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A Study of Blockchain Technology in Farmer's Portal

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***Abstract*—Blockchain is a method in which a confirmation of a transaction is kept by means of a crypto-currency. The record is maintained transversely, linking several computers in a peer to peer network. Contracts, transactions, and the records of them define the economic system of a country. They set boundaries and provide security to the assets. Considering the features of blockchain such as immutability and maintaining the footage of transaction details, this paper highlights the usage of blockchain technology with farmer's portal that keep the footage of selling and buying information of crops. The proposed solution uses the python as a programming language in integration with the blockchain system that will benefit the farmers or vendors and individuals by preserving the contract of trade. An interface for the farmers is designed using a python programming language in addition with blockchain technology, which is used to store the information related to seller, buyer, selling and buying an item and total value transacted.**

Keywords— Blockchain, Digitization, Crypto-currency, Immutability, Public-ledger, ICT, Farmer's Portal

I. INTRODUCTION

Blockchain [1] an open, disseminated and decentralized ledger that evidences transactions involving two parties capably in a confirmable and stable way (Iansiti, Lakhani 2017). In the above given definition, open means the blockchain is accessible to one and all, disseminated means that there is no single party control and decentralized means there is no central third party available, capable means it is fast and more scalable than the conventional technologies, confirmable means that everyone can check the validity of the information and stable means that the data is nearly immutable that is it is nearly impossible to change or tamper the data or information. They verify and validate the identities and chronological events. They guide every action, transactions that have taken place among individuals, communities, organizations and nations as well. In this era of digitization, the way maintained and regulated these type of data must be changed, it must be highly secure and the blockchain is the solution to this.

In the era of information and communication technology, a farmer's portal has always been helpful for farmers in many ways, providing ease of use and convenience of information to the farmers [1]. The Government of India has also taken many initiatives for the same. Few examples of such portals are *Krishijagran.com, farmer.gov.in, agricoop.nic.in* and *agriwatch.com* etc. Apart from these some E-commerce websites are also available; *fert.nic.in* and *enam.gov.in* etc. The sectors currently using blockchain are shown in Fig.1. Using blockchain technology in the field can make available decentralized computation and information sharing platform that enables multiple authoritative domains, which do not trust each other, to cooperate, coordinate and collaborate in a rational decision-making process, a reliable information recording system can be made that can contribute for the development in the

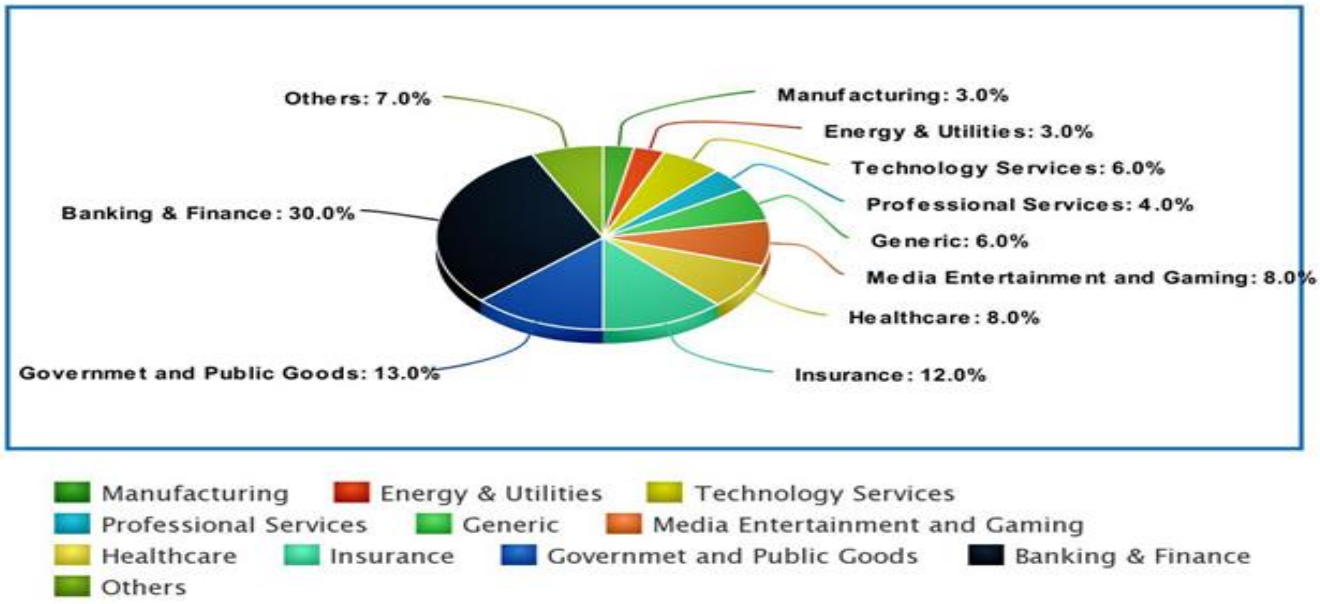

Fig. 1 Sectors Using Blockchain [2]

agriculture sector. Since blockchain works like a public-ledger, so it can be utilized to ensure many different aspects such as [3]:

- **Protocols for Commitment**: Ensure that every valid transaction from the clients are committed and included in the blockchain within a finite time.
- **Consensus**: Ensure that the local copies are consistent and updated.
- **Security**: The data needs to be tamper-proof. Note that the client may act maliciously or can be compromised.
- **Privacy and Authenticity**: The data or transactions belong to various clients; privacy and authenticity need to be ensured.

Cryptography is a foremost part of the functioning of blockchain technology [4]. Public key encryption is the root of blockchain wallets and transaction, cryptography hash functions endow with the trait of immutability and merle trees systematize transactions while enabling blockchain to be more competent.

Ensuring the above aspects numerous work has been carried out in the field of blockchain. The presented portal is a contribution over them. It can help to maintain a secure platform for farmers, where they can trade with the customers electronically. The main objective of this study is to record the secure transactions between a seller and a buyer that ensures a contract between the two. This can help farmers to get a legitimate price for their commodity. The system also facilitates a single place to record the whole trade transaction.

The rest of the paper has been organized as follows: Section II presents the related works with their limitations. The proposed work is explained in Section III. Section IV shows the implementation of the proposed methodology and Section V concludes the paper.

II. Related Work

Farmers, as well as agriculture, are the foundation of life. Numerous work has been done towards the enhancement of agriculture by developing technologies that support directly and indirectly to agriculture. A range of research shows that with the various enhancements in the field of ICT, the farmers are unable to take its advantage and fail to get the proper sale value for their crops.

Gosh et al. [5] has designed an interface that benefited the farmers by providing the information related to the advancement of agriculture techniques; farmers can interact with the system by means of text and speech as an input. The approach was the first rate in terms of providing the interface to the farmers.

Manav et al. [6] proposed an android based mobile application that would take care of updating the farmers regarding agricultural products, weather forecasts, and agricultural news. However, the system was good in providing the instant update to the farmer but the version was only in the English language, which was the limitation of the system.

Jason [7] has discussed various technical approaches made in agriculture, mostly in the field of food and supply chain management. The incorporation of blockchain technology in agriculture has improved the efficiency of the agriculture supply chain by reducing the need for verification of data. However, the technology proposed benefited only the producers in terms of maintaining the accuracy of data for supply.

Jing Hua et al. [8] has used blockchain technology and proposed an agricultural tracing system that is decentralized, maintained collectively and provides trust and reliability in case of supply chain management. The system proposed is beneficial for producers in terms of safeguarding the data of production and supply that is immutable.

III. Proposed Work

The Proposed Farmer's portal is a single gateway through which the e-commerce activity of crops can be performed. The users' experience of the portal can be tailored according to the individual need. It is a single access point i.e., everything is in a single place, the only thing needed is single login to approved users.

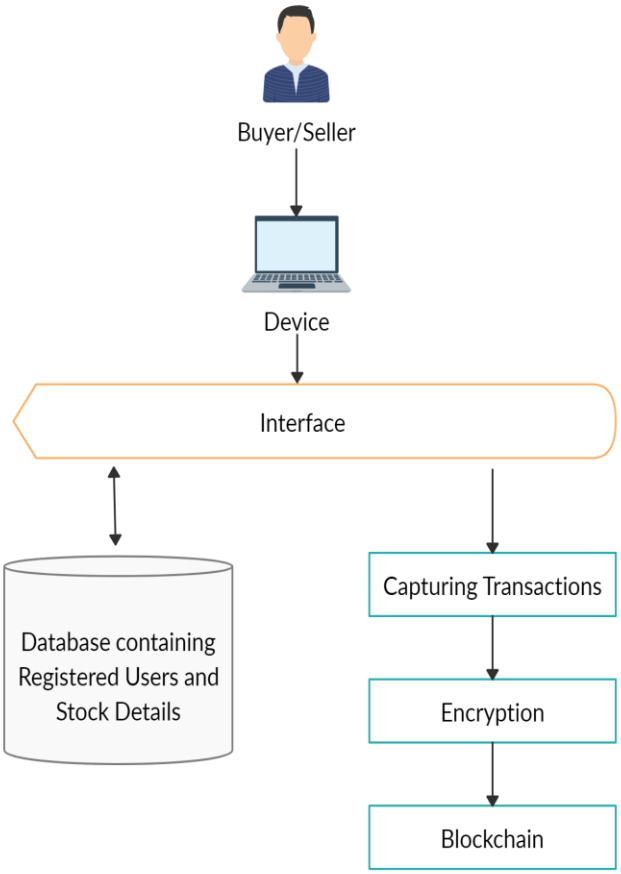

Fig. 2 Block Diagram of Proposed Work

The block diagram of the proposed work is shown in Fig.2. It explains the high-level working of the farmer's portal.

User: A user can be a buyer or a seller. The seller may be a farmer or a representative of him.

Device: The user can interact through the portal using a computer or a laptop.

Interface: To access the portal, the user needs to register using a sign-up. The registered user logins using the correct credentials. Once the user signs in successfully. The user will have access to the portal/ interface. A user can view available items that are crops and seeds with their price.

Buyer: The buyer can buy a product and can search for any product according to the requirement. They can add the product in cart and update the cart. After finalizing the product to buy and verifying the cart user can check out.

Seller: The seller can add a new item, update the existing items, allot and update the price of the item. It will increase the market reach and will also eliminate the middleman.

Database: The record of the registered user is stored. The added and updated items are stored in it.

Capturing Transaction, Encryption and Blockchain: Every activity related to introducing a new item and purchasing an item is considered as a transaction and is added to the blockchain accordingly with the correct unique digital signature and timestamp so that any user cannot deny the activity done by them.

All these transactions are visible to everyone in the network. The blockchain is a peer to peer transaction based on distributed node systems by means of data encryption, time stamping and consensus [9]. It makes the portal more secure at the data as it is immutable, transparent and accessible to all.

The security of the blockchain is maintained in the way that the transactions are bundled together to form a block that has a unique ID [10]. The data in it is made tamper-proof by using a cryptographic hash function and adding a digital fingerprint to the block. Each block has its hash value and the hash value of the previous block which makes it the chain of blocks, then proof of work is also added as a constraint in the hash value to make it a cumbersome process for the user to mine a block in the chain. The blockchain implements hash functions. If someone tries to alter the data in the blockchain, he has to do the following things, first has to calculate all the hash values once again, second, he has to do the corresponding proof of work and third he has to take the influence on at least 51 percent of the nodes in the network. And these three things are nearly impossible to be done simultaneously. The larger the network, the more temper resistance it will be.

The retrieval of a particular transaction of interest in future from the storage is one of the most important characteristics as this functionality will help the user to have the chronological ledger of everything done in the past. In our system, a simple generic blockchain is implemented which keeps the record of a transaction for an active session only because it is stored in a local system but when a deployable blockchain will be used and the storage may be on a cloud it can retrieve any data from the generic block to the last block which has been added to the blockchain. This ultimate ledger of the transaction will be transparent to every node in the network and it can also help us in tracking and tracing any information or data related to the items in the portal.

A. ADVANTAGES OF THE PROPOSED WORK

- It is enhancing the degree of participation, reducing the intermediation cost; many farmers experience difficulty when they try to sell their product at a fair price, the portal helps the farmers to reach the market without taking any extra help from the middlemen.
- The portal stores all the information at a single place so it can be easily accessed by those who need it and hence simplifying the entire process and solving the time and energy.
- The use of blockchain ensures greater efficiency, trust, accessibility and transparency from farm to groceries. It will benefit users with more options and get competitive returns.
- Improved level of customer interaction, customer and business loyalty will ensure increased workflow, smarter decision making and increased productivity.

IV. IMPLEMENTATION

An uncomplicated shopping gateway is developed using Python language for the backend and HTML, CSS, JS for frontend fraction. The component used for backend development is Flask which is a micro web framework for web applications written in python.

The build system has two types of relation i.e. Buyer relation and Seller relation; Buyer can search and buy the accessible commodities. The seller can post or add commodities. The blockchain is introduced at two points, one at the time of updating the item in the system and another at the time of completion of the transaction. When a farmer adds his crop details on the portal to sell, a transaction is added on the blockchain containing information about the items and seller details. On the other hand when a buyer purchases an available item the transaction is added on blockchain including item and buyer details.

As the merchandise like crop has a low shelf life, so it's troublesome to return and resell the item. So, in the sequence to evade the loss that can be caused to the farmer and individual a contract is ensured between them using blockchain at the entry and end of the transaction. The added blockchain will save the digital footage of the details of item added, item sold, item purchased and seller as well as buyer that is immutable and tamper-proof; ensures that no one can disagree with the contract to sell and buy the commodity which they have confirmed.

For this application to be built modules of python have been used in it.

- **flask** – It is a micro-web framework for the backend of web applications written in python. In this work, it is used to develop the backend of a portal using its functionalities namely Routing, Rendering of Templates, Framing Redirects, and Building Sessions etc. Flask is based on Jinja2 for template and Werkzeug for WSGI toolkit. It is easy to use and an efficient framework to use in applications like e-commerce or trade portal.
- **SQLAlchemy** – It is a Python SQL Tool Pack which provides ease and flexibility of using SQL round the application. In this portal, it is used to integrate SQL to Web applications directly and perform required operations.
- **hashlib** – It is a module responsible for giving an interface to programs for many of the hashing and message digest algorithms such as SHA1, SHA224, SHA256, SHA384, SHA512 and RSA MD5. Suma V. [11] has made a comparison for Average time (ms) and average cost (%) for blockchain with RSA-DS and blockchain without RSA-DS. The author has found that

a blockchain with RSA-DS is efficient. However, the RSA-DS does not contain any hashing, so to make it more secure SHA2 is recommended since it provides better security [12]. The proposed system uses SHA256. It is used to generate a hash of the block containing index, transaction, timestamp, previous_hash and nounce.

- **json** – It is a light-weighted data interchange format which is used to request data in JSON format.
- **Time** – This module is equipped with functions associated with time. In our work, it has been used to capture the juncture on which the transaction is being succeeded.
- **os** – This module equips functionality which is dependent on the operating system. In our work, it is used for defining system paths, Directories etc.

The application is present in the master directory which has sub-directories and some important files to drive the application. The master directory contains a sub-directory namely "app" and files to drive the web application and deploy the blockchain. Coming to the sub-directory "app", have eight sub-directories namely cart, items, notifications, reviews, static, tags, templates, users which are the main necessary classes.

All the eight sub-directories consist of files which are used to declare and control the methods and variables needed to drive the web app. These files control all the activities and interferences of that particular entity and contain the declaration of the particular attributes of that entity.

In a sequence to this, a file to implement and deploy a blockchain in the master directory is made which is responsible for Storing transactions into blocks that attach digital footprints to the blockchain that provides proof of work algorithm. This local blockchain has been integrated to run on port localhost: 8000 with the main app running on port localhost: 5000.

Before running the flask application, blockchain is deployed and runs on localhost: 8000 for capturing transactions of Buying and selling to ensure it's ready for operation. Finally, the main flask app is run on localhost: 5000 and loaded in the browser.

The pseudo-code of application for the juncture at which footage is recorded when a commodity is added to the system:

START

Function AddItems:

    If user not authenticated seller:

        Return "Login with seller account"

    If HTTP request is POST:

        Input item details

        JsonPacket = {Name: Item Name, Quantity: Quantity of items Purchased, Buyer: Buyer Name, Price: Total Value of transaction};

        Add JsonPacket as a transaction to the blockchain

        Add item in a database

        Return to item table page

        END

The pseudo-code of application for the juncture at which footage is recorded when a commodity is purchased:

START

Function BuyItemsInCart:

    If HTTP request method is POST:

        Select all Items available in Cart

        Set flag to 0

        For item in cart:

            If item not in stock:

                Set flag to 1

        If flag is 1:

            Return "Item Shortage"

        For item in cart:

            JsonPacket = {Name: Item Name, Quantity: Quantity of items Purchased, Buyer: Buyer Name, Price: Total Value of transaction};

            Add JsonPacket as a transaction to blockchain

            Update Item in stock

        Return "Thank you For Purchasing"

END

A. SCHEMATIC FLOW DIAGRAM OF PROPOSED WORK

Fig.3 Shows the Schematic Flow diagram of the proposed work. The diagram describes the portal functions. First, the user needs to register and login as a buyer or a seller. Depending on these two use cases the portal displays the home page of the portal. If one is a buyer then can browse item, search item, view item, add an item, view cart and update cart and then purchase the item. And if the other a seller than can alter the quantity of the item by adding an item, deleting item updating item and then the item can be sold. The transactions are added to the blockchain at two instances, once when an item is purchased and the second when the item is sold. And then the user terminates the session by logging off through the interface.

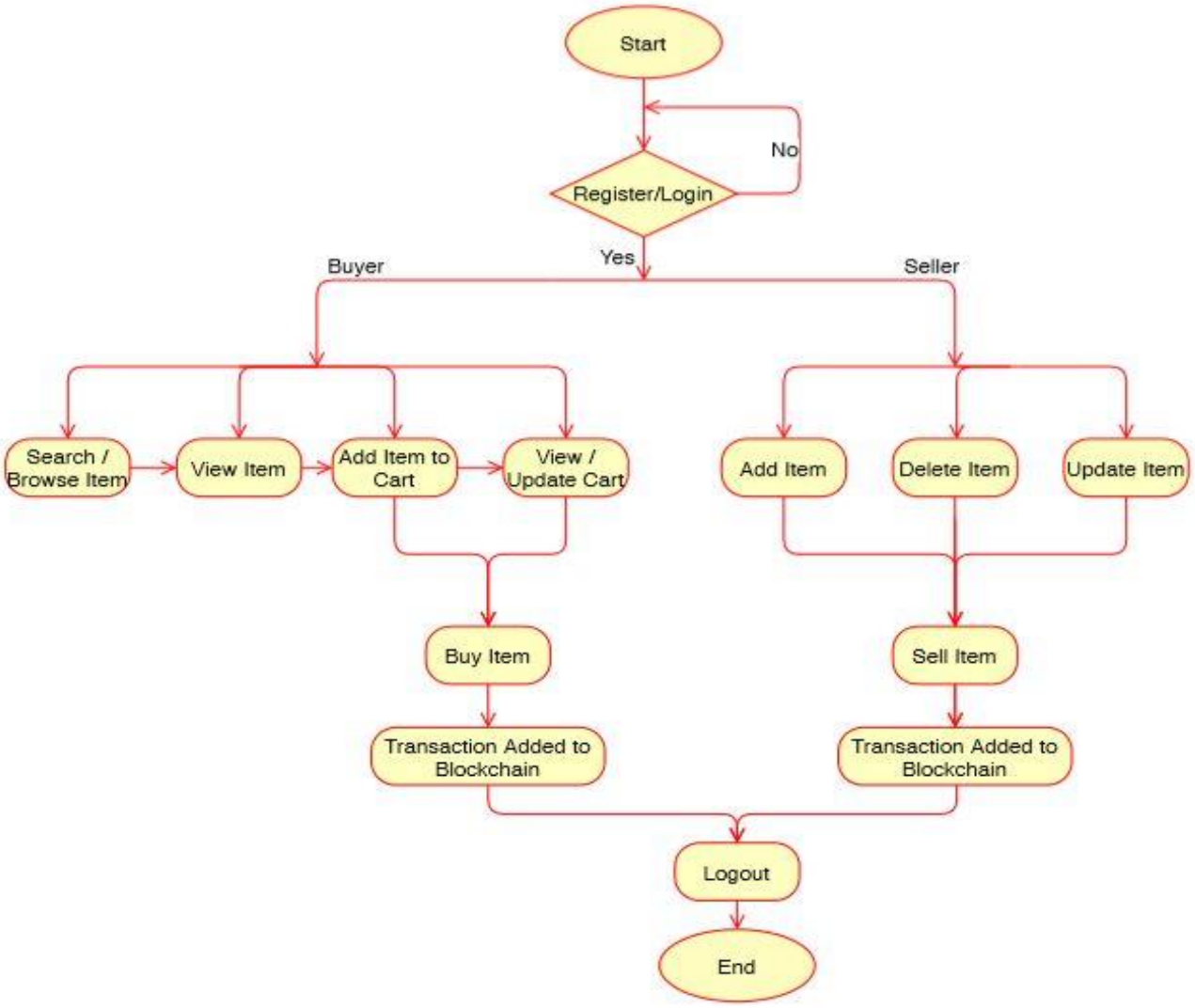

Fig. 3 Schematic Flow Diagram

V. CONCLUSION AND FUTURE SCOPE

Blockchain Technology in the field of agriculture can bring a revolutionary enhancement in the area of maintaining farmers data securely, ensuring the quality of seed, monitoring of moisture content in the soil, data of crop yield and lastly demand and sale price of crops. In this work, a blockchain-based portal is proposed to deal with the issue of demand and sale price of crops which in result ensure crop security to farmers as well as to get fair price of the crop. For this, a portal is proposed on which a farmer can register and sell his crops, recording a transaction on a blockchain at a point when buyers commit to buy a farmer's crop. This transaction is capable of recording crop details, the price at which it is committed to buying and quantity of crop purchased.

This immutable nature of blockchain technology will fortify farmers to get a legitimate price of crop and reduce the cost of operation for selling and buying crops when compared to traditional methods.

Akin kind of portal can be implemented by the government and its confederate bureaus to ensure amelioration in the field of farming and commerce of crops which will improve the prominence of the nation's farmers.

This application can be more refined with increasing integration of blockchain in a spectrum of areas and constellating it into a single paramount portal for farmers. This can be done by putting farmer's crop details to the blockchain, buyer's data to the blockchain and adding more features and services to the single portal and bringing all possible facilities for farmers of the nation under sui generis awning.

Information integrity and precision issues can be solved using open, protected and trusted systems presumptuous; the infrastructure dispensation and footage connections are protected and suitably provided. The blockchain technology did not promise the information reliability in the footage. Thus realization in blockchain faces several boundaries that might require a vital authority or protected footage of confirmation.

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