriDigital executed the world's first settlement of the sale of 23.46 tons of grain on a blockchain HenryMKim and Marek Laskowski. (2018), since then, over 1,300 users and more than 1.6 million tons of grain has been transacted over the cloud-based system, involving $360 million in grower payments. The success of AgriDigital served as an inspiration for the potential use of this technology in the agricultural supply chain. AgriDigital is now aiming to build trusted and efficient agricultural supply chains by means of blockchain technology Kari, Jukka and Tomi. (2017). The food chain worldwide is highly multi-actor based and distributed, with numerous different actors involved, such as farmers, shipping companies, distributors, and groceries. This system is currently inefficient and unreliable. For example, when people buy goods locally, they are not aware of the origins of these goods, or the environmental footprint of production. Various initiatives have been identified, where blockchain technology could be used to solve real-life practical problems at the agricultural supply chain. These initiatives can be divided into four main categories below: a) food security, b) food safety, c) food integrity, and d) support of small farmers.

FOOD SECURITY BETWEEN ENDS TO END POINT

The Food and Agriculture Organization (FAO) defines food security as the situation when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". Achieving this objective has proven to be extremely challenging under humanitarian crises related to environmental disasters, violent political and ethnic conflicts, etc. Blockchain is regarded as an opportunity for the transparent delivery of international aid, for disintermediating the process of delivery, for making records and assets verifiable and accessible and, ultimately, to respond more rapidly and efficiently in the wake of humanitarian emergencies Hsiang-

Tsung and John (1981). Examples include digital food coupons having been distributed to Palestinian refugees in the Jordan's Azraq camp via an Ethereum-based blockchain Satoshi, (2008), where the coupons could be redeemed via biometric data Andrea and Wiebe (2016). At the moment, the project is helping 100,000 refugees.

FOOD SAFETY USING THE DISTRIBUTED LEGDER SYSTEM

Food safety is the condition of processing, managing and storing food in hygienic ways, in order to prevent illnesses from occurring to human population. CDC claims that contamination because of food causes 48M Americans to become ill and 3,000 to die every year Rüdiger, (2001). In 2016, Oceana performed a research on seafood fraud, showing that 20% of seafood is labelled incorrectly Jiajun, Pingyu, and Jiewu (2017). Leet et al. commented that food supply chains are characterized by reduced trust, long shipment distances, high complexity, and large processing times Thomas and Schwartz. (2014). Blockchain could provide an efficient solution in the urgent need for an improved traceability of food regarding its safety and transparency. Walmart and Kroger constitute examples of the first companies to embrace blockchain and include the technology into their supply chains Feng Tian. (2016), working initially on case studies that focus on Chinese pork and Mexican mangoes.

The integration of blockchain with Internet of Things (IoT) for real-time monitoring of physical data and tracing based on the HACCP system has recently been proposed Tian, (2017). This is particularly critical for the maintenance of the cold-chain in the distribution logistics of spoilable food products. As an example, ZetoChain performs environmental monitoring at every link of the cold chain, based on IoT devices Feng, (2017). Problems are identified in real-time and the parties involved are notified immediately for fast action-taking. Smart contracts are harnessed to increase the safety of sales and deliveries of goods. Mobile apps can be used by consumers to scan Zeto labels on products in order to locate the product's history.

FOOD INTERGRITY IN A BLOCKCHAIN SYSTEM

Food integrity is about reliable exchange of food in the supply chain. Each actor should deliver complete details about the origin of the goods. This issue is of great concern in China, where the extremely fast growth has created serious transparency problems Kentaroh et al (2017), Food safety and integrity can be enhanced through higher traceability. By means of blockchain, food companies can mitigate food fraud by quickly identifying and linking outbreaks back to their specific sources Wei-Tek et al, (2016). Recent research has predicted that the food traceability market will be worth $14 billion by 2019 Fabian and Buterin, (2014). There are numerous examples of companies, start-ups and initiatives aiming to improve food supply chain integrity through the blockchain technology.

The agricultural conglomerate Cargill Inc. aims to harness blockchain to let shoppers trace their turkeys from the store to the farm that raised them Jiani and Nguyen. (2018). Turkeys and animal welfare are considered at a recent pilot involving blockchain Zibin et al, (2017). Coca-Cola has attempted to employ blockchain to sniff out forced labor in the sugarcane sector The European grocer Carrefour is using blockchain to verify standards and trace food origins in various categories, covering meat, fish, fruits, vegetables and dairy products.

Downstream beer is the first to use blockchain technology, revealing everything one wants to know about beer, i.e. its ingredients and brewing methods. Every aspect of this craft beer is being recorded and written to the blockchain as a guarantee of transparency and authenticity. Consumers can use their smart phones to scan the QR code on the front of the bottle and they are then taken to a website where they can find relevant information, from bottling to the raw ingredients. Moreover, "Paddock to plate" is a research project aiming to track beef along the chain of production-consumption, increasing the reputation of Australia for high quality Theo Haerder and Andreas, (1983).

The project uses BeefLedger as its technology platform Thomas and Schwartz (2014). As another example, the e-commerce platform JD.com monitors the beef produced in Inner Mongolia, distributed to different provinces of China. By scanning QR codes, one can see details about the animals involved, their nutrition, slaughtering and meat packaging dates, as well as the results of food safety tests. To guarantee customers that their chickens are actually free-range, Gogochicken uses an ankle bracelet to showcase that its chickens are free-range, and this information is then available through the web Schwartz, Youngs, and Britto, (2014). The aim of the company is to build trust by documenting the origins of the food. The Grass Roots Farmers' Cooperative sells a meat subscription box, which uses blockchain technology to inform consumers in a reliable way about the raising conditions of their animals. Moreover, in April 2017, Intel demonstrated how Hyperledger Sawtooth, a platform for creating and managing blockchains, could facilitate traceability at the seafood supply chain. The study used sensory equipment to record information about fish location and storing conditions.

In January 2018, the World Wildlife Foundation (WWF) announced the Blockchain Supply Chain Traceability Project Satoshi, (2008). to eliminate illegal tuna fishing by means of blockchain. Traceability of tuna is also the focus of Balfegó. Furthermore, ripe.io has created the Blockchain of Food, which constitutes a food quality network that maps the food's journey from production to our plate. Furthermore, with OriginTrail, consumers can see at which garden the ingredients they will put into their soup have grown, the true value of poultry line etc. Also, the project "blockchain for agri-food" developed a proof-of-concept blockchain-based application about table grapes from South Africa. Finally, a framework for greenhouse farming with enhanced security, based on blockchain technology, is proposed in project review.

SMALL FARMERS SUPPORT

Small co-operatives of farmers constitute a strong method in order to raise competitiveness in developing countries, helping individual farmers to win a bigger share of the value of the crops they are cultivating. AgriLedger uses distributed crypto-ledger to increase trust among small co-operatives in Africa. FarmShare aims to create new forms of ownership of property, cooperation of communities and self-sufficient local economies Nakamoto (2018). OlivaCoin is a B2B platform for trade of olive oil, supporting the olive oil market, in order to reduce overall financial costs, increase transparency and gain easier access to global markets. Finally, some startups support small farmers by offering tools that increase the traceability of goods, such as Provenance, Arc-Net, Bart.Digital and Bext360. As a recent example, the Soil Association Certification Soil Association Certification, (2018) has teamed up with Provenance to pilot technology which tracks the journey of organic food.

It was noted that even medium-size farmers could benefit from blockchain and the aforementioned initiatives, as they form a clearly different category than the large corporations. Cooperatives, on the other hand, might be formed by either small or medium-size farmers, and can become quite large entities. Still, they are an ideal ground for blockchain, as the transparency of information involved could help to more easily solve disputes and conflicts among the farmers in a fairer way for everyone Zibin et al (2016). Summing up, Table 1 shows blockchain technology initiatives/projects, in relation to the goods and/or products targeting, from the examples presented in Sections 2.2.8-2.2.12. The last column indicates the objectives for employing blockchain technology at each case. Financial reasons are associated with food traceability in the commercial initiatives.

3.0 Proposed System (blockchain technology; an improved Agri-food (poultry) Ontology Tracking and Tracking Origin

These are actual components of the proposed system; blockchain technology an improved Agro-food (poultry) Ontology Tracking Origin. The distributed ledger is the record keeping system for information stored in the database with an uncompromised security system. The poultry farm record activities could be done on record book or the computer system using the database schema etc for secured storage of information but the issues remains that it could be deleted or altered. The distributed ledger work closely with the blockchain. The blockchain technology is an organized structural system that stores transaction record, as a block of the public in many databases know as chains in network connected peer to peer nodes. Poultry farm is a provided with a blockchain distributed ledger for poultry birds, the records cannot be compromised by a hacker. Once the ID is deleted, it is recovered immediately, this is one of the great advantages of blockchain over computer based database model**.**

The Existing System

The poultry farm system is an integral part of Agriculture, majorly for a meat production. The tracking and tracing of poultry processed sealed meat is a very difficult process, in a situation of product compromise in quality and quantity. The conventional system of poultry record keeping only record information about the birds from day old to point of sales within the poultry farm. As well as the computer database method of poultry electronic record keeping this could be compromised for selfish reason. The conventional practice of poultry record keeping has been in use for decades past. Not until the technological advancement in record management, were the records are required not be comprisable. The problems associate with the existing system;

1. Record stored in databases are comprised by the hackers and poultry record could be lost.
2. Conventional poultry records only existing within the poultry firm.
3. Lack chain of supply and distribution, this remains that no information about poultry product located outside the farm.
4. Tracking and tracing of product are not homogenous and holistic.
5. Origin of poultry product are not traceable on ends only in the farm.

The Proposed System

Decades past and even the present day in which we live in, the operational process of poultry record keeping in a ledger, this method are not distributable. The proposed System employs blockchain technology to keep record inside and outside poultry firm. The blockchain system keep records of poultry birds from the day old to wholesaler to retailer and finally the consumer. Between each sales point a verifying system confirms the origin of product and determine the quality and quantity of the poultry birds. The supply chain is never broken or compromised and cannot be deleted. The ledger system are distributed in a unique format easy to track and trace. A mobile application system is interfaced with the application (server) for verification and identifying product origin.

The proper study and review on literatures talking about block chain technology majorly on agro-food traceability of the origin of product and supply chain linking to enhance the system transparency, technology of block chain is to reduce theft in database system thereby improving security and privacy of data stored in the system. The project work is to improve "Agro-food Cargill Inc. Bunge, (2017), Genetics First, the agricultural conglomerate Cargill Inc. aims to harness blockchain to let shoppers trace their turkeys from the store to the farm that raised them, this is a standalone system no real time, not distributed web based application" by implementing the following features;

1. A web based system for Agro-food (poultry) ontology tracking origin products
2. Using block chain and hybrid cryptography to eradicate conspiracy and improve transparency in the system
3. Build a complex algorithm alongside with block chain technology to detect and trace the originality and origin of product (poultry birds)
4. Develop a real time distribution network supply chain for poultry (destination and origin in a given time).
5. Asymmetric algorithm encrypts genetic properties of poultry bird into byte value
6. Byte values is converted into encrypted image known as Qrcode

The proposed system has its advantages over the existing system. The proposed system have its difference from the existing system which forms the advantages of the new system. The shortcoming of the system studied is motivation for project work. The following are the advantages of new system;

1. Immutability of history, meaning poultry products from point of purchase of the day old birds to the consumer ends, all through verification points
2. Unhackability of the system, blockchain security is highly sophisticated and cannot be compromised
3. Persistence of the data, it has a reoccurring data in several end point of product checking.
4. No single point of failure, all poultry products are in a cycle of chains of block traceable. With this no fake product claims.

Diagrammatic Description of the Proposed System

This is a proposed model for complete design and implementation of the blockchain distribution ledger system for poultry record management system.

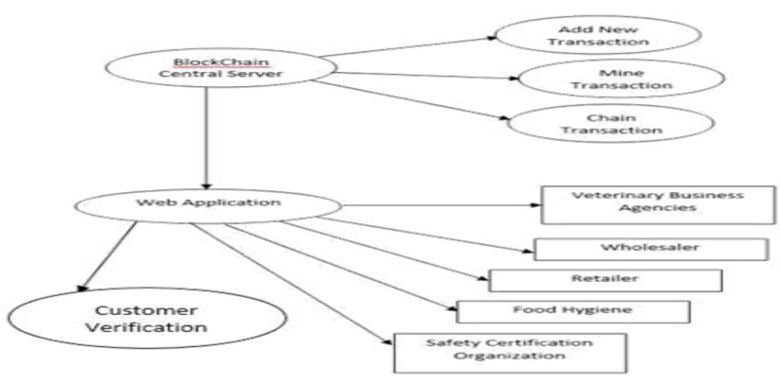

Figure 3.0 Proposed System Diagram [Researchers, (2022)]

Figure 3.0 complete model of proposed System

Blockchain Central Server: consist of three functional module; the new, mine and chain transaction. The distributed ledger poultry record move in this serial structure to be stored in chains.

The Web Application: series of verification systems are the poultry record channel. The veterinary business agencies, wholesalers, retailers, food hygiene and safety certification organization. The poultry product passes through the above check point to determine the origin, quality and quantity of the products before it gets to the final consumers.

Customer Verification: is a mobile application that determine the poultry product origin, expiring date etc.

Operation Process of the complete model

The day old birds are purchased with an nth number. The whole product are stored in a blocks of chain to hold information about a product from a specific poultry farm, wholesaler, retailers and verification systems to the financial consumer. E.g in shopping malls. The customer pick a processed package chicken on it a verification qrcode. The customer scan to verify product origin and expiring date.

Use Case Diagram of the Proposed System

The blockchain distributed ledger system for poultry management is secured and protected using the blockchain technology not comprisable system. The use case diagram is very important proposed system design model in UML is to demonstrate the different ways that a user might interact with a system.

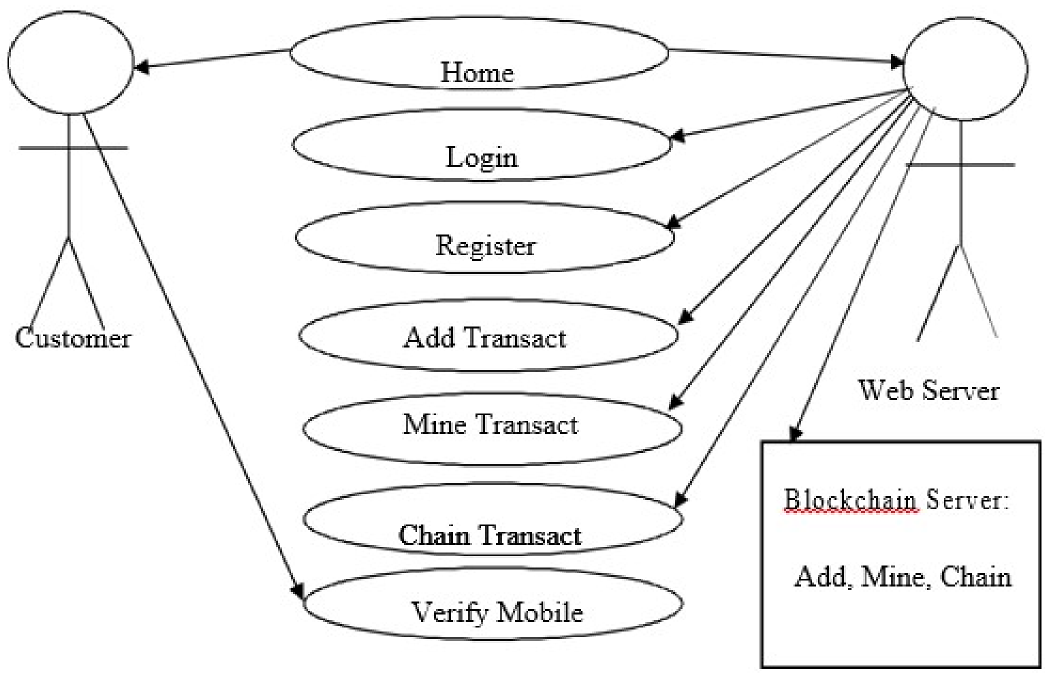

Figure 3.1 Use Case Diagram [Researecher, 2022]

The blockchain technology perform some certain module activities like adding transaction, mine transaction and finally chain transaction. The process is a common task with blockchain technology. The poultry record are secretly store in blockchain storage medium. The several stakeholder involved in the process of the supply chain and the verification of poultry products.

System Architecture

Demonstrates our system architecture. The user submits request for deploying blockchain distributed ledger system for poultry record management application through the web server. The resource allocator takes the requests from the input queue and assigns resources based on scheduling algorithms. Details of our resource allocator system can be found from George and Sarah (2015). In this research work, we focus on the installation and deployment system.

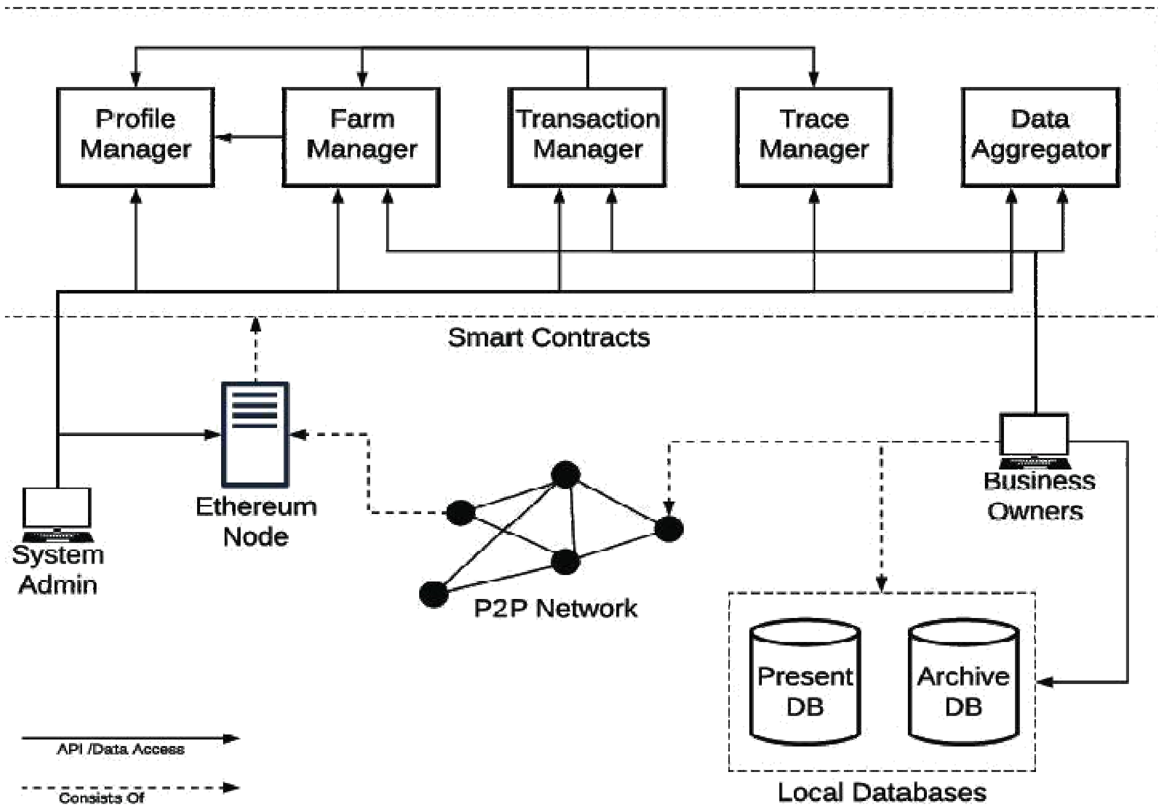

Figure 3.2 System Architecture for Proposed System

The system architecture is a description of the complete component interfacing with each other to achieve the objective of the given proposed focus. The profile manager and farm manager work hand-in-hand to control and monitor the activities of other components. The transaction manager keep record of daily activities in the poultry farm. The tracer manager is to identify and locate an immutable blockchain id (poultry product). The ethereum introduce p2p system transaction to the poultry farm product. Connecting each node to each other in any transaction. This eradicate third party activities and make immutable. The business owner are majorly stakeholder the view the operation of the system. The data/information are stored in local database making the system dynamic in nature.

4.0 Discussion and Result

The blockchain technology, an improved Agro-food (poultry) Ontology tracking origin, it is actually focused on poultry product tracking and teasing the origin of the products. Poultry products movement is verified using the blockchain technology which cannot be immutable or destroyed. A blockchain is created by mining the block and added to the chain (distribution chain). The movement of bird (day old) to poultry farm to retailer to wholesaler to slaughter house to sales-point (shopping mulls). In different stage a block is create for poultry bird using the previous hash this form a supply chain after which transaction are verifying in the p2p system of ethereum blockchain. This intensify and prevent third part interruption in transaction i.e making it immutable and cannot be changed.

The outcome of the blockchain technology is that it intensify the security of the poultry product distribution by tracing and tracking the origin of the poultry product. Customer which is the final consumer can track the poultry farm that produced the bird, the manufacturing date and expiring date. Some customer like the broiler from a particular farm based on the fact of hygiene and cleanness. Customer could claim damage based on the fact expiration of product but it is traced using the qrcode on the body of sealed bird part. Once the customer scans the qrcode the detailed information of the poultry product origin is displayed.

CONCLUSION:

The purpose of this study was to develop a traceability techniques using blockchain technology in poultry farm, as well as their application in the poultry farming industry. Ontology Tracking and Tracing is a blockchain activities that has gotten a lot of attention throughout the year in a p2p blockchain transaction activities. Several regulations, directives, and laws governing the traceability of agri-food products have been encourage around the world through blockchain technology. However, despite the fact that blockchain technology has been the topic of intensive research over the past decade, certain research studies on the deployment of blockchain in agriculture (Agro-food poultry products) traceability systems have just recently surfaced. Simultaneously, a growing trend in startups and pilot applications can be seen. In the framework of this paper.

In conclusion a successful development of a propose system should enable the following: I cost reduction, (ii) risk reduction, (iii) time savings, and (iv) increased confidence and transparency. Only when stakeholders are convinced that the proposed approach is user-friendly, boosts productivity, and adds value will they be willing to implement it. Taking all of this into account, it is evident that integrating new technologies into the traditional agricultural (poultry firm management) is a huge task that must be tackled step by step, and only by effectively engaging the directly impacted stakeholders along the supply chain.

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