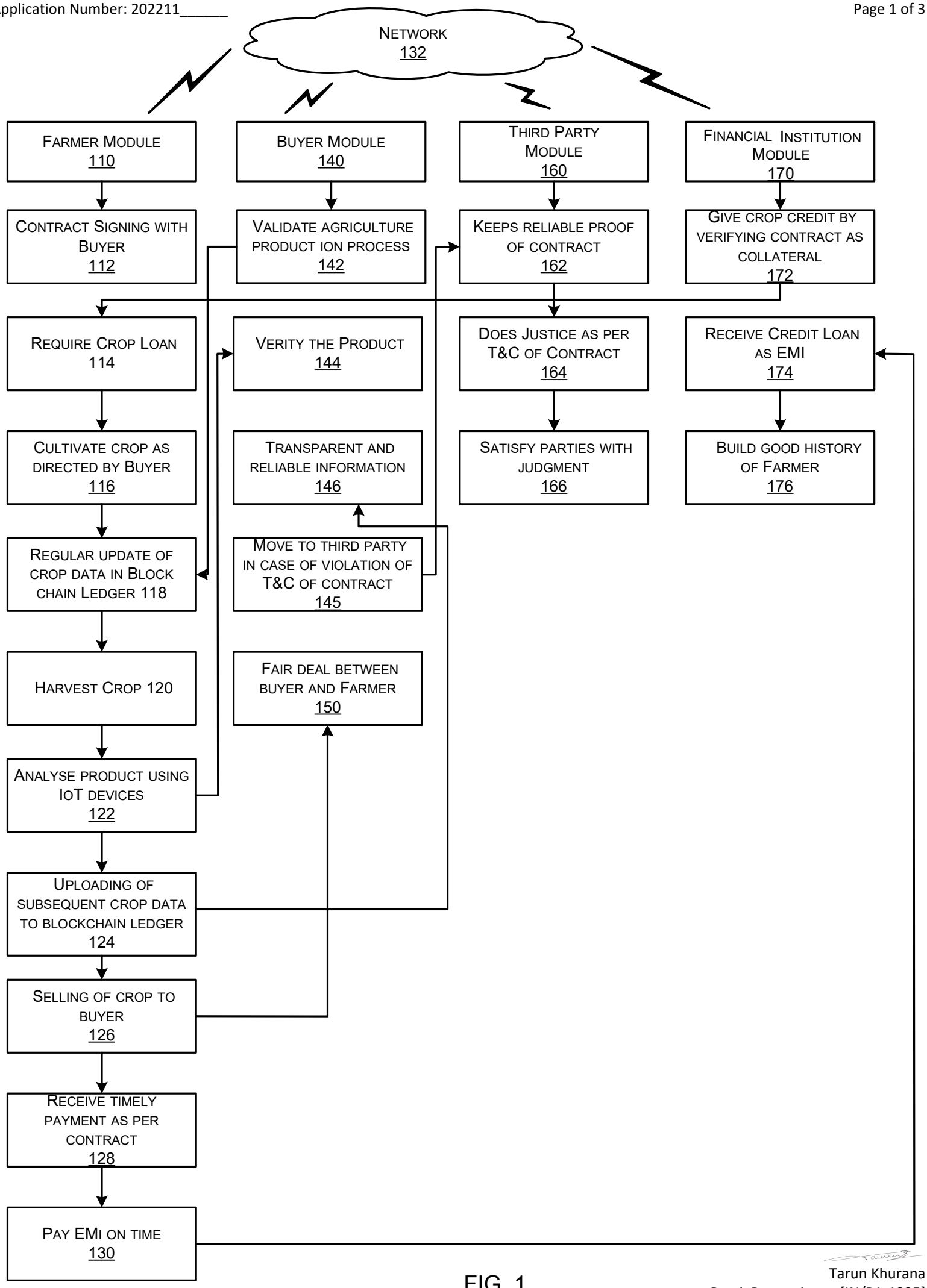


FIG. 1

Tarun Khurana
Regd. Patent Agent [IN/PA-1325]
Dated: 26th September, 2022

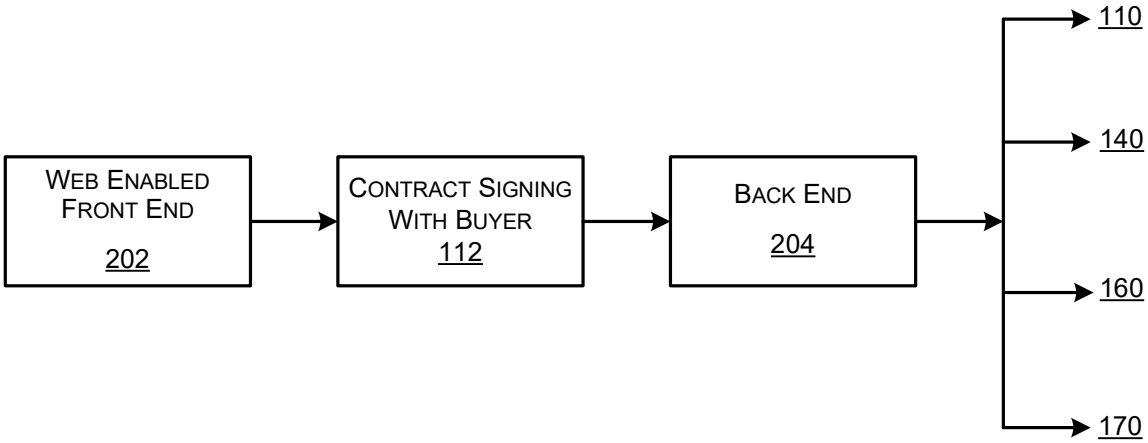


FIG. 2

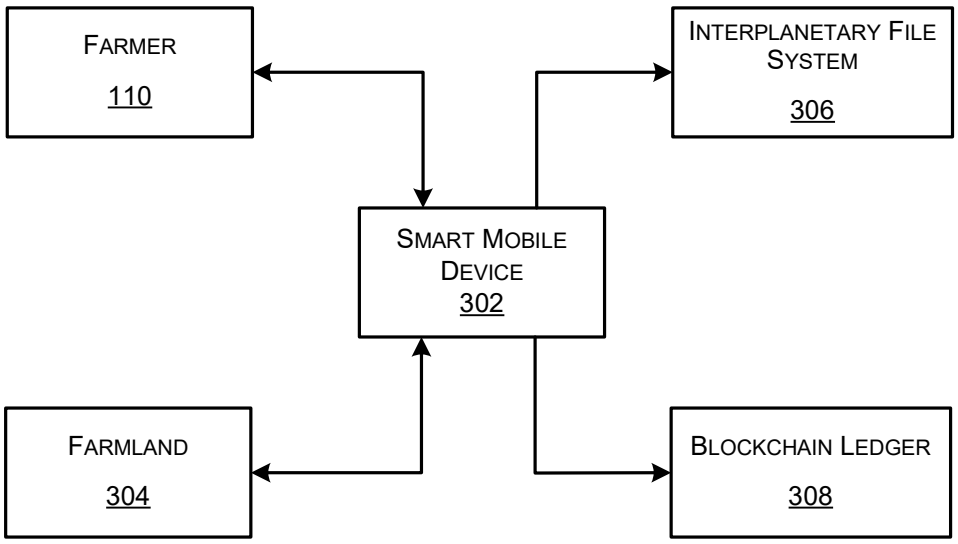


FIG. 3

Tarun Khurana
Regd. Patent Agent [IN/PA-1325]
Dated: 26th September, 2022

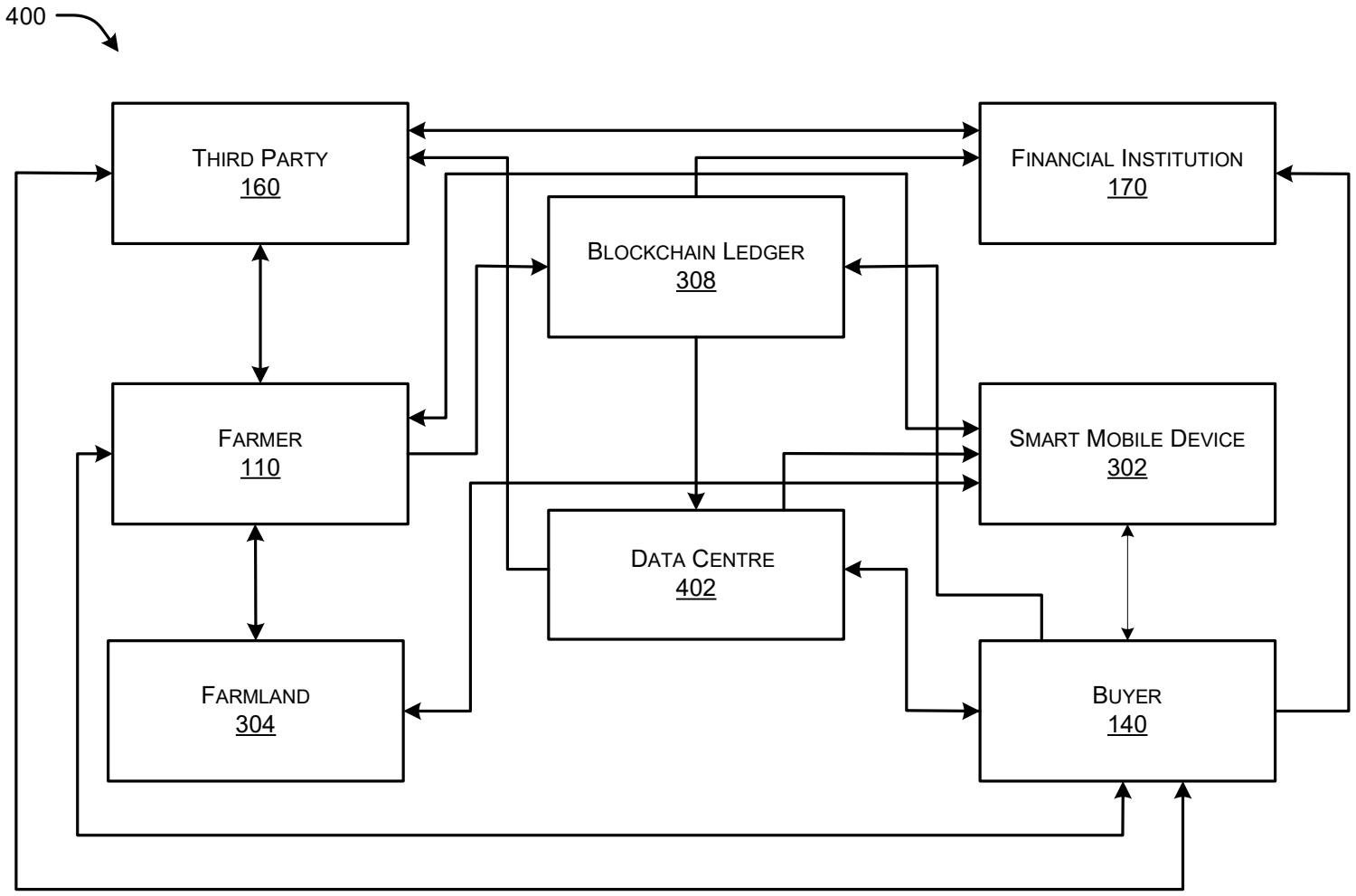


FIG. 4

Tarun Khurana
Regd. Patent Agent [IN/PA-1325]
Dated: 26th September, 2022

FORM 2

THE PATENTS ACT, 1970

(39 of 1970)

&

The Patent Rules, 2003

COMPLETE SPECIFICATION

(See sections 10 & rule 13)

1. TITLE OF THE INVENTION

BLOCKCHAIN-BASED SECURED SYSTEM FOR SMART CONTRACT FARMING

2. APPLICANT (S)

NAME	NATIONALITY	ADDRESS
Chitkara University	IN	Chitkara University, Chandigarh-Patiala National Highway, Village Jhansla, Rajpura, Punjab - 140401, India.
Chitkara Innovation Incubator Foundation	IN	SCO: 160-161, Sector - 9c, Madhya Marg, Chandigarh- 160009, India.

3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed.

TECHNICAL FIELD

[0001] The present invention relates generally to the field of agriculture. More particularly, the disclosure is a blockchain-based secured system of smart contract farming where a farmer and a buyer enter into a smart contract with the support of a legal and a financial institution to achieve profitable results.

BACKGROUND

[0002] Background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[0003] In conventional farming, particularly a small farmer is often trapped in a vicious cycle of low intensity, low yields, and insufficient profits to make beneficial investments. These factors contribute to high levels of poverty in many rural areas. Also, linking poor farmers to markets is one option to break this vicious cycle, but it requires overcoming various barriers and market imperfections. Hence, small farmers may face high risks while lacking the skills, technologies, and financial services to produce a marketable surplus or to supply the quality, quantity, and types of commodities demanded by buyers.

[0004] Over the past decade contract farming has emerged as an alternative institutional innovation in Indian agriculture to reduce the uncertainties faced by the farmers. The logic behind promoting contract farming is the expected increase in agricultural productivity, employment, and income for the farmer.

[0005] Contract farming is a pre-harvest agreement between the farmers and the buyers which is commonly understood as a useful tool to mitigate prevalent market failures and to reduce the risks facing by the farmers. Contract farming is not a new phenomenon in the rapid modernization of agricultural value chains in developing countries.

[0006] Many prior arts have come in the market providing different systems and the method for contract farming but some limitations and shortcomings of the systems have been felt by the farmers. Efforts have been made to provide such

solutions but absence of a legal framework to resolve the disputes and faster disbursement of the finance at initial stages as well as after selling the crops to the buyers. Transparency, tracking and tracing, as well as other difficulties such as lower crop prices, a lack of quality inputs, a delay in crop payment, farmers and contractors violating terms and conditions, and a lack of finance for crop production

[0007] Hence, to overcome the drawbacks, limitations, and shortcomings associated with the existing systems of contract farming and to mitigate problems related to transparency, tracking and tracing, delay in crop payment, farmers and contractors violating terms and conditions, and a lack of finance for crop production, the present invention has been disclosed.

OBJECTS

[0008] Some of the objectives of the present invention, which at least one embodiment herein satisfies are listed herein below.

[0009] An object of the present disclosure is to provide a simple, secure, and faster blockchain-based system of smart contract farming.

[0010] Another object of the present disclosure is to provide a programmable short contract with complete transparency in the system.

[0011] Another object of the present disclosure is to provide a system where all records are individually encrypted to make the system secure.

[0012] Yet another object of the present disclosure to provide the system with a transaction timestamp is recorded on a block and all records are irreversible, validated, and cannot be altered.

SUMMARY

[0013] This summary is provided to introduce simplified concepts of a system for the time-bound availability check of an entity, which is further described below in the Detailed Description. This summary is not intended to identify key or essential features of the claimed subject matter, nor is it intended for use in determining/limiting the scope of the claimed subject matter.

[0014] The present invention relates generally to the field of agriculture. More particularly, the disclosure is a blockchain-based secured system for smart contract farming where a farmer and a buyer enter into a smart contract with the support of a legal and a financial institution to achieve profitable results.

[0015] An aspect of the present disclosure is a system of immutable payout to a farmer by a buyer in smart contract farming using a blockchain can include a plurality of nodes connected mutually in a network, a plurality of sensors configured in farmland to obtain time-based data packets to monitor irrigation and growth data, and a data centre.

[0016] In an aspect, the data centre is coupled with a memory stores instructions and is capable of facilitating the functionalities executable by one or more processors. The data centre is configured to generate at a first node from the plurality of nodes, a first private encryption key, and a second encryption key pair for another node from the plurality of nodes, and receive at one or more processors, a credit request initiated by the first node for a crop under smart contract farming to the one node from the plurality of nodes, wherein the credit request is digitally signed by the first node using the private encryption key.

[0017] In an aspect, the data centre further validates the credit request by authenticating the identity and credit score of the first node based upon the data ledger and digital signature upon the smart contract made between the farmer and a buyer and in response to the validation of the credit, adding, by the one or more processors, and crop credit record to a block, and when the block is cryptographically validated by at least one of the plurality of nodes, adding, by the one or more processors, the block to the blockchain, and operate a decentralized application configured with a decentralized network that combines a backend and a user interface on the front end.

[0018] In an aspect, the blockchain is maintained by a plurality of nodes comprises a farmer node, a buyer node, a third party node, and a financial institution node and a smart contract for the smart contract farming is made between a farmer node and a buyer node and is made available on the mobile devices held by both of them. The smart contract is in encrypted form and stored in the blockchain. The

farmer who needs credit for crop his credit request is validated by one or more processors based on the smart contract data and detected by at least one other node of the plurality of nodes.

[0019] In an aspect, the farmer node upload weather data, crop production data, and harvesting data captured through the plurality of sensors to the plurality of nodes to monitor the progress of the crop and all the crop-related data in the smart contract is stored in the data storage unit and is accessed by the plurality of nodes on demand. The plurality of sensors are moisture sensors, temperature sensors, and humidity sensors.

[0020] In an aspect, the system disputes are resolved by the third party nodes based on the smart contract and the smart contract is accessed by the plurality of nodes. The system is capable to add the blocks to the blockchain by transmitting the block to at least one node of the plurality of nodes and the blocks are identified with a hash value that shows at least a previous block including at least one additional smart contract is made between another farmer and the buyer.

[0021] In an aspect, a decentralized, immutable record also ensures that all nodes have equal access to information and contributes to the development of trust. The smart contracts increase mutual openness, traceability, and efficiency, allowing it to be more adaptable among the different nodes. The adoption of various IoT devices will add in the grading or analysis of farm produce.

[0022] Various objects, features, aspects, and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments, along with the accompanying drawing figures in which like numerals represent like components.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] The accompanying drawings are included to provide a further understanding of the present disclosure and are incorporated in and constitute a part of this specification. The drawings illustrate exemplary embodiments of the present disclosure and, together with the description, serve to explain the principles of the present disclosure.

[0024] In the figures, similar components and/or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label with a second label that distinguishes among the similar components. If only the first reference label is used in the specification, the description is applicable to any one of the similar components having the same first reference label irrespective of the second reference label.

[0025] FIG. 1 illustrates an exemplary flow chart representation of the proposed bockchain based smart and secured solution for smart contract farming system, in accordance with an embodiment of the present disclosure.

[0026] FIG. 2 illustrate an exemplary block diagram of the working of the decentralized application (DApp) and the farmer interaction with DApp respectively.

[0027] FIG. 3 illustrates an exemplary block diagram with the interconnectivity in the role of the farmer with IPFS and block chain ledger in blockchain-based smart contract farming.

[0028] FIG. 4 illustrates an exemplary block diagram for the communication between the farmer and other nodes in the blockchain-based smart contract farming, in accordance with an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0029] The following is a detailed description of embodiments of the disclosure depicted in the accompanying drawings. The embodiments are in such detail as to clearly communicate the disclosure. However, the amount of detail offered is not intended to limit the anticipated variations of embodiments; on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present disclosure as defined by the appended claims.

[0030] Various terms as used herein are shown below. To the extent a term used in a claim is not defined below, it should be given the broadest definition persons in the pertinent art have given that term as reflected in printed publications and issued patents at the time of filing.

[0031] The present invention relates generally to the field of agriculture. More particularly, the disclosure is a blockchain-based secured system for smart contract farming where a farmer and a buyer enter into a smart contract with the support of a legal and a financial institution to achieve profitable results.

[0032] Embodiment of the present disclosure pertains to a system of immutable payout to a farmer by a buyer in smart contract farming in a blockchain can include a plurality of nodes connected mutually in a network, a plurality of sensors configured in farmland to obtain time-based data packets to monitor irrigation and growth data, and a data centre.

[0033] In an aspect, the data centre is coupled with a memory stores instructions and is capable of facilitating the functionalities executable by one or more processors. The data centre is configured to generate at a first node from the plurality of nodes, a first private encryption key, and a second encryption key pair for another node from the plurality of nodes, and receive at one or more processors, a credit request initiated by the first node for a crop under smart contract farming to the one node from the plurality of nodes, wherein the credit request is digitally signed by the first node using the private encryption key.

[0034] In an aspect, the data centre further validates the credit request by authenticating the identity and credit score of the first node based upon the data ledger and digital signature upon the smart contract made between the farmer and a buyer and in response to the validation of the credit, adding, by the one or more processors, and crop credit record to a block, and when the block is cryptographically validated by at least one of the plurality of nodes, adding, by the one or more processors, the block to the blockchain, and operate a decentralized application configured with a decentralized network that combines a backend and a user interface on the front end.

[0035] In an embodiment, the blockchain is maintained by a plurality of nodes comprises a farmer node, a buyer node, a third party node, and a financial institution node and a smart contract for the smart contract farming is made between a farmer node and a buyer node and is made available on the mobile devices held

by both of them. All the crop-related data in the smart contract is stored in the data storage unit and is accessed by the plurality of nodes on demand.

[0036] In an aspect, the system disputes are resolved by the third party nodes based on the smart contract and the smart contract is accessed by the plurality of nodes. The system is capable to add the blocks to the blockchain by transmitting the block to at least one node of the plurality of nodes and the blocks are identified with a hash value that shows at least a previous block including at least one additional smart contract is made between another farmer and the buyer.

[0037] Referring to FIG. 1 that shows the proposed blockchain-based smart and secured system 100 for smart contract farming. The blockchain system 100 is maintained by a plurality of nodes. The different nodes include a farmer module 110, a buyer module 140, a third party module 160, and a financial institution module 170. The smart contract for the smart contract farming is made between a farmer 110 and a buyer 140 forming nodes and is made available on the mobile devices held by nodes. As the finance is to be made available to the farmer 110 by the financial institution 170, and a trusted third party need to be involved in settling a dispute which can arise between these nodes, hence the third party node 160 is also included in the system 100.

[0038] In an embodiment, the farmer 110 will collaborate with the buyer 120 to create a smart smart contract 112 by signing terms and conditions that can be verified. The smart smart contract 112 will incorporate information such as farm product ownership, a predetermined price, sharing of crop data, decision on process of farming, payment terms and so on. The farmer 110 may then use a smart contract 112 to borrow agricultural credit 114 from financial institution 170. The financial institution 170 will verify the smart contract 112 and taking it as a collateral guarantee 172 will transfer the credit amount in a digital wallet opened with the farmer 110 using a smart mobile device and start seeding the farmland to cultivate crops 116 as per the agreed terms mentioned in the smart contract 112. The farmland is configured with moisture sensors, humidity sensors and temperature sensors to decide the irrigation of the farmland. The data are regularly updated those

are obtained 118 by the sensors and are given to the buyer node 140 and other nodes as per terms.

[0039] In an aspect, when the crop is ready 120, the farmer 110 obtained the yield and approaches the buyer 140 to purchase. The buyer 140 then, analyse the crop using smart devices 122 and subsequently, the crop data are uploaded to the ledger 124 to update. Thereafter, the buyer purchases crops 126 and the farmer 110 receives payment as decided in smart contract 128 and after getting payment, the farmer 110 pays the money taken by him as credit to the financial institution 170 in the form of equated monthly instalment 130 on time.

[0040] In an embodiment, the credit request 114 is digitally signed by the farmer 110 using the private encryption key, validate the credit request 114 by authenticating the identity and credit score of the farmer 110 based upon the data ledger and digital signature upon the smart contract 112 made between the farmer 110 and the buyer 140 and in response to the validation of the credit, adding, by the one or more processors, and crop credit record to a block, and when the block is cryptographically validated by at least one other node of the plurality of nodes, adding, by the one or more processors, add the block to the blockchain.

[0041] In an embodiment, the other nodes are in communication to the farmer 110 in one or another terms as per the smart contract 112. For example, the buyer 140 validates the agriculture production process 142 after receiving the updated data of crop 118. This also help to maintain a transparent and reliable information system 146 between the farmer 110 and the buyer 140. Any violation of terms and conditions148 listed in the smart contract 112 is brought to the notice of the third party 160 who is provided with the copy of smart contract 112 as a proof 162. In case of any violation, the third party 160 does justice 164 as per the terms and conditions laid down in the smart contract 112 and keep the farmer 110 and buyer 140 satisfied.

[0042] In an aspect, the financial institution 170 is in communication with the farmer 110 to give crop credit 172 and to receive in EMIs 174. In case all EMIs are paid in time, the financial institution 170 enhance the credit rating 176 of the farmer 110 which will help the farmer110 to obtain credit in future.

[0043] In an aspect, this establishes strong communication between farmer 110 and the buyer 140 in order to get the intended yield. When the farmer 110 analyses the harvest from his end 122, verifies the inputs, and if everything is in order, the smart contract 112 is triggered, and the predefined crop price is delivered to the farmer's digital wallet. When the buyer 140 pays the money, ownership of the farm produce will be transferred to the buyer 140. Somehow, if both parties agree to break the smart contract 112 at any moment, they can use the 'kill switch' mechanism to terminate the existing smart contract 112 and establish a new contract with all new terms and conditions.

[0044] FIG. 2 illustrate an exemplary block diagram of the working of the decentralized application (DApp) 200 and the different nodes interact with decentralised application 200. The use of a decentralised application 200 will save the basic data about the crop such as its name, variety, and projected harvest time that the contractor wants the farmer 110 to cultivate. The decentralized application 200 is constructed on a decentralized network that combines a backend 204 and a user interface on the front end 202. The front end 202 user interface is created using hypertext mark up language, cascading style sheets, and java script just like an application. The back end 204 code is mostly made up of smart contracts 112 written in java script and python that operate on a decentralized peer-to-peer network. Smart contracts 112 are programs that execute when specific conditions are met and are recorded on a blockchain.

[0045] Furthermore, the buyer 140 and the farmer 110 will collaborate to construct the smart contract 112, which will then be verified and signed. When the farmer 110 updates the crop cultivation data 118 on the decentralised application 200, he will validate it and provide additional inputs from his end to improve the outcomes. Decentralised application 200 is to generate a first private encryption key at a first node of the plurality of nodes and a second encryption key pair for another node from the plurality of nodes to receive at the one or more processors a credit request 114 initiated by the farmer 110 for a crop under the contract farming. The back end 204 is in communication with the farmer node 110, buyer node 140, third

party node 160 and the financial institution node 170 and verifying the shared database.

[0046] FIG. 3 illustrates an exemplary block diagram 300 with the interconnectivity in the role of the farmer 110 with IPFS 306 and blockchain ledger 308 in blockchain-based contract farming system 100. Smart contract 112 are programs that execute when specific conditions are met and are recorded on a blockchain. While blockchain shares a ledger 308 with its nodes, the interplanetary file system 306 is a peer to peer file-sharing system that hashes files very similar to the way blockchain hashes transactions, and then allows users to search for files based on those hashes. IPFS 306 and blockchain are very different.

[0047] In an embodiment, the farmer 110 develops farmland 304 with IoT devices like sensors. The data is accessed by the smart mobile device 302 and fed to IPFS 306 and in data center in the form of a blockchain ledger. The IPFS 306 used to store files while the hashes are kept on the blockchain. IPFS 306 will provide a publicly accessible database while blockchain makes it publicly verifiable. Storing data on the blockchain can be expensive. Therefore, solutions like IPFS 306 are used frequently where a node is needed to access it.

[0048] FIG. 4 illustrates an exemplary block diagram 400 for the communication between the farmer 110 and other nodes in the blockchain-based contract farming system 100. A smart mobile device 302 is required to be held by the farmer 110 to monitor crop parameters through different IoT devices like sensors and also share these data with a data centre 406 where these data can be shared by different nodes based on their requirement. The document for the contract farming is also one part of that where all terms and conditions of the smart contract 112 is present. The data stored in the data centre 402 are encrypted and cannot be altered.

[0049] In an embodiment, the farmer node 110, buyer node 140, third party node 160 and the financial institution node 170 are in communication with each other. The farmer 110 will plant the required crop in farmland 304 and will input crop production statistics on a regular basis picked up and analysed by the smart mobile device 302. These input data includes current-day weather conditions,

images of the crop, fertilizers and pesticides used, pest attacks on crop, etc. All this information will be sent to the blockchain ledger 408 for verification by the buyer 140. When the farmer 110 receives payment from the buyer 140, the smart contract 112 made with the financial institution 170, in case of crop credit given, will be triggered, and the agreed-upon equated monthly instalment payment is automatically delivered to the financial institution 170.

[0050] In an aspect, in the event of a breach of the terms and conditions, the problem is resolved by a trustworthy third party 160. As a result, it is also added to the system to settle the issue. The third party 160 can see the data and its history on the blockchain ledger 408 and so make a more informed judgment based on verifiable digital evidence and satisfy parties.

[0051] Furthermore, if the farmer 110 requires crop financing, he will contact a financial institution 170 which can be a bank. The financial institution 170 may then review the smart contract 112 between the farmer 110 and the buyer 140 to make a choice and provide the farmer 110 with the necessary crop credit 114. When the farmer 110 receives payment from the buyer 140 for his yield, the EMI payment from the farmer's wallet is automatically deducted and transferred to the financial institution 170.

[0052] It should be apparent to those skilled in the art that many more modifications besides those already described are possible without departing from the disclosed concepts herein. The disclosed subject matter, therefore, is not to be restricted except in the spirit of the appended claims. Moreover, in interpreting both the specification and the claims, all terms should be interpreted in the broadest possible manner consistent with the context. In particular, the terms “includes” and “including” should be interpreted as referring to elements, components, or steps in a non-exclusive manner, indicating that the referenced elements, components, or steps may be present, or utilized, or combined with other elements, components, or steps that are not expressly referenced.

[0053] It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those

skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the appended claims.

[0054] While the foregoing describes various embodiments of the invention, other and further embodiments of the invention may be devised without departing from the basic scope thereof. The scope of the invention is determined by the claims that follow. The invention is not limited to the described embodiments, versions or examples, which are included to enable a person having ordinary skill in the art to make and use the invention when combined with information and knowledge available to the person having ordinary skill in the art.

[0055] While embodiments of the present disclosure have been illustrated and described, it will be clear that the disclosure is not limited to these embodiments only. Numerous modifications, changes, variations, substitutions, and equivalents will be apparent to those skilled in the art, without departing from the spirit and scope of the disclosure, as described in the claims.

ADVANTAGES

[0056] Some of the advantages of the present invention, which at least one embodiment herein satisfies are listed herein below.

[0057] The present disclosure provides a simple, secure, and faster blockchain-based system of smart contract farming.

[0058] The present disclosure provides a programmable short smart contract with complete transparency in the system.

[0059] The present disclosure provides a system where all records are individually encrypted to make the system secure.

[0060] The present disclosure provides the system with a transaction timestamp is recorded on a block and all records are irreversible, validated, and cannot be altered.

We Claim:

1. A system (100) of immutable payout to a farmer (110) in smart contract farming by a buyer (140) in a blockchain, the system (100) comprising:

a plurality of nodes connected mutually in a network (132);

a farmland (304) configured with plurality of sensors to obtain time-based data packets to monitor irrigation and growth data; and

a data centre (402) coupled with a memory stores instructions and facilitating the functionalities executable by one or more processors, wherein the data centre (402) is configured to:

generate at a first node from the plurality of nodes, a first private encryption key, and a second encryption key pair for another node from the plurality of nodes;

receive at one or more processors, a credit request (114) initiated by the first node for a crop under smart contract farming to another node from the plurality of nodes, wherein the credit request (114) is digitally signed by the first node using the private encryption key;

validate (172) the credit request (114) by authenticating the identity and credit score of the first node based upon the data ledger and digital signature upon the smart contract made (112) between the farmer and a buyer and in response to the validation of the credit (172), adding, by the one or more processors, and crop credit record to a block;

add the block to the blockchain if the block is cryptographically validated by at least one of the plurality of nodes, by the one or more processors; and

operate a decentralized application (200) that combines a backend (204) and a user interface on the front end (202).

2. The system as claimed in claim 1, wherein the blockchain is maintained by a plurality of nodes comprises a farmer module (110), a buyer module (140), a third party module (160), and a financial institution module (170).

3. The system as claimed in claim 1, wherein the smart contract (112) for the smart contract farming is made between a farmer (110) and a buyer (140) and is made available on the mobile devices (302) held by both of them and in data centre (402).

4. The system as claimed in claim 1, wherein one or more processors are configured to validate (172) the credit request (114) based on the smart contract (112) data and detection by at least one other node of the plurality of nodes validate the request, wherein the smart contract (112) is in encrypted form and stored in the blockchain as well.

5. The system as claimed in claim 1, wherein the farmer (110) upload weather data, crop production data, and harvesting data (118) captured through the plurality of sensors to the plurality of nodes to monitor the progress of the crop.

6. The system as claimed in claim 1, wherein all the crop-related data (124) in the smart contract is stored in the data centre (402) and is accessed by the plurality of nodes on demand.

7. The system as claimed in claim 1, wherein the plurality of sensors are moisture sensors, temperature sensors, and humidity sensors.

8. The system as claimed in claim 1, wherein the system disputes (148) are resolved by the third party (160) based on the smart contract (112) wherein the smart contract (112) is accessed by the plurality of nodes.

9. The system as claimed in claim 1, wherein the system (100) is capable to add the blocks to the blockchain by transmitting the block to at least one node of the plurality of nodes.

10. The system as claimed in claim 9, wherein the blocks are identified with a hash value that indicates at least a previous block including at least one additional smart contract is made between another farmer and a buyer.

For Chitkara University and
Chitkara Innovation Incubator Foundation



Tarun Khurana
Regd. Patent Agent [IN/PA-1325]
Dated: 26th September, 2022

ABSTRACT

BLOCKCHAIN-BASED SECURED SYSTEM FOR SMART CONTRACT FARMING

A system 100 of immutable payout to a farmer 110 by a buyer 140 in smart contract farming using blockchain comprises a plurality of nodes mutually communicating in a network 132, a plurality of sensors, and a data centre 402. The financial institution module 170 provides crop credit 114 in a digital wallet created in a smart mobile device 302 and receive equated monthly instalments in return 174. The blockchain is maintained by a plurality of nodes to validate and store data wherein the data is accessed by the plurality of nodes on demand. The system 100 is capable to further add blocks to the blockchain.



FIG. 1

For Chitkara University and

Chitkara Innovation Incubator Foundation

5

Tarun Khurana

Regd. Patent Agent [IN/PA-1325]

Dated: 26th September, 2022