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Blockchain Technology for Agricultural Supply Chain

J.S Shyam Mohan[a], Karuru Swetha[b], Kandi Sridivya[a,b],*

[a]Assistant Professor,*Department of Computer Science and Engineering, SCSVMV University, Kanchipuram-631561, India*

[b]*Student, Department of Computer Science and Engineering, SCSVMV University, Kanchipuram-631561, India*

A B S T R A C T

Since the world has been progressing in different ways, it also has a great impact on the agricultural sector. As a result of globalization, Current agriculture development and reforms are calling for few techniques and innovations. One of such emerging techniques is blockchain technology. What distinguishes blockchain from other information storage systems is that it stores data in blocks that are linked together. Unlike the existing centralized and monopolistic agriculture systems, blockchain offers a data structure which is decentralized, to store and retrieve data. Supply chain generally refers to processing of goods and services from suppliers to customers their designing and distribution. These supply chains are majorly prone to error, corruption as they are typically under centralized management systems. Application of blockchain asks for wide participation and collaboration involving parties in the food chain which is important to play its full role in future.

1. Introduction

Food is the major part in human beings lives and in human societies all over the world. Hence the food and agriculture sectors are considered to be employing major part at a worldwide level. Due to the involvement of large number of stakeholders from different sectors, the agriculture supply chain management has been one of the most complex and challenging tasks. Hence to meet the present challenges, blockchain technology provides a problem-solving platform. In recent times, blockchain technology is attracting significant attentions in various industries precisely in financial sector. However, there is one such field that blockchain has potential to reshape; that is agriculture. A brief explanation of applications of blockchain in agriculture is shown in Figure 1. Further prospects of application of block chain technologies are highlighted at the end.

* *Corresponding author.* Tel.: +0-000-000-0000 ; fax: +0-000-000-0000.
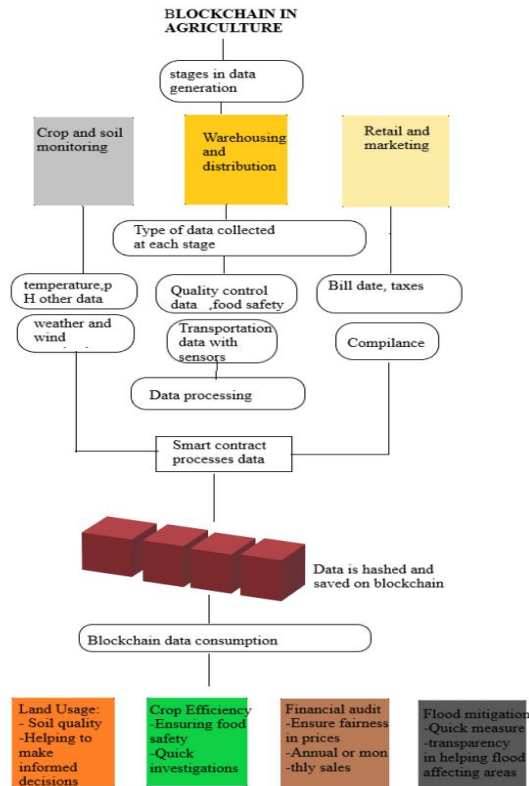E-mail address: author@institute.xxx

Figure 1. Applications of blockchain in agriculture

2. Literature Survey

Paper 1: Blockchain-Based Agri-Food Supply Chain: A Complete Solution

Authors: A. Shahid, A. Almogren, N. Javaid, F. A. Al-Zahrani, M. Zuair and M. Alam

Description: Supply chains are becoming into automated and extremely complicated networks, and they are becoming an increasingly important source of potential advantages in today's environment. This paper also includes

smart contract simulations and evaluations, as well as security and vulnerability analysis.

Paper 2: Blockchain-Based Soybean Traceability in Agricultural Supply Chain

Authors: K. Salah, N. Nizamuddin, R. Jayaraman and M. Omar.

The globalization of agriculture production and distribution has refocused attention on the safety, quality, and validation of numerous key criteria in agriculture and food supply chains. Blockchain is a disruptive technology that has the potential to deliver an innovative solution for agricultural and food supply chain product traceability.

Paper 3: Blockchain Technology for Transparency in Agri-Food Supply Chain: Use Cases, Limitations, and Future Directions

Authors: S. Menon and K. Jain

Description: Modern agri-food supply chains have evolved from autonomous and independent local actors to a worldwide interconnected system of multi-actors linked by complicated relationships, influencing how food is produced, processed, transported, and delivered to end consumers.

Paper 4: Blockchain Technology in Current Agricultural Systems: From Techniques to Applications

Author: W. Lin et al.

Description: This paper describes that looked into both the methodologies and applications of blockchain technology in agriculture. The technical features, such as data structure, cryptographic algorithms, and consensus procedures, are first thoroughly explained. Second, to demonstrate the usage of blockchain techniques, existing agricultural blockchain applications are categorized and assessed. Finally, we highlight the fundamental challenges that many future agricultural systems face, as well as the attempts and potential solutions that have been made to address these issues. Furthermore, as a demonstration of

how blockchain technology can be used effectively, we execute an enhanced food supply chain in the post-COVID-19 pandemic economy.

3. Problem Statement

This paper elaborates the major challenges faced by the agriculture industry namely, the food production and food supply chain. The main aim is to reduce the poor-quality goods and unreliable distribution using proper labelling and tracking.

4. Existing System

All existing techniques were using centralized server (single main server) to store data and if this server hack by malicious users then they can easily alter data on that servers

User's may get wrong or fake data and there is no proper software to detect that alteration and to overcome from this problem Blockchain technology has been introduced.

Blockchain support decentralized (data stores at multiple nodes) storage and each node will store data as block of transaction by associating each block with hash code and whenever new data arrive for storage then all nodes will verify hash code of existing blocks and if all nodes contains same hash code then data will be consider as secured and unaltered and then new block will be added. If any node report incorrect hash code then that node consider as attacked and then collect data from genuine nodes.

5. Architecture

IoT- Grounded Agriculture Protocol for the Smart Model

IoT bumps are ideal for cluster granges because they consume lower energy than WSN and can be further reduced through an effective clustering protocol. Thus, this exploration proposed a new clustering protocol IOT- grounded husbandry, as shown in Figure 2, grounded on the LEACH protocol, to reduce energy consumption and extend network life.
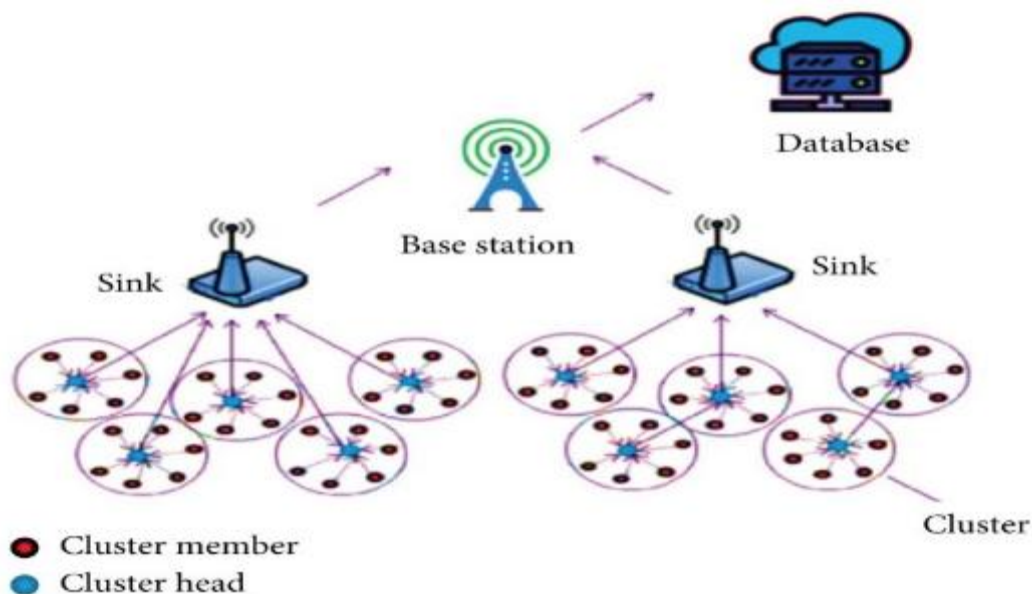

Figure 2. IOT Protocol for the smart model

6. Implementation

The In this paper we are using IOT network and Blockchain security technology in agriculture food supply chain. In propose work IOT network will be setup in agriculture farms and this IOT will sense food quality growing farms and then report to its nearest cluster head and cluster head will report to base station. Base station will collect food quality data from Cluster Head and then store that data in decentralized Blockchain nodes. This data can be access by various users such as distributors, suppliers, farmers and consumers to know the quality of the food.

All existing techniques were using centralized server (single main server) to store data and if this server hack by malicious users then they can easily alter data on that servers and user's may get wrong or fake data and there is no proper software to detect that alteration and to overcome from this problem Blockchain technology has been introduced. Blockchain support decentralized (data stores at multiple nodes) storage and each node will store data as block of transaction by associating each block with hash code and whenever new data arrive for storage then all nodes will verify hash code of existing blocks and if all nodes contains same hash code then data will be consider as secured and unaltered and then new block will be added. If any node report incorrect hash code then that node consider as attacked and then collect data from genuine nodes. Above verification of hash code is consider as PROOF OF WORK.

Above Blockchain technology helps in detecting attack nodes and make data secured.

In propose work we are using IOT networks and this IOT network consists of following operations

1) Generate Network: using this module IOT network will get setup
2) Cluster Head Selection: all IOT networks exchange there available battery power and then check which IOT covering more number of nodes and can reached to base station with less energy consumption then that node will be elected as cluster head.
3) Collect Data: using this module IOT will collect/sense food data from agriculture farm.
4) Data Transmission Routing Phase: using this module IOT will find shortest path to reached cluster head and then transfer data to selected cluster head. CH will send data to base station. Base station will collect data and then store in Blockchain node. Blockchain store each data as block of transaction and will generate hash code for verification
5) View Blockchain Data: various users such as consumer, farmers, distributors and many more users may use this module to retrieve data from Blockchain and view it.

Result:

To run this application double click on 'run.bat' file to get below screen
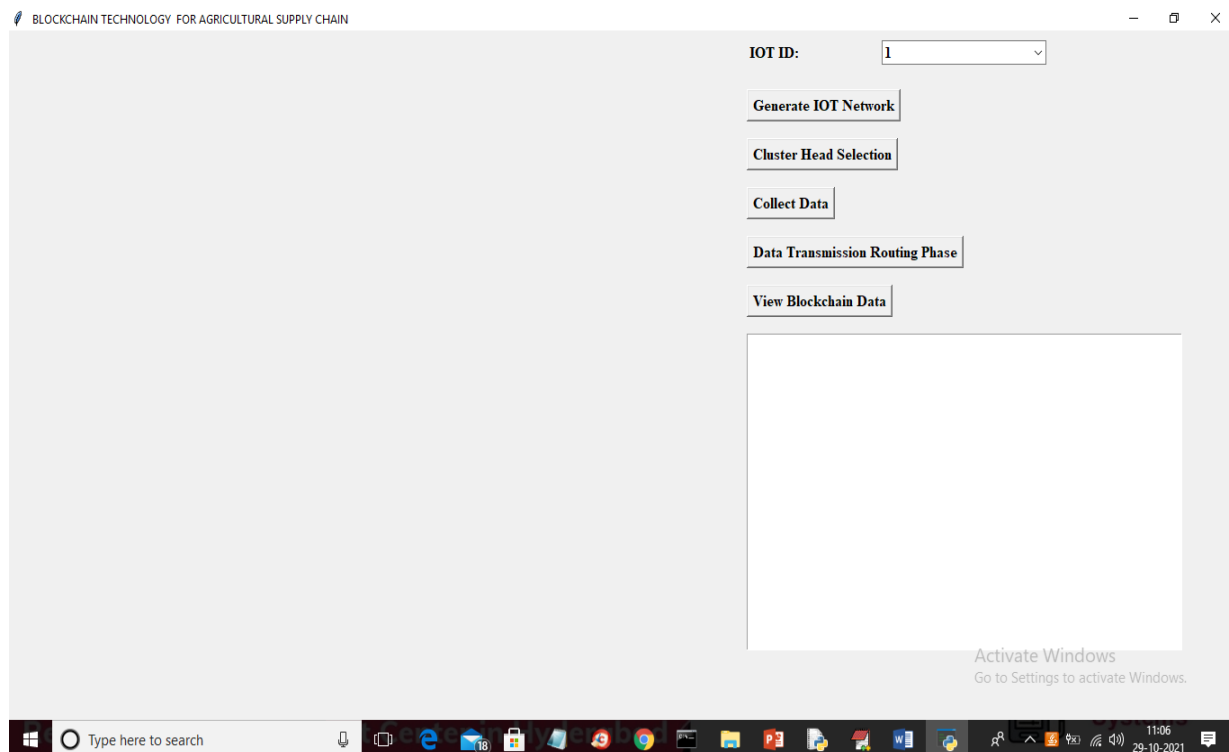
In above screen click on 'Generate IOT Network' button to generate IOT simulation network and to get below screen
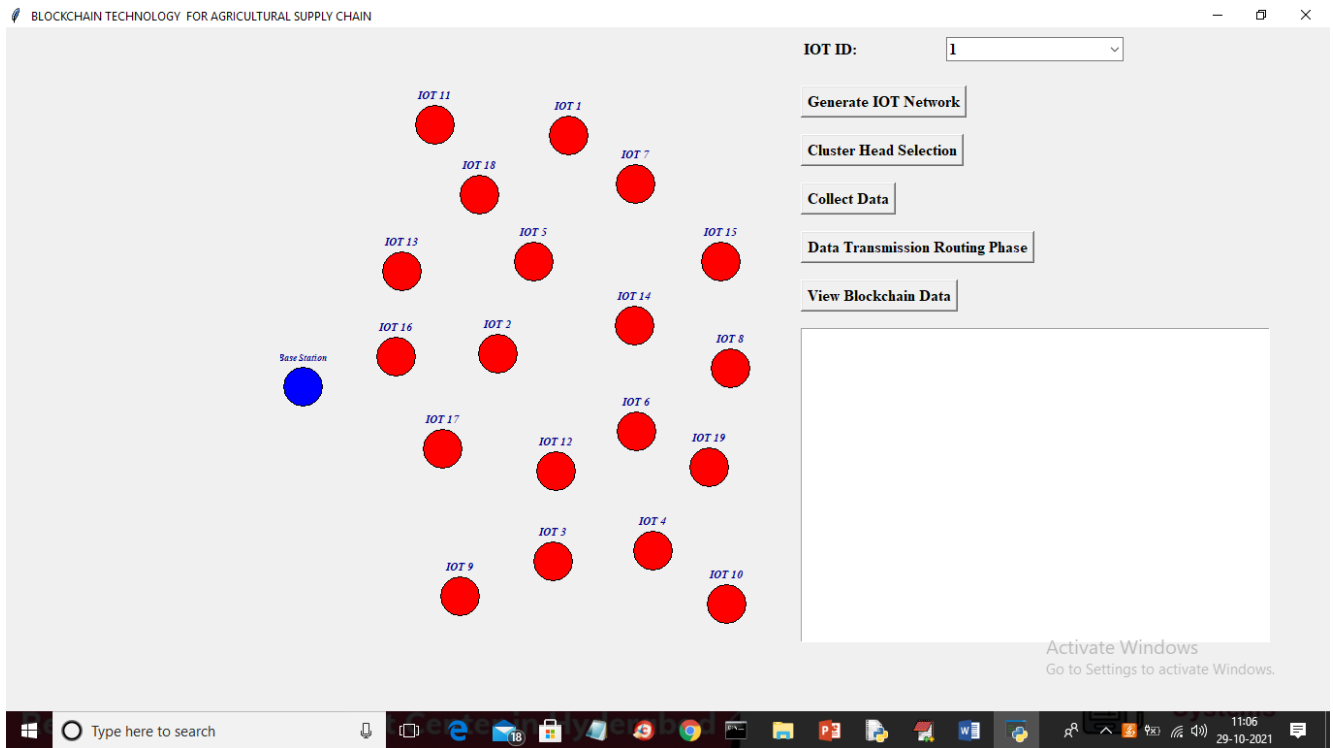
In above screen each red colour circle represents as IOT sensors installed in agriculture farms and blue colour circle represents Base Station. Now click on 'Cluster Head Selection' button to select cluster head with high available energy and can reach to more IOT with less distance to Base station.
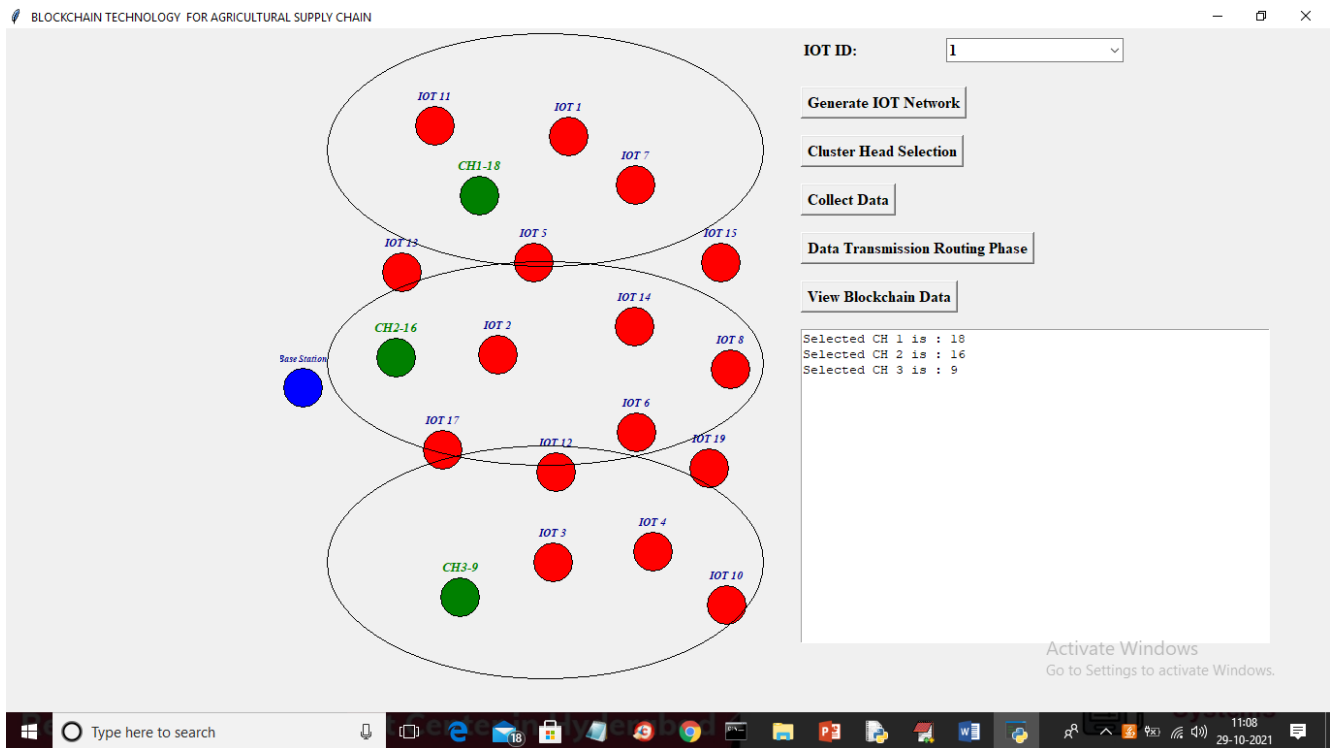

In above screen green colour IOT is selected as Cluster Head and all the IOT inside big oval will be consider as cluster member of that cluster and total 3 clusters are generated and now click on 'Collect Data' to enter some manual data as we don't have any sensor to sense data so we collect data from keyboard manually.
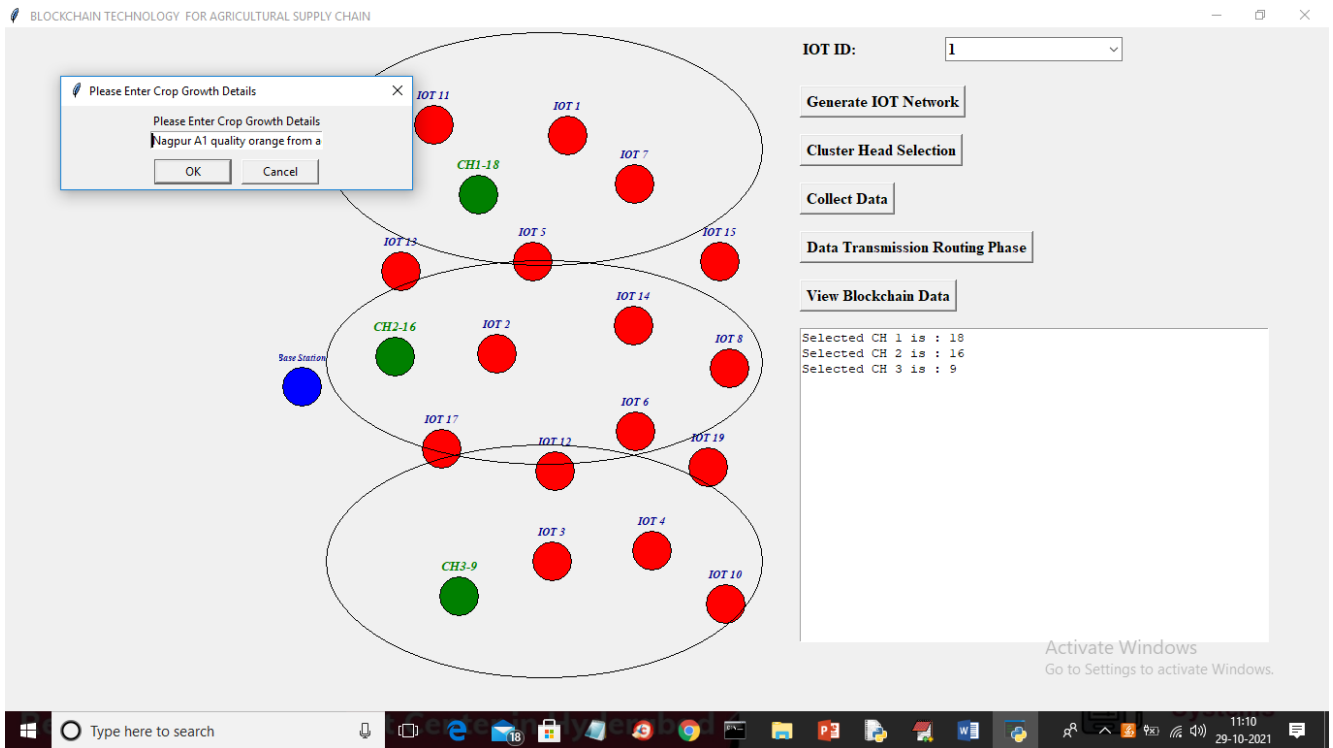
In above screen as data collection I entered some data and then click on 'OK' button to get below screen
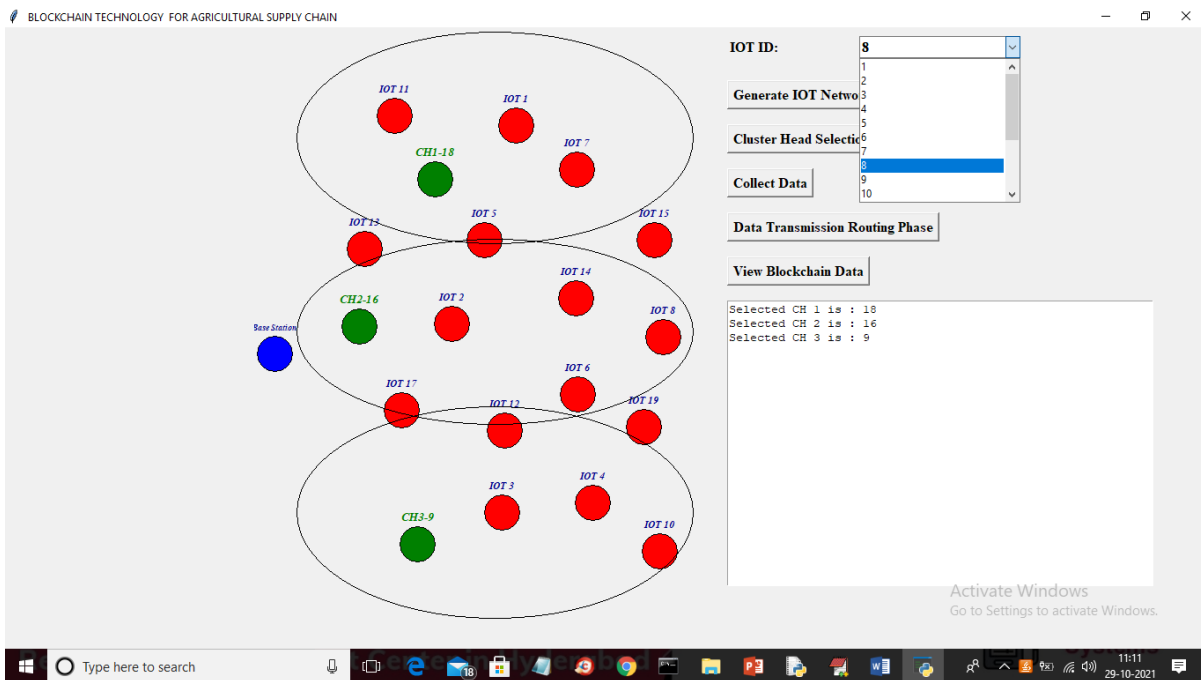
In above screen from IOT drop down box I selected sender IOT as 8 and then click on 'Data Transmission Routing Phase' button to allow IOT 8 to select shortest path to reached cluster head and then transfer data.
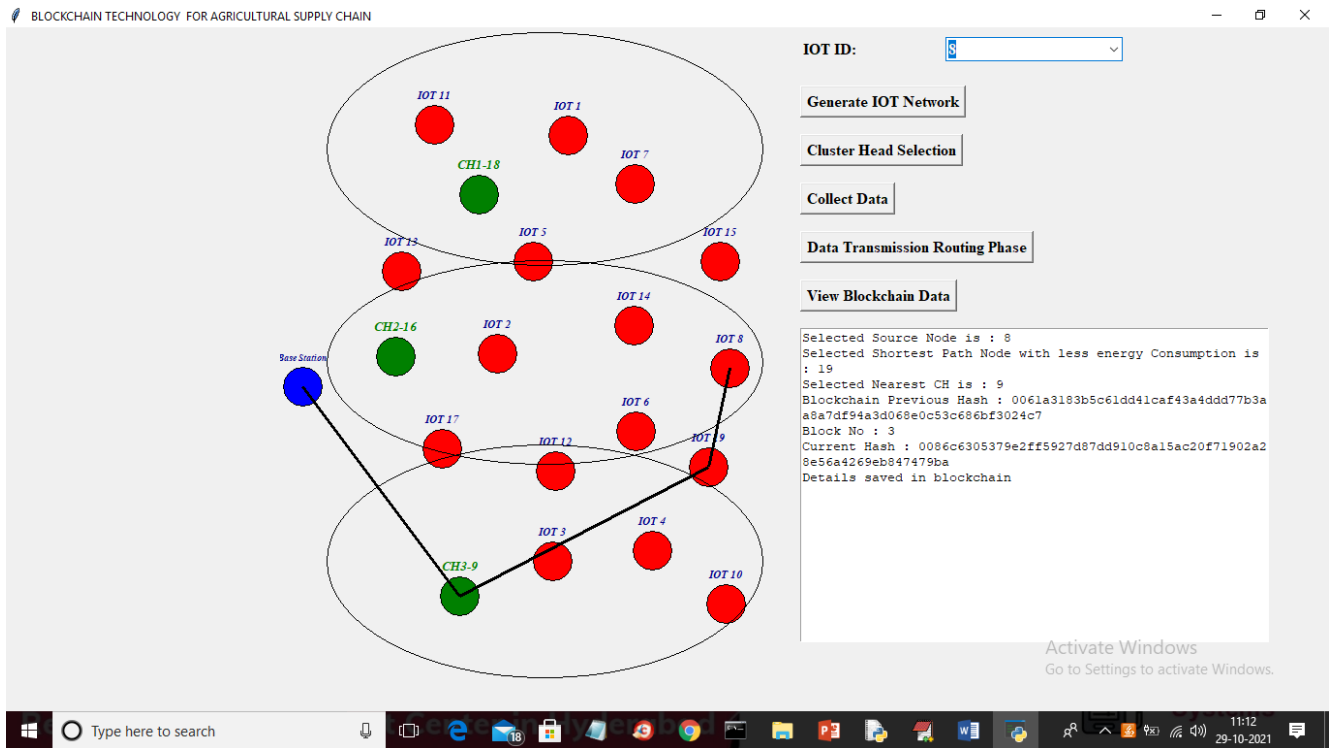
In above screen IOT 8 selected nearest hop as 9 and that 9 belongs to CH3 so it send data to CH3 and CH3 is sending data to base station and similarly you can select any IOT and then transfer data.
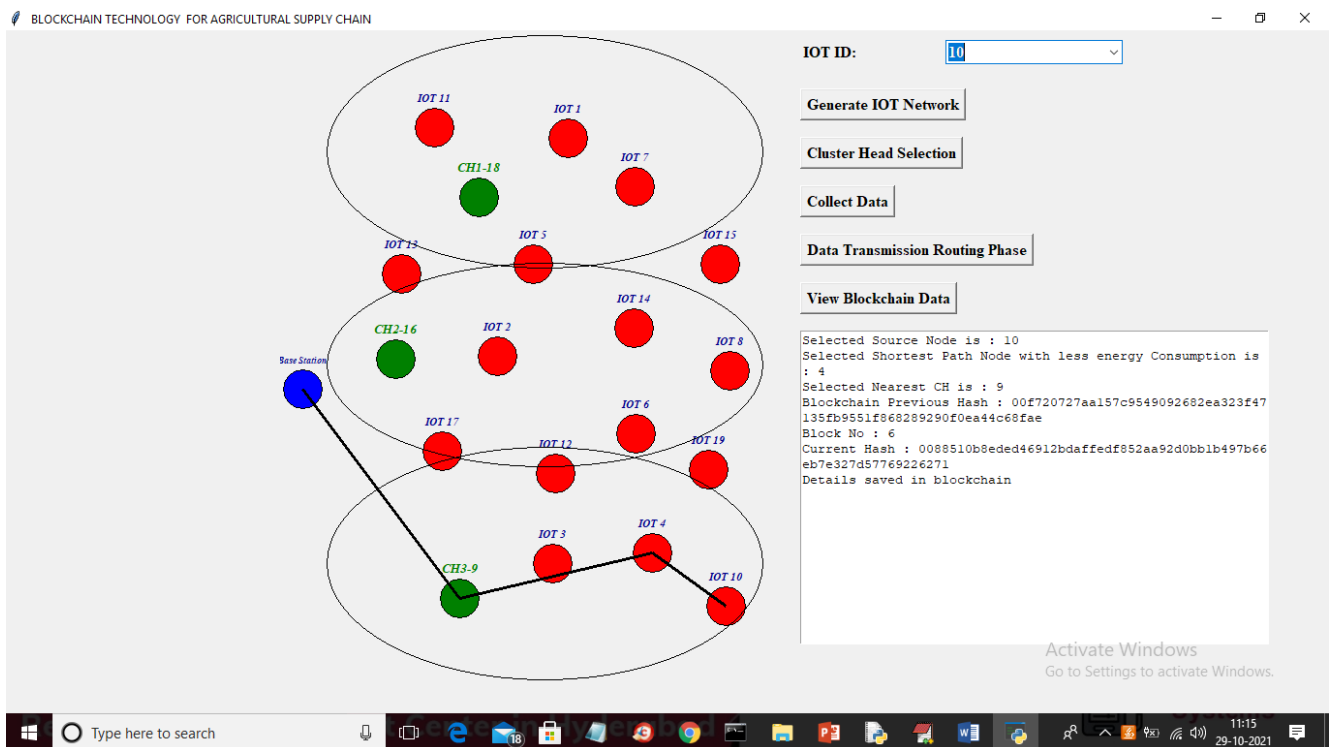
In above screen I selected IOT 10 and then it select CH 3 to send data to base station and in above screen we can see each data is stored at Blockchain and each block associated hash code is also displaying and now select any IOT and click on 'View Blockchain Data' to extract data from Blockchain for selected ID

In above screen I selected IOT as 1 and then clicked on 'View Blockchain Data' button and then in text area all data for that IOT retrieve from Blockchain and then displaying and I am displaying hash code of that block.

7. Conclusion

Above Blockchain technology helps in detecting attack nodes and make data secured. In propose work we are using IOT networks and this IOT network implemented following operations successfully,

1. Generate Network
2. Cluster Head Selection
3. Collect Data
4. Data Transmission Routing Phase
5. View Blockchain Data

In this paper we have used IOT sensors and agriculture field but we don't have any sensors so we built this concept as simulation and analysed successfully

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