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Auction Algorithm: Peer-To-Peer System Based on Hybrid Technologies for Smallholder Farmers to Control Demand and Supply

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Abstract:** The demand for agricultural goods could be affected by variables such as population growth and consumer tastes. Environmental and zoonotic risks jeopardise crop yields as well as the dependability of distribution and storage networks. Governments can aid in addressing issues of supply and demand by enacting policies like price controls and subsidies. Climate change threatens agricultural output and livestock health, while other climate variables have been polluted by outside sources. Pesticides not only endanger wildlife that isn't intended to be harmed, but they also poison the environment, killing beneficial insects and other organisms. The rising costs of agricultural goods may be mitigated, at least in part, through regional and global trade agreements. When third parties intervene in farming, farmers stand to lose money. One example is the utilisation of low-quality inputs, while another is predatory financing. So we are proposing an Auction Algorithm: peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply. To implement an auction algorithm, you need to set up the auction platform and back-end systems. You may also need to integrate the platform with hybrid technologies such as block chain and machine learning. Together, machine learning and blockchain technology can help agriculture companies improve their forecasts of demand and supply, make it easier to keep track of inventory, and reduce risks and inefficiencies in the supply chain. Designing and constructing the blockchain, establishing the P2P network, testing and deploying the system these are the stages of bringing a peer-to-peer system to life using blockchain technology. When we implement the above technologies in the agriculture sector, they have the potential to improve efficiency, promote transparency, and eventually help farmers increase their earnings. This technology can help increase agricultural quality by enhancing industrial efficiency, transparency, and sustainability.

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Keywords: Auction Algorithm, Supply Chain, Block Chain, Machine Learning, Peer-To-Peer.

1. INTRODUCTION

Peer-to-peer (P2P) blockchain technology has the potential to help smallholder farmers control demand and supply. P2P blockchains can be used to create smart contracts that automatically execute when certain conditions are met. A smart contract could be set up to automatically buy a certain amount of food from a smallholder farmer, for example.

Blockchain algorithms could potentially be used to control demand and supply in agriculture. It may be possible to identify patterns or anomalies that could indicate manipulation of the supply chain. Analyzing data on the agricultural supply chain could help you identify this type of activity as well as potential manipulation.

Monitor for suspicious activity in the agricultural supply chain. This could include monitoring for unusual price fluctuations or quantities of a particular commodity being traded. Use machine learning to analyse transaction data and look for patterns that suggest a particular individual or group is trying to manipulate the market. Implement blockchain technology to create a transparent, immutable record of transactions.

Auction algorithms could be implemented in a peer-to-peer system based on hybrid technologies for smallholder farmers. The first step in implementing an auction algorithm is to define the rules and parameters of the auction. This might include the types of products being auctioned, the criteria for matching buyers and sellers, and the bidding and pricing rules.

Related work

Out of India's total land area of 3,892,38 hectares, only 2,98,875 hectares are used for farming. After the States, India is the world's largest consumer of arable land. India has the world's second-largest gross agricultural output, with a workforce consisting of around two-thirds farmers. India is the world's leading exporter of fruits, vegetables, rice and wheat, among many other agricultural products. Rice and wheat are two of India's most important agricultural exports. Estimating future harvests is a difficult agricultural endeavor. It's a crucial factor in policymaking on a global, national, and local scale, as well as in the field. Predicting agricultural production requires looking at a number of factors, including soil, weather, environment, and crop. There are several options to think about when choosing a payment processing platform. There are a lot of threats to the security of your business and your customers' personal information that can arise when accepting payments online, and there are also certain security standards that must be met by your payment gateway. Knowing the most common issues with online payments can help you optimise your payment processing strategy. In order to provide the smoothest payment processing possible, we have outlined the most typical issues with online payments and how to circumvent them.

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Compromises in data security and fraudsters seeking out data breach possibilities account for a significant portion of the difficulties with online payment processing. Over 680,000 incidents of identity theft occurred in 2021 alone, making it the most frequent kind of fraud. Over 20% of the more than 3 million fraud instances submitted to the FTC involved identity theft. The most prevalent kind of identity theft is credit card fraud. More than 45 percent of incidents of identity theft in 2021 were the result of credit card fraud, most often the creation of new accounts without the victim's knowledge. Credit card fraud was at its highest in 2021, but identity theft is forecast to surge owing to an increase in data breaches. When personal information is exposed due to a data breach, it leaves victims open to identity theft. As agriculture companies rushed to find ways to keep operating remotely, customers shopped online more often, and health hazards rose, the crisis created ideal conditions for fraud. Fraud will remain a serious threat to the safety of payment processing well into the next decade, even after the current crisis has passed. Agricultural marketing continues to be in a bad shape in India. Farmers have to depend upon local traders and middlemen for disposal of their farm produce. In the absence of an organised marketing structure, private traders dominate the marketing and trading of agricultural produce.

P_ID	**DIST**	**Land_ Size (Acre)**	**CROP_NAME**	**Soil**	**INVESTMENT**	**3rd_Part Issue(0/1)**	**LOSS**
12001	EAST_GODAVARI	4	Paddy,Cotton,Greengram and Sugarcane	Black	2,00,000	1	78000
12002	West_Godavari	4	Paddy, Coconut, Tomato and cabbage	Black	2,00,000	1	79000
12003	Krishna	3	Coconut, Mango, Guava, PalmOil	Black	1,50,000	1	71000
12004	Gunture	3	Paddy, Cotton, Chilli, Tobacco	Black	1,80,000	1	70000

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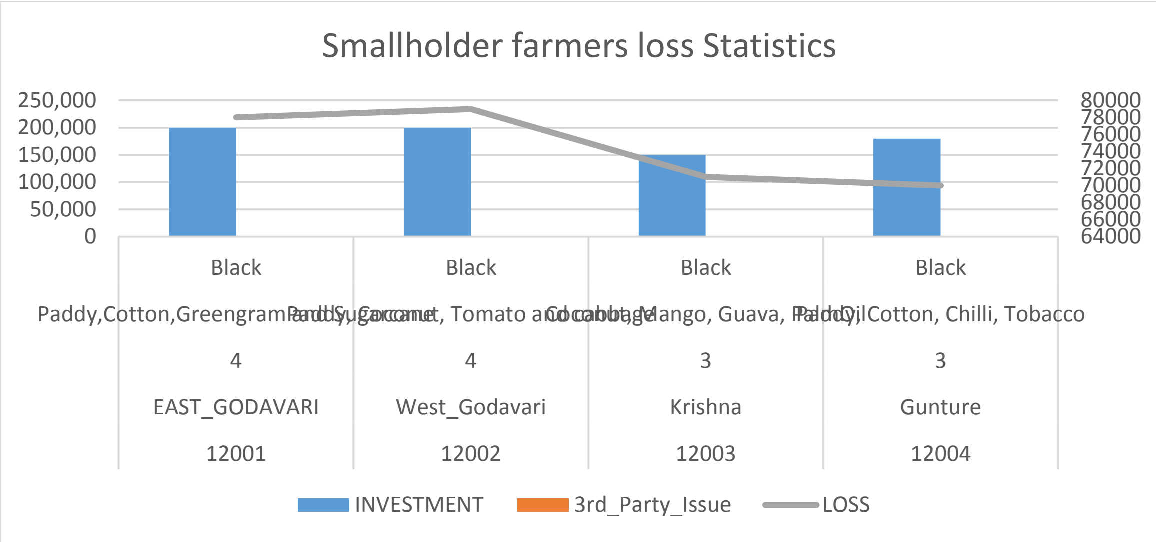
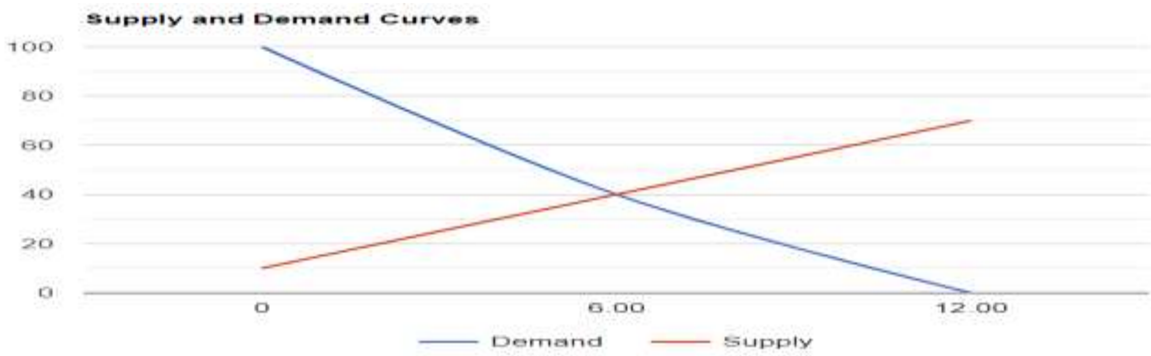


Out of control in demand and supply because of centralized system: Whenever there is an abundance of an agriculture food product or service on the market, the price drops. When demand is higher than supply, prices typically go up. With constant demand, prices should fall as supply rises. However, when demand rises but supply stays the same, the equilibrium price increases. But now a days most of the 3rd party involvement is very high, those who are participated in network there manipulate the quality, reliability and reduce famers profit step by step then most of the farmers got loss because of centralized system. Most of the participants involved in

The Data

Demand Curve:	**P =100 - 10 Q**
Supply Curve:	**P =10 + 5 Q**

Equilibrium:
Equilibrium Price:40.00
Equilibrium Quantity:6.00



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Quantity	Demand	Supply
0	100	10
6.00	40	40
12.00	0	70

Table 1: Supply and Demand

Price	Quantity Demanded		Quantity Supplied
100.00	0.00	Excess Supply	18.00
91.00	0.90	Excess Supply	16.20
82.00	1.80	Excess Supply	14.40
73.00	2.70	Excess Supply	12.60
64.00	3.60	Excess Supply	10.80
55.00	4.50	Excess Supply	9.00
46.00	5.40	Excess Supply	7.20
37.00	6.30	Excess Demand	5.40
28.00	7.20	Excess Demand	3.60
19.00	8.10	Excess Demand	1.80
10.00	9.00	Excess Demand	0.00

Agriculture Markets can be said to have excess demand when the demand for a good or service exceeds the available supply. This condition represents the antithesis of an overabundance of resources. When the supply of a product or service exceeds the demand for it, resulting in a price that is higher than the level established by supply and demand, we have a scenario known as an "economic surplus."

Proposed work

We proposed a peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply. To get the government's crop forecast and crop suggestions for smallholder farmers, each farmer must first register their farm's agricultural acreage and the crops that will be grown there. Smallholder farmers and the state alike will greatly benefit from this processing technology. With this information, the government can simply regulate supply and demand by importing and exporting the appropriate amounts of output.

Auction algorithm: smallholder farmers to control demand and supply using hybrid technologies

Auction algorithms could be implemented in a Peer-to-Peer system based on hybrid technologies for smallholder farmers to control demand and supply:

1. Define the auction rules and parameters: The first step in implementing an auction algorithm in the system is to define the rules and parameters of the auction. This might include the types of products being auctioned, the criteria for matching buyers and sellers

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(e.g. price, quantity, quality, location), the bidding and pricing rules (e.g. minimum and maximum bid increments, minimum and maximum prices), and any other relevant rules or constraints.

2. Set up the auction platform: The next step is to set up the platform or infrastructure for conducting the auction. This might involve creating a user interface for buyers and sellers to participate in the auction, as well as implementing the necessary back-end systems and processes for handling bids, matching buyers and sellers, and conducting the auction.
3. Onboard buyers and sellers: Once the platform is set up, the next step is to onboard buyers and sellers onto the system. This might involve verifying the identities and qualifications of buyers and sellers, as well as collecting any necessary information or documentation.
4. Conduct the auction: Once the buyers and sellers are onboarded, the auction can be conducted according to the rules and parameters defined in step 1. This might involve opening the auction for a predetermined period of time, during which buyers and sellers can submit

Proof-of-Authority (PoA) is a consensus algorithm that is commonly used in private or permissioned blockchain networks. PoA allows a small group of pre-approved users (called "validators") to create new blocks and add them to the chain. Using POA could help ensure the integrity and security of the supply chain.

Pseudo-code for an Auction algorithm in a Peer-To-Peer system based on hybrid technologies for smallholder farmers to control demand and supply:

```
# Define the auction rules and parameters
auction_duration = 14 days  # duration of the auction
min_bid_increment = 1  # minimum bid increment
min_price = 10  # minimum price
max_price = 100  # maximum price
# Set up the auction platform
create user interface for buyers and sellers
implement back-end systems and processes for handling bids and conducting the auction
# Onboard buyers and sellers
verify identities and qualifications of buyers and sellers
collect necessary information and documentation
# Conduct the auction
open the auction for the specified duration
allow buyers and sellers to place bids on products
if a bid is received:
  check if the bid meets the minimum bid increment and price requirements
  if the bid is valid:
    update the current winning bid for the product
  else:
    reject the bid
if the auction duration has expired:
  determine the winning bid for each product
  notify the winning bidder and seller of the auction results
  facilitate the transaction between the buyer and seller
  update the supply and demand information in the system
```


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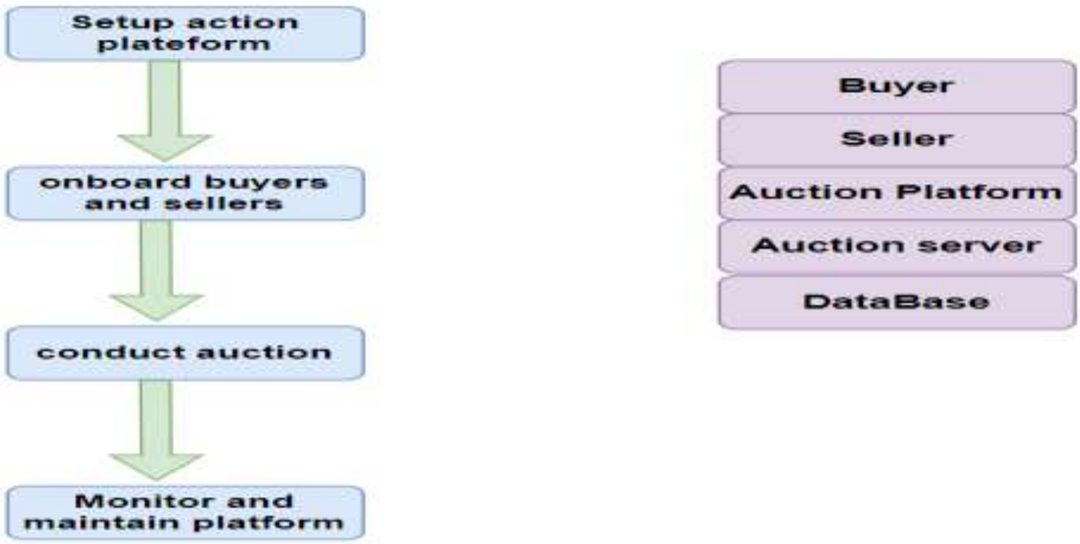

Figure: Architecture for an Auction algorithm in a Peer-To-Peer system based on hydride technologies for smallholder farmers to control demand and supply

In this architecture, buyers and sellers can interact with the auction platform through their devices, such as computers or smartphones. The auction platform communicates with the auction server to process bids, conduct the auction, and facilitate the transactions. The auction server stores the information about the auctions and transactions in a database.

```
# Define the auction parameters and rules
auction_duration = 14 days  # duration of the auction
min_bid_increment = 1  # minimum bid increment
min_price = 10  # minimum price
max_price = 100  # maximum price
# Set up the auction platform
create user interface for buyers and sellers
implement back-end systems and processes for handling bids and conducting the auction
# Onboard buyers and sellers
verify identities and qualifications of buyers and sellers
collect necessary information and documentation
# Conduct the auction
open the auction for the specified duration
allow buyers and sellers to place bids on products
if a bid is received:
  check if the bid meets the minimum bid increment and price requirements
  if the bid is valid:
    update the current winning bid for the product
  else:
    reject the bid
if the auction duration has expired:
  determine the winning bid for each product
  notify the winning bidder and seller of the auction results
  facilitate the transaction between the buyer and seller
  update the supply and demand information in the system
# Monitor and maintain the auction platform
continuously monitor the auction platform for any issues or problems
take necessary actions to resolve them
keep the platform up-to-date with the latest technologies and features to improve the user experience
```


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This program sets up the auction platform and onboard buyers and sellers. It then conducts the auction by allowing buyers and sellers to place bids on products, and updates the winning bid if a valid bid is received. When the auction duration expires, the program determines the winning bid for each product, notifies the winning bidder and seller, facilitates the transaction, and updates the supply and demand information in the system. Finally, the program continuously monitors and maintains the auction platform to ensure smooth operation and optimal performance.

Finding thief in between supply chain in smart agriculture using hybrid technologies: The key to preventing theft in a supply chain for smart agriculture using hybrid technology is to use a combination of traceability, machine learning, security measures, and collaboration with partners. By looking at your supply chain as a whole, you can reduce the chance of theft by a lot and make it more efficient and effective.

Pseudo code: Finding thief in between supply chain in smart agriculture using hybrid technologies

```
# Function to add a new customer to the supply chain
def addCustomer(customer):
  customers.append(customer)
# Function to add a new product to the supply chain
def addProduct(product):
  products.append(product)
# Function to track the flow of goods through the supply chain
def trackGoods(product):
  # Check if the product is being tracked
  if product in products:
    # Check with each supplier if they have the product
    for supplier in suppliers:
      if product in supplier.products:
        # Check with each customer if they have received the product
        for customer in customers:
          if product in customer.orders:
            # The product has been successfully delivered, so no thief was found
            return False
        # The product was found with the supplier, but not with any customers
        # This suggests that the supplier is the thief
        thief = supplier
        return True
  # The product is not being tracked or was not found with any suppliers
  return False
# Function to detect the thief using hybrid technologies
def detectThief(product):
  # Use RFID tracking to determine the physical location of the product
  location = RFIDtracking(product)
  # Use GPS tracking to determine the location of the suspected thief
  thief_location = GPStracking(thief)
  # Compare the locations to determine if the thief has the product in their possession
  if location == thief_location:
    # The thief has been caught with the stolen product
    return True
  return False
```

The addSupplier, addCustomer, and addProduct functions can be used to add new suppliers, customers, and products to the system. The trackGoods function is used to track the flow of a

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particular product through the supply chain. The detect-thief function detects a thief using RFID and GPS tracking.

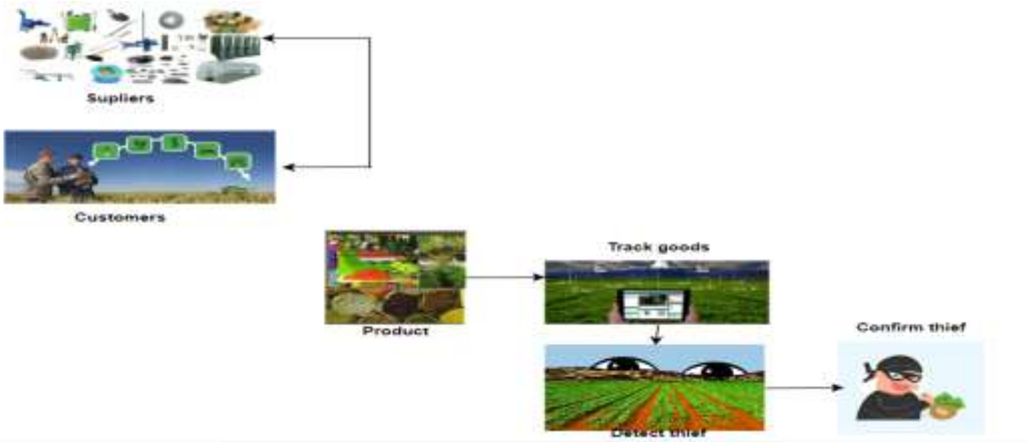

Figure: Finding thief in between supply chain in smart agriculture using hybrid technologies

This block diagram shows the various steps involved in finding a thief in a supply chain in smart agriculture using hybrid technologies. The process begins with the identification of a product that has gone missing or has been stolen. The system then tracks the flow of the product through the supply chain, using data from suppliers and customers to determine where the product was last seen. If the product is found with a supplier but not with any customers, this suggests that the supplier may be the thief.

Peer-to-Peer network for implementing secure supply chain system in smart agriculture: A peer-to-peer (P2P) network can be a useful solution for implementing a secure supply chain system. In a P2P network, each device or node on the network is able to communicate directly with other nodes. This decentralised structure can make it more difficult for malicious actors to disrupt or compromise the system.

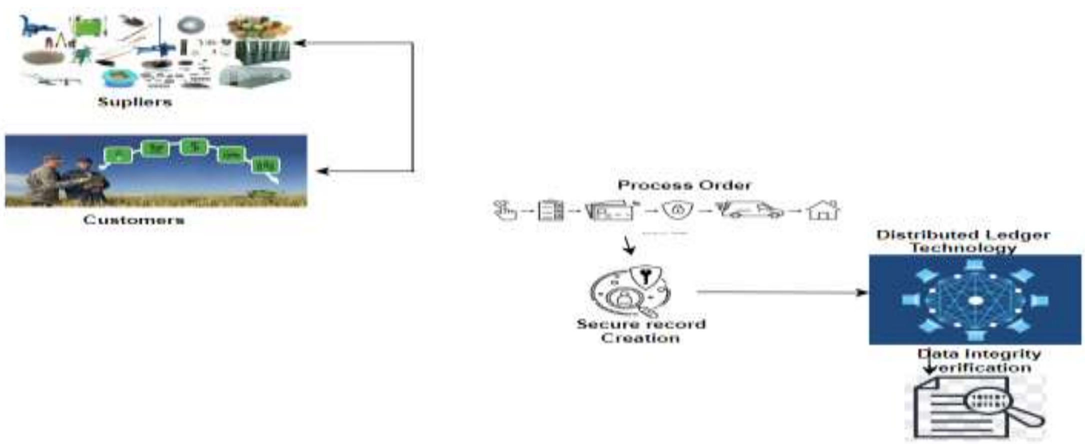

Figure: Peer-to-Peer network for implementing secure supply chain system in smart agriculture

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Pseudo code that could be used to implement a supply chain system in smart agriculture:

```
# Initialize variables
products = []
suppliers = []
customers = []
# Function to add a new product to the supply chain
def addProduct(product):
  products.append(product)
# Function to add a new supplier to the supply chain
def addSupplier(supplier):
  suppliers.append(supplier)
# Function to add a new customer to the supply chain
def addCustomer(customer):
  customers.append(customer)
# Function to process an order
def processOrder(order):
  # Check if the requested product is in stock
  if order.product in products:
    # Check if the customer is registered in the system
    if order.customer in customers:
      # Check if the supplier has the product in stock
      if order.product in suppliers[order.supplier].products:
        # Process the order
        products.remove(order.product)
        suppliers[order.supplier].products.remove(order.product)
        customers[order.customer].orders.append(order)
        return True
  return False
```

The addProduct, addSupplier, and addCustomer functions can be used to add new products, suppliers, and customers to the system. The processOrder function is used to process an order from a customer. There are many other features and considerations that you may want to include in a more complete supply chain system.

Estimating crop production growth and control the demand and supply: Collect data on weather conditions, soil conditions, and past crop yield data. Use data to develop a model for predicting crop production growth. Monitor market conditions and gather data on demand for the crop. Use the demand data and the production growth model to estimate the supply of the crop. Compare the estimated supply to the estimated demand to determine if there is a surplus or deficit. If there is a surplus, implement strategies to decrease demand (e.g. through marketing or price adjustments). If there is a deficit, implement strategies to increase supply (e.g. through increased production or importation). Continuously monitor and adjust the supply and demand estimates and control strategies as needed.

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Pseudo Code

```
# Initialize variables
crops = []
supply = 0
demand = 0
# Function to add a new crop to the system
def addCrop(crop):
  crops.append(crop)
# Function to estimate the growth of a particular crop
def estimateGrowth(crop):
  # Use data on past growth rates, weather conditions, and soil quality to estimate the growth of the crop
  growth_estimate = predictGrowth(crop)
  return growth_estimate
# Function to update the supply and demand for a particular crop
def updateSupplyDemand(crop, growth_estimate):
  # Update the supply based on the growth estimate
  supply += growth_estimate
  # Update the demand based on market data and consumer trends
  demand = predictDemand(crop)
  # Calculate the balance between supply and demand
  balance = supply - demand
  return balance
# Function to adjust the price of a particular crop based on the supply and demand balance
def adjustPrice(crop, balance):
  # If the balance is positive, there is excess supply and the price should be lowered
  if balance > 0:
    price = lowerPrice(crop)
  # If the balance is negative, there is excess demand and the price should be increased
  elif balance < 0:
    price = raisePrice(crop)
  # If the balance is zero, the supply and demand are balanced and the price can remain unchanged
  else:
    price = currentPrice(crop)
  return price
```

Code defines several functions that can be used to estimate crop production growth and control demand and supply. The addCrop function is used to add a new crop to the system. The estimateGrowth function estimates the growth of a particular crop based on past growth rates, weather conditions, and soil quality.

2. EXPERIMENTAL RESULT DISCUSSION

A peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply:

1. The system consists of a central server that is connected to a database and a web server.
2. Smallholder farmers use hybrid technologies to produce and store crops. They can access the system through a mobile app or a website.
3. The mobile app or website allows farmers to create profiles and list their available crops, including information such as the type of crop, quantity, price, and location.
4. Buyers can access the system through the mobile app or website and browse listings of available crops. They can place orders for the desired crops and make payments through the system.
5. The central server processes the orders and payments, and communicates with the web server to update the listings and availability information in the database.
6. The system also includes security measures to protect the privacy and sensitive information of the users.

A peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply. It is important to consider factors such as the specific needs and constraints of smallholder farmers, as well as the technical capabilities and infrastructure required to support the use of hybrid technologies.

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```
function createProfile(farmerID: string, name: string, location: string, crops: string[])
  farmer = {
    farmerID: farmerID,
    name: name,
    location: location,
    crops: crops
  }
  add(farmer)
  return farmer
end
function listCrop(farmerID: string, crop: string, quantity: int, price: float)
  farmer = get(farmerID)
  listing = {
    farmerID: farmerID,
    crop: crop,
    quantity: quantity,
    price: price
  }
  add(listing)

  return listing
end
function placeOrder(buyerID: string, listingID: string, quantity: int)
  listing = get(listingID)
  if listing.quantity < quantity
    return "Error: Insufficient quantity available"
  end
  cost = quantity * listing.price
  payment = processPayment(buyerID, cost)

  if payment == "Success"
    listing.quantity = listing.quantity - quantity
    update(listing)
    order = {
      buyerID: buyerID,
      listingID: listingID,
      quantity: quantity,
      cost: cost,
      status: "Pending"
    }
    add(order)
    return order
  else
    return "Error: Payment failed"
  end
end
```

Pseudo code for a peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply. The actual implementation of the system would depend on the specific requirements and constraints of the system, as well as the programming language and tools being used.

```
In [18]: class Farmer:
           def __init__(self, farmer_id, name, location, crops):
             self.farmer_id = farmer_id
             self.name = name
             self.location = location
             self.crops = crops
           def list_crop(self, crop, quantity, price):
             listing = {
               "farmer_id": self.farmer_id,
               "crop": crop,
               "quantity": quantity,
               "price": price
             }
             add_to_database(listing)
             return listing
         class Buyer:
           def __init__(self, buyer_id, name):
             self.buyer_id = buyer_id
             self.name = name
           def place_order(self, listing_id, quantity):
             listing = get_from_database(listing_id)
             if listing["quantity"] < quantity:
               return "Error: Insufficient quantity available"
             cost = quantity * listing["price"]
             payment = process_payment(self.buyer_id, cost)
             if payment == "Success":
               update_database(listing_id, {"quantity": listing["quantity"] - quantity})
               order = {
                 "buyer_id": self.buyer_id,
                 "listing_id": listing_id,
                 "quantity": quantity,
                 "cost": cost,
                 "status": "Pending"
               }
               add_to_database(order)
               return order
             else:
               return "Error: Payment failed"
         def process_payment(buyer_id, cost):
           # Implement payment processing logic here
           return "Success"
         def add_to_database(data):
           # Implement database insertion logic here
           pass
         def get_from_database(id):
           # Implement database retrieval logic here
           pass
         def update_database(id, data):
           # Implement database update logic here
           pass
```


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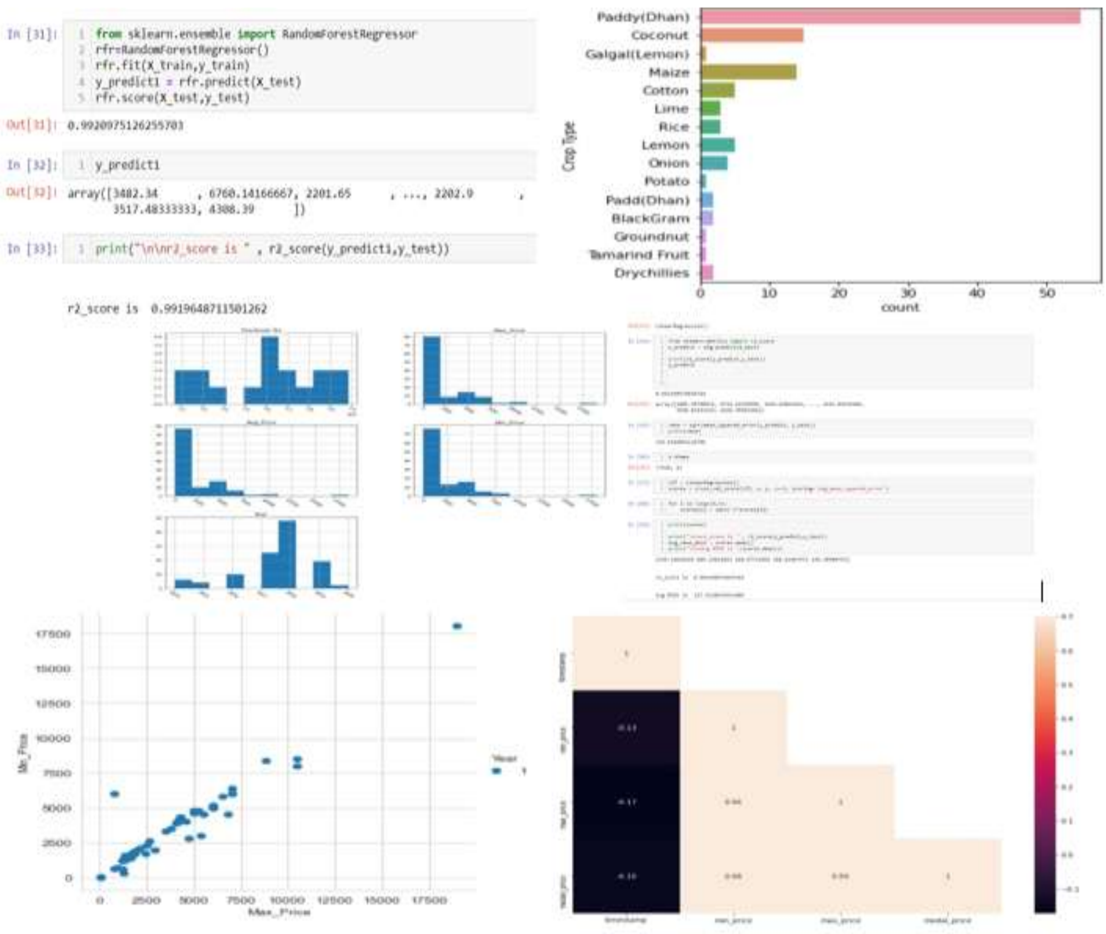

3. CONCLUSION

In this paper, we are implementing peer-to-peer system based on hybrid technologies for smallholder farmers to control demand and supply. Together, machine learning and blockchain technology can help agriculture companies improve their forecasts of demand and supply, make it easier to keep track of inventory, and reduce risks and inefficiencies in the supply chain. Designing and constructing the blockchain, establishing the P2P network, testing and deploying the system these are the stages of bringing a peer-to-peer system to life using blockchain technology. When we implement the above technologies in the agriculture sector, they have the potential to improve efficiency, promote transparency, and eventually help farmers increase their earnings. This technology can help increase agricultural quality by enhancing industrial efficiency, transparency, and sustainability.

4. REFERENCE

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