PROPOSEDSTRATEGIESFORSUSTAINABLE AGRICULTURE-CHATBOT

APROJECTREPORT

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PANIMALARENGINEERINGCOLLEGE,CHENNAI-600123.

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BONAFIDECERTIFICATE

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Examination held on.....

INTERNALEXAMINER **EXTERNALEXAMINER**

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ABSTRACT

Theagriculturalsectorfacesmultiplechallenges,includingclimatevariability,inefficientresource management, and concerns regarding data security. Addressing these issues requires innovative solutions that integrate emerging technologies. This paper proposes a novel methodology that combines**blockchaintechnology**withan**AI-poweredchatbotplatform**toprovidefarmerswith real-time, secure, and accurate crop recommendations.

Blockchain technology ensures data integrity, transparency, and protection against unauthorized modifications, mitigating risks associated with data tampering. The chatbot serves as an interactive interface where farmers can input essential parameters such as **soil composition , geo graphiclocation , and real-time weather conditions**. By leveraging **historical agricultural data** and **predictive analytics models**, the system processes these inputs and recommends optimal crops suited for the given conditions.

This integrated approach enhances **decision-making in precision agriculture**, promoting sustainability by optimizing resource utilization, improving crop yield, and reducing environmental impact. Furthermore, by fostering **data-driven farming practices**, this solution contributes to long-term food security and economic stability in the agricultural sector.

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CHAPTER1

INTRODUCTION

Agriculture is an important sector that has a fundamental role in supporting global food production and livelihoods of more tha none billion people globally. The sector is connected to economic growth, employment, and food security. Sectors are facing specific challenges instigated by climate change, soilloss, waters hortages, global food demand. Lack of certainty in weather conditions and lack of sufficient timely and accurate information render farming difficult. Small and medium farmers especially are deprived of access to inputs, scientific data, and technology, resulting in inefficiency and reduced yields. The second main issue is that agricultural data and knowledge are highly fragmented. Traditional farming practices are largely location- and experience-dependent, so there is limited possibility of generalizing best practices Moreover, central databases for agriculture are subject to manipulation and attacks, lowering trust inelectronic solutions. The absence of coordination between various agricultural technologies also aggravates the situation, as farmers are unable to make informed choices. Blockchain technology marks an innovative solution to these problems in the guise of data security, transparency, and decentralization. Blockchain offers secure storage of data and provable records of weather, farm inputs, and crop performance.

With AI-powered chatbots, which offer instant advice based on scientific data, farmers can get real-time, personalized crop advice and resource management techniques. This integration boosts decision making , maximizes resource use, and enhances agricultural over all sustainability. Conventional farm systems tend to be based on human experience, which might not always be optimal. Farmers might not be able to read soil nutrient content, predict weather patterns, and choose the most appropriate crops for their own land. Our system overcomes these constraints by combining AI and blockchain technology into a chatbot interface that enables farmer to engage with a smart assistant that gives secure and databased information.

CHAPTER2

LITERATURE SURVEY

TITLE : TOWARDS A GREENER TOMORROW: EXPLORING THE POTENTIAL OF AI, BLOCKCHAIN, AND IOT IN SUSTAINABLE DEVELOPMENT

AUTHOR : Megha chauhan , Deepali Rani Sahoo

YEAR OF PUBLICATION : Feburary2023

Green technology, also known as sustainable technology, refers to innovations that minimize environmental impact while enhancing efficiency and sustainability. It includes renewable energy solutions , energy-efficient systems ,waste reduction strategies , and eco-friendly industrial processes. In the context of AI , blockchain , and IoT, green technology plays a crucial role in optimizing energy consumption , improving resource management , and enabling predictive maintenance through AI-driven analytics. Blockchain enhances transparency in sustainable supply chains, carbon credit tracking, and waste management, while IoT enables real-time environmental monitoring, improving water and air quality management and advancing smart city infrastructure. By integrating these technologies into sustainable practices, stakeholders can reduce carbon footprints, optimize resource usage, and contribute to a greener future. However, challenges such as high costs, ethical concerns, and data security must be addressed to ensure their effective implementation.

TITLE : SENSOR DRIVEN SMART IRRIGATION SYSTEM USING IOT AND CLOUD COMPUTING

AUTHOR : Sharmaetal.

YEAR OF PUBLICATION : 2022

Sharma et al. (2022) developed a sensor-driven smart irrigation system using IoT and cloud computing to enhance water efficiency in agriculture. Their system provided real-time soil moisture monitoring and automated irrigation, reducing water wastage while improving crop health and productivity .The use of cloud stall owed remote access to agricultural data ,but they identified security risks , including cyber threats and data manipulation. To overcome these challenges, they proposed blockchain integration for secure, decentralized , and tamper-proof data storage , ensuring reliable and transparent agricultural insights .Allowed remote access to agricultural data, but they identified security risks , including cyber threats and data manipulation .To overcome these challenges, they proposed blockchain integration for secure, decentralized, and tamper-proof data storage, ensuring reliable and transparent.

TITLE : BLOCKCHAIN-POWERED CHATBOT FOR SMART AGRICULTURE

AUTHOR : JohnSmith, PriyaPatel

YEAROFPUBLICATION : 2023

The integration of blockchain and chatbot technology in agriculture has the potential to revolutionize farming by providing secure ,real-time, and data-driven solutions. This paper presents a blockchain-powered chatbot system designed to assist farmers decision-making regarding crop selection ,pest management, and weather forecasting. The chatbot collects user input, such as soil quality, weather conditions, and past yield data , and leverages blockchain for data integrity and security .AI- powered analytics provide personalized recommendations, while blockchain ensures tamper-proof data storage. The proposed system enhances efficiency , trust, and transparency in agricultural advisory services, promoting sustainable farming practic**es**.

TITLE: SECURE AGRICULTURAL CHATBOT USING BLOCKCHAIN TECHNOLOGY

AUTHOR: Ahmed Khan , Elena Rodriguez

YEAR OF PUBLICATION: 2022

With the growing demand for smart agriculture solutions ,the use of blockchain and chatbot systems offers a robust approach to secure communication and data exchange in farming. This research introduces a decentralized agricultural Chatbot integrated with blockchain technology to provide accurate ,real-time Farming advice. Farmers can inputs oil and weather parameters , and the system ,using

AI-driven analytics, delivers crop recommendations. Blockchain ensures secure data logging, preventing misinformation and fraud. The study highlights the enhanced trust, security, and efficiency blockchain brings to agricultural advisory systems ,reducing risks and optimizing resource management.

TITLE: CHATBOTS – AN INTERACTIVE TECHNOLOGY FOR PERSONALIZED COMMUNICATION ,TRANSACTIONS AND SERVICES

AUTHOR : DariusZumstein , SophieHundertmark

YEAR OF PUBLICATION : Feburary2022

This research explores the role of chatbots in enhancing personalized communication and transactions .It highlights how AI-powered chatbots streamline customer interactions by providing instant responses and recommendations. The study examines the impact one-commerce ,banking ,and customer service sectors, improving efficiency and user satisfaction. Natural language processing and machine learning enable chatbots to understand user intent and deliver tailored assistance. Overall, it demonstrates how chatbots revolutionize digital interactions by offering seamless, automated services.

TITLE : IOT-SUPPORTED INTELLIGENT PLANT OPTIMIZED CROP YEILD

AUTHOR : Nehraetal

YEAR OF PUBLICATION : 2023

In this paper, IoT-based plant management system designed to enhance agricultural productivity by continuously measuring soil moisture and nutrient concentration was done. By deploying IoT sensors, the system provided real-time insights into soil health, enabling farmers to make informed decisions regarding irrigation and fertilization. Their study demonstrated that the use of IoT technology led to a 15%

increase in crop yield, highlighting its effectiveness inprecision agriculture. However, a major drawback of their approach was the reliance on centralized data storage, which posed a significant security vulnerability. This centralized architecture made the system susceptible to cyber-attacks and unauthorized data manipulation.

TITLE : AGRICULTURAL SUPPLY CHAIN MANAGEMENT USING HYPER LEDGER AND A IOT

AUTHOR : Anurag Kumar Jha, Aparna Raj

YEAR OF PUBLICATION : 2025

This paper explores the integration of Hyper ledger Fabric blockchain with AI and IoT to enhance supply chain efficiency, transparency, and security. The proposed system ensures real-time monitoring and optimal conditions for transporting sensitive goods like medical supplies and perishable items. By eliminating third-party intermediaries, it guarantees immutability, remote accessibility, and regulatory compliance. AI-driven insights help reduce waste and improve operational efficiency.

TITLE : DEEP LEARNING AND BLOCKCHAIN APPLICATION IN SMART AGRICULTURE AND FARMING

AUTHOR : Namrata kumari , Nushrat Praveen

YEAR OF PUBLICATION : 2025

Agriculture is under going a transformation through the integration of deep learning and blockchain technology , addressing productivity, sustainability, and transparency challenges. This revolutionary approach in smart agriculture leverages Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) to analyze agricultural data accurately and promptly. This analysis aids in yield prediction, insect identification, and crop health monitoring, enhancing decision-making and resource allocation. Consequently ,crop yields are increased, and resource waste is minimized. The combination of deep learning and blockchain technology in smart agriculture creates a wide impact on technology

CHAPTER3

SYSTEM ANALYSIS

EXISTING SYSTEM:

The current agricultural advisory systems largely depend on manual Consultations , government extension services ,and third-party agencies for providing crop recommendations and farming guidance. Farmers often rely on agronomists, agricultural research centers, and cooperative societies for advice on crop selection, irrigation methods , pestcontrol , and soil management. Additionally , mobile-based applications and web portals have been introduced in some regions to help farmers access weather forecasts, soil health data, and market prices. These platforms are usually centralized and require continuous internet access, making them challenging for farmers in remote areas with poor connectivity. In recent years, AI and IoT-based smart farming solutions have been developed to enhance decision-making and productivity. These systems leverage satellite imagery, weather predictions, and soil sensors to provide farmers with data- driven insights. AI-powered chatbots have also been introduced in some cases to provide automated responses to farmer queries. However, these solutions primarily rely on centralized cloud storage, making them vulnerable to cybersecurity threats and data breaches. Additionally, farmers must trust third-party organizations managing these platforms, which raises concerns about data privacy and manipulation

LIMITATIONS OF EXISTING SYSTEM:

Despite advancements in agricultural technology, the existing systems face several critical limitations that hinder their effectiveness and reliability. One of the primary issues is data security and integrity, as most advisory platforms rely on centralized databases , making them susceptible to cyberattacks , unauthorized modifications,

This lack of a secure and transparent record system results in misinformation , fraud,and manipulation of agricultural data, leading to distrust among farmers. Additionally, these platform sheavily depend on continuous internet connectivity, which poses a significant challenge in rural and remote farming areas where network infrastructure is weak or inconsistent. Another major limitation is high implementation sensors, cloud storage, and periodic system upgrades, making them unaffordable for small-scale farmers. Furthermore, user accessibility remains a challenge, as many that result in suboptimal crop planning and inefficient resource utilization.

Moreover, the traditional agricultural framework lacks automation in financial transactions , making processes such as subsidy distribution, crop insurance claims, and supply chain payments highly bureaucratic and prone to corruption. Lastly, environmental concerns arise due to the in efficient use of resources like water , fertilizers , and pesticides, leading to significant wastage, soil depletion, and long-term agricultural sustainability issues. These limitations highlight the pressing need for a decentralized , real-time, and secure agricultural advisory system that can enhance data transparency, reduce dependency on intermediaries, and ensure optimal resource utilization.

PROPOSEDSYSTEM:

To overcome these challenges, we propose an AI-powered chatbot integrated with blockchain technology to provide farmers with secure, transparent, and real-time agricultural insights. The system allows farmers to input soil conditions, weather parameters , and location details ,after which the chatbot processes this information using historical data and predictive analytics to suggest the most suitable crops. Blockchain technology ensures that all agricultural data is securely stored in a decentralized and tamper-proofledger , eliminating concerns regarding data manipulation and unauthorized modifications.

Additionally, IoT sensors integrated with the system continuously monitor soil moisture, temperature, and humidity levels, updating farmers with real-time environmental conditions. The use of smart contracts further automates key agricultural processes such as subsidy disbursement, crop insurance claims, and secure transactions in the supplychain ,reducing dependency on intermediaries . Another keyfeature of the proposed system is its multi-platform accessibility, allowing farmers to interact with the chatbot via mobile applications, web interfaces, and even USSD codes for offline users. By decentralizing data storage and ensuring transparent transactions, this system enhances trust, reduces costs, and significantly improves agricultural productivity.

ADVANTAGESOFPROPOSEDSYSTEM:

The proposed system, integrating blockchain technology with a chatbot platform, offers numerous advantages over existing agricultural advisory systems. One of its most significant benefits is enhanced data security and integrity. By leveraging blockchain's decentralized and tamper-proof nature, all agricultural data, transactions, and recommendations are securely recorded, eliminating the risks of fraud, data manipulation, and unauthorized alterations. This transparency fosters trust among farmers, government agencies, and agricultural organizations, ensuring that all data remains authentic and immutable. Another key advantage is real-time and accurate crop recommendations .The chatbot serves as an interactive and user-friendly platform wherefarmerscaninputsoilparameters,location,andweatherconditionstoreceiveinstant,AI- driven crop suggestions based on historical data and predictive analytics. This real-time advisory system significantly enhances decision-making, improving crop yield and sustainability. Additionally, the system operates efficiently in low-internet environments, making it highly accessible to farmers in rural and remote regions, bridging the technological divide. Moreover, the elimination of intermediaries in financial transactions ensures direct payments for subsidies, cropsales, and insurance cl aims using block chain smart contracts. This automation reduces bureaucratic delays, corruption, and transaction costs, ultimately benefiting the farmers by ensuring timely and transparent payments. The system also promotes efficient

Resource management , as AI-driven insights help in optimal water usage , pesticide application, and fertilizer distribution, reducing environmental impact and minimizing wastage.

SOFTWAREREQUIREMENT:

WIFI

Frontend

HTML

CSS

JS

Backend

Python

SQL

Database

HARDWARE COMPONENTS

Soil NPK sensor

NodeMCUBoard

CHAPTER4

SYSTEMDESIGN

The System is designed to automate and optimize the process of creating shopping assistants for educational institutions using AI-based Recommendation Algorithms.The Three main components: The Frontend, The Backend, and The Database, which work together to facilitate the shopping assistant generation process.

FRONTEND:

React: The core library for building the user interface, allowing for dynamic rendering of components such as the search bar, product list, and product details. React provides the flexibility to create a seamless, interactive shopping experience.

Axios: Used for making HTTP requests to the FastAPI backend. Axios will send user search queries, handle product search results, and manage authentication requests (login, signup) by interacting with the backend API.

Tailwind CSS: A utility-first CSS framework that simplifies the process of designing the UI. It will be used for styling the interface, creating responsive layouts, and ensuring the application is visually appealing and mobile-friendly.

React Router: Used for managing navigation within the app, ensuring that users can smoothly transition between pages like login, product search results, and product details without page reloads.

BACKEND:

FastAPI : The main framework used to build the backend APIs. FastAPI will handle user authentication, product search functionality, and the AI-powered recommendations. It provides high performance and easy-to-use APIs.

Python: The primary programming language for implementing the backend logic, including handling user authentication, managing product search and recommendations, and interacting with the MongoDB database.

Sentence-Transformer: A library used for generating embeddings for product data and user queries. It enables semantic search by converting textual data into vectors, allowing for better product recommendations and search results.

Scipy: Used for calculating cosine similarity between product embeddings and user queries, enabling the backend to return the most relevant products based on the search query.

CORS (Cross-Origin Resource Sharing): A middleware for handling cross-origin requests from the frontend React application, allowing the frontend to securely interact with the backend API.

DATABASE:

MongoDB: The NoSQL database used to store product information and userdata. MongoDB will store product details like title, description, price, and user details like email .

TEMPERATURESENSOR:

DHT11 is a Humidity and Temperature Sensor, which generate scalibrated digital output.DHT11can be interface with any microcontroller like Arduino, Raspberry Pi, etc. and get instantaneous results.

DHT11 is alow-cost humidity and temperature sensor which provides high reliability and long-term stability.

In this project, we will build a small circuit to interface Arduino with DHT11Temperature and Humidity Sensor.

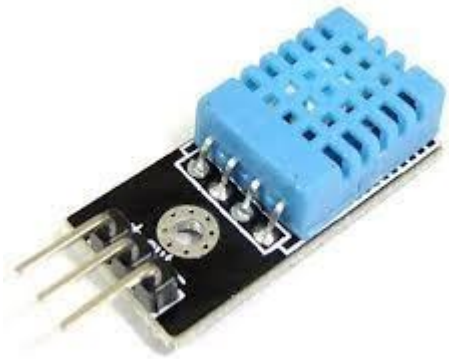
One of the main applications of connecting DTH11sensor with Arduino is weather monitoring.

DHT11 is allow – cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

DHT11humidity and temperature sensor is available as a sensor and as a module .The difference between this sensor and module is the pull-up resistor and a power-on LED.

.

Fig.4.4.1TEMPERATURESENSOR:



TEMPERATURE SENSOR:

4.2NODEMCU

The Node mcu (Node Micro Controller Unit) is an open sources of software and hardware development environment around the ESP8266, a very inexpensive system-on - a-chip (SoC) environment.

The ESP8266, designed and manufactured by Express if Systems , involves all the main parts of modern pcs: CPU, RAM, networking (Wi-Fi), and even a modern operating system and SDK.

When purchased in bulk , the ESP8266 chip costs just $2USD a piece .This makes it a excellent choice for IoT initiatives of all kinds.

The ESP8266, however, is also difficult to access and use as a chip. For the simplest tasks such as powering it on or sending a key stroke to the "computer" on the chip, you have to sold wires with the appropriate analog voltage.

Fig.4.4.2NODEMCU:

and, you have to program it in instructions for low-level machines that the chip hardware can interpret. whilethislevelofintegrationisnotanissuewhentheesp8266is used in mass- produced electronics as an integrated controller chip,

it is a enormous burden on hobbyists , hackers ,or learners who want to experiment with it in their own iot projects.

Borrowing a page from the successful play books of Arduino berry pi ,the node mcu project aims to simplify esp8266 development.

it has two key components . an open source firm ware esp8266 constructed onto of the proprietary sdk of the chip manufacturer.

4.4.3.PowerSupply

Fig4.4.3Power Supply

The microcontroller drives Transistor to control the fan speed.

This project uses regulated12V,2Apowersupply
This project is useful in process industries for maintenance and controlling of Boilers temperature.

When the temperature exceeds 30°C the fan starts rotating .Alow- frequency pulse - width modulation (PWM) signal, whose duty cycle is varied to adjust the fan's speed is used.

A voltage regulator is an integrated circuit(IC) that provides a constant fixed output voltage regardless of a change in the load or input voltage.

It can do this many ways depending on the topology of the circuit within ,but for the purpose of keeping this project basic, we will mainly focus on the linear regulator.

In power supplies , capacitors are used to smooth(filter) the pulsating DC output after rectification so that a nearly constant DC voltage is supplied to the load .

The pulsating output of the rectifiers has an average DC value and an AC portion that is called ripple voltage . Filter capacitors reduce the amount of ripple voltage to a level that is acceptable.

It should be noted that resistor sand inductors can be combined with the capacitors to form filter networks. Here we will concentrate on capacitive filters only . In a filter circuit the capacitor is charged to the peak of the rectified input voltage during the positive portion of the input.

When the input goes negative , the capacitor begins to discharge into the load.

The rate of discharge is determined by the RC time constant formed by the capacitor and the load's resistance.

Filters is used to removes ripple sand noise.

4.4. MOTOR DRIVE:

Fig4.4.4 Motor drive

One of the easiest and in expensive way to control DC motors is to interface L293D Motor Driver IC with Arduino. It can control both speed and spinning direction of two DC motors.

And as a bonus , it can even control a unipolar stepper motor like28BYJ-48 or Bipolar stepper motor like NEMA 17 Controlling a DC Motor.

In order to have a complete control over DC motor,

We have to control its speed and rotation direction . This can be achieved by combining these two techniques.

• PWM–For controlling speed H-Bridge–For controlling rotation direction

• PWM–For controlling speed The speed of a DC motor can be controlled by varying its input voltage.

A common technique for doing this is to use PWM (Pulse Width Modulation)

PWM is a technique where average value of the input voltage is adjusted by sending a series of ON-OFF pulses.

The average voltage is proportional to the width of the pulses known as Duty Cycle. The higher the cycle, the greater the average voltage being applied to the dc motor(High Speed) and the lower the duty the less the average voltage being applied to the dc motor(Low Speed). Below image illustrates PWM technique with various duty cycles and average

CHAPTER5

SYSTEMARCHITECTURE

5.1PROPOSEDSTRATEGIESFORSUSTAINABLE AGRICULTURE-CHATBOT

The proposed architecture for the sustainable agriculture domain chatbot with blockchain integration consists of multiple interconnected components designed to enhance agricultural decision-making, ensure transparency, and secure data management. At the core of the system is an AI-powered chatbot that serves as the primary interface for farmers, enabling them to receive personalized recommendations on crop selection , pest control , weather-based strategies, and resource management. This chatbot processes user inputs and utilizes machine learning algorithms to analyze historical and real-time data, providing actionable insights.

To ensure data security and transparency, blockchain technology is integrated into the system, offering a decentralized and tamper-proof ledger for storing critical agricultural data, such as s oil reports, weather conditions, and yield forecasts. Smart contracts further streamline agricultural operations by automating processes like subsidy distribution, insurance claims, and trade agreements, reducing dependency on intermediaries. Additionally, IoT sensors deployed in fields continuously monitor environmental parameters like soil moisture, temperature, and humidity, feeding real-time data into the system . This information helps in generating accurate recommendations and triggering alerts for necessary interventions.

Awebandmobiledashboardprovidesfarmerswithauser-friendlyinterfacetotrackblockchain transactions, view AI-driven insights, and monitor farming conditions effectively. The integration of these technologies ensures a seamless, efficient, and secure agricultural ecosystem, empowering farmers with data-driven decisions while promoting sustainability in farming practices.

4o

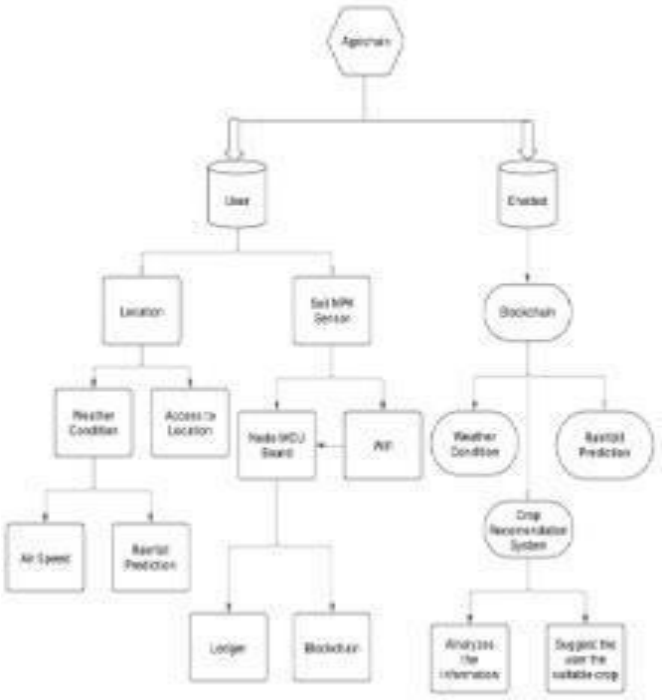


Fig5.1.1 Architecture of Personalized Chatbot Assistant

CHAPTER6

SYSTEMIMPLEMENTATION

SAMPLECODE:

```
<!DOCTYPEhtml>
<htmllang="en">
<head>
<metacharset="UTF-8">
<metaname="viewport"content="width=device-width,initial
scale=1.0">
<title>AgrichainChatbot</title>
<style>
body {
font-family:'Arial',sans-serif;
margin: 0;
padding:0;
background-color:#f1f8e9;
display: flex;
justify-content:center;
align-items: center;
height: 100vh;
flex-direction:column;
overflow: hidden;
}
.chat-container {
background-color:#ffffff;
```

```
width:380px;
  max-width: 100%;
border-radius:12px;
box-shadow:010px20pxrgba(0,0,0,0.1); padding:
20px;
position:relative;
display: flex;
flex-direction:column;
height: 500px;
overflow: hidden;
}
.chat-header{
background:linear-gradient(45deg,#66bb6a,#388e3c);
color: white;
padding:15px;
border-radius:12px12px00;
text-align: center;
font-weight:bold;
font-size: 18px;
box-shadow:04px8pxrgba(0,0,0,0.1);
}
.chat-box{
height:calc(100%-120px);/*Adjustheighttofittheinput box */
```

```
overflow-y: auto;
margin-bottom:10px;
padding-right: 15px;
border-bottom:2pxsolid#66bb6a;
flex-grow: 1;
display:flex;
flex-direction:column;
gap: 15px;
}
.message {
display:flex;
align-items: center;
padding:10px15px;
border-radius:25px;
max-width: 75%;
box-shadow:06px12pxrgba(0,0,0,0.15); animation:
slideIn 0.4s ease-in-out;
}
@keyframesslideIn{
from {
transform:translateX(20px);
opacity: 0;
}
to {
transform:translateX(0);
```

```
opacity:1;
}
}
.bot-message{
background-color:#a5d6a7;
text-align: left;
margin-left:0;
}
.user-message {
background-color:#66bb6a;
color: white;
text-align: right;
margin-left:auto;
}
.input-container{
display: flex;
justify-content: flex-start;
align-items: center;
position: absolute;
bottom: 20px;
left:20px;/*Align theinputboxtotheleft */
width:90%;/*Keepsitwithinthewidthofthechat container
*/
box-sizing:border-box;
}
```

```
.input-containerinput{
width: 80%;
padding: 12px 15px;
border:2pxsolid#66bb6a;
border-radius: 50px;
font-size:16px;
outline: none;
transition:border-color0.3s;
}
.input-containerinput:focus{
border-color: #388e3c;
}
.input-container button {
background-color:#66bb6a;
color: white;
padding: 12px;
border: none;
border-radius:50%;
cursor: pointer;
transition:background-color0.3sease;
margin-left:10px;/*Spacebetweeninputandbutton */
}
.input-containerbutton:hover{
background-color: #388e3c;
}
```

```
.input-container button:focus
  outline: none;
  }
  </style>
  </head>
  <body>
  <divclass="chat-container">
  <divclass="chat-
  header">Agrichain Chatbot
</div>
<divclass="chat-box"id="chat-box">
<!--Messageswillappearhere-->
</div>
<divclass="input-container">
<inputtype="text"id="user-input"placeholder="Askme anything
  about Agrichain..." />
<buttonid="send-button">→</button>
</div>
</div>
<script>
const chatBox = document.getElementById("chat-box");const
userInput = document.getElementById("user-input");
constsendButton=document.getElementById("send-button");
//Sampleresponsesforthechatbot
  const botReplies = {
```

```
"hello":"Hi!I'mAgrichain.HowcanIassistyouwith
blockchain today?",
"what is agrichain?": "Agrichain is a blockchain-based
platform designed to streamline agricultural processes.",
"help": "I can help you understand how Agrichain uses
blockchainfortransparencyinagriculture.Askmeanything!",
"MyNPKvaluesare12.3,45.7,89.5,whattypeofcropscani
grow?":"Itlooksgood !Youcangrowmilletsandrice.ButFirst may I
know your location?",
"IaminPorur":"Porurisafantasticplace,togrowallthese crops
go ahead!",
"default":"Sorry,Idon'tunderstandthat.Canyouask
something else about Agrichain?"
};
functionsendMessage(message,isUser=false){
constmessageElement=document.createElement("div");
messageElement.classList.add("message");
if (isUser) {
messageElement.classList.add("user-message");
```

```
messageElement.textContent=message;
}else{
messageElement.classList.add("bot-message");
messageElement.textContent = message;
}
chatBox.appendChild(messageElement);
chatBox.scrollTop=chatBox.scrollHeight;//Scrolltothe
latest message
}
functiongetBotResponse(userMessage){
const lowerMessage = userMessage.toLowerCase();
returnbotReplies[lowerMessage]||botReplies["default"];
}
sendButton.addEventListener("click",()=>{
const message = userInput.value.trim();
if(message){
// Show user's message
sendMessage(message, true);
userInput.value="";//Clearinputfield
//Showbot'sreply
```

```
const botResponse = getBotResponse(message);
setTimeout(()=>sendMessage(botResponse,false),500);
}
});
userInput.addEventListener("keypress",(e)=>{
if (e.key === "Enter") {
sendButton.click();
}
});
//Initialgreetingfromthebot
        setTimeout(()=>sendMessage("Hi!WelcometoAgrichain. How
        can I help you today?", false), 500);
        </script>
        </body>
        </html>
```

BACKENDIMPLEMENTATION:

```
classTemperatureAnalyzer:
    def __init__(self):
    self.crop_data = {
```

```
        'Tomato':{'min_temp':15,'max_temp':30},
       'Lettuce':{'min_temp':10,'max_temp':25},
       'Wheat':{'min_temp':5,'max_temp':20},
       'Corn':{'min_temp':20,'max_temp':35},
        potato':{'min_temp':10,'max_temp':25},
       'Soybean':{'min_temp':20,'max_temp':30},
          'Cabbage':{'min_temp':10,'max_temp':25}
            }

    Def recommend_ crops(self, temperature):
          suitable_crops = []
          forcrop,temp_rangeinself.crop_data.items():
           iftemp_range['min_temp']<=temperature<=temp_range['max_temp']:
                 suitable_crops.append(crop)
           returnsuitable_crops

classSoilSample:
def __init__(self,nitrogen,phosphorus,potassium):
   self.nitrogen = nitrogen
   self.phosphorus=phosphorus
   self.potassium = potassium


          classPlantDatabase:
             def __init__(self):
```

```
            self.plant_data={
                'Tomato':{'nitrogen':(0.5,0.8),'phosphorus':(0.3,0.6),'potassium':
(0.4,0.7)},
                'Lettuce':{'nitrogen':(0.4,0.7),'phosphorus':(0.2,0.4),'potassium':
(0.3,0.6)},
                'Carrot':{'nitrogen':(0.3,0.6),'phosphorus':(0.2,0.5),'potassium':
(0.3,0.6)}
            }


        defrecommend_plant(self, soil_sample):
            recommended_plants = []
            forplant,rangesinself.plant_data.items():
                if(ranges['nitrogen'][0]<=soil_sample.nitrogen<=
ranges['nitrogen'][1] and
                    ranges['phosphorus'][0]<=soil_sample.phosphorus<=
ranges['phosphorus'][1] and
                    ranges['potassium'][0]<=soil_sample.potassium<=
ranges['potassium'][1]):
                    recommended_plants.append(plant)
            return recommended_plants


#Exampleusage:
        temperature=25
```

soil_sample=SoilSample(nitrogen=0.6,phosphorus=0.4,potassium=0.5)

```
analyzer=TemperatureAnalyzer()
recommended_crops=analyzer.recommend_crops(temperature)

ifrecommended_crops:
        print("Recommendedcropsbasedonthetemperatureof",temperature,
"°C:")
    forcropinrecommended_crops:
        print("-", crop)
else:
    print("No crops recommended for the temperature of ", temperat ure,"°C.")

plant_db = PlantDatabase()
recommended_plants=plant_db.recommend_plant(soil_sample)

ifrecommended_plants:
    print("\n Recommended plants based on soil sample:")
    for plant in recommended_plants:
        print("-",plant)
else:
   print("\n No plants recommended for the given soil sample.")


classTemperatureAnalyzer:
    def __init__(self):
```

```
                self.crop_data={
                    'Tomato':{'min_temp':15,'max_temp':30},
                    'Lettuce':{'min_temp':10,'max_temp':25},
        'Wheat':{'min_temp':5,'max_temp':20},
        'Corn':{'min_temp':20,'max_temp':35},
        'Potato':{'min_temp':10,'max_temp':25},
        'Soybean':{'min_temp':20,'max_temp':30},
        'Cabbage':{'min_temp':10,'max_temp':25}
    }

  defrecommend_crops(self, temperature):
    suitable_crops = []
    forcrop,temp_rangeinself.crop_data.items():
      iftemp_range['min_temp']<=temperature<=temp_range['max_temp']:
        suitable_crops.append(crop)
    returnsuitable_crops



classSoilSample:
  def __init__(self,nitrogen,phosphorus,potassium):
    self.nitrogen = nitrogen
    self.phosphorus=phosphorus
    self.potassium = potassium
```

```
classPlantDatabase:
    def __init__(self):
        self.plant_data={
            'Tomato':{'nitrogen':(0.5,0.8),'phosphorus':(0.3,0.6),'potassium':(0.4,0.7)},
            'Lettuce':{'nitrogen':(0.4,0.7),'phosphorus':(0.2,0.4),'potassium':(0.3,0.6)},
            'Carrot':{'nitrogen':(0.3,0.6),'phosphorus':(0.2,0.5),'potassium':(0.3,0.6)}
                    }

                defrecommend_plant(self, soil_sample):
                    recommended_plants = []
                    forplant,rangesinself.plant_data.items():
                        if(ranges['nitrogen'][0]<=soil_sample.nitrogen<=
        ranges['nitrogen'][1] and
                            ranges['phosphorus'][0]<=soil_sample.phosphorus<=
        ranges['phosphorus'][1]
                            ranges['potassium'][0]<=soil_sample.potassium<=
        ranges['potassium'][1]):
                            recommended_plants.append(plant)
                    return recommended_plants


                #Exampleusage:
                temperature=25
                soil_sample=SoilSample(nitrogen=0.6,phosphorus=0.4,potassium=0.5)
```

```
analyzer=TemperatureAnalyzer()
recommended_crops=analyzer.recommend_crops(temperature)

ifrecommended_crops:
        print("Recommendedcropsbasedonthetemperatureof",temperature,
"°C:")
    forcropinrecommended_crops:
        print("-", crop)
else:
    print("Nocropsrecommendedforthetemperatureof",temperature,"°C.")

plant_db=PlantDatabase()
recommended_plants=plant_db.recommend_plant(soil_sample)

ifrecommended_plants:
    print("\nRecommendedplantsbasedonsoilsample:") for
    plant in recommended_plants:
        print("-",plant)
else:
       print("\nNoplantsrecommendedforthegivensoilsample.")
```


Agrichain Chatbot
Hi! Welcome to Agrichain. How can I help you today?
Ask me anything about Agrichain...


Agrichain Chatbot
Hi! Welcome to Agrichain. How can I help you today?
what is agrichain?
Agrichain is a blockchain-based platform designed to streamline agricultural processes.
Ask me anything about Agrichain...


Agrichain Chatbot
Hi! Welcome to Agrichain. How can I help you today?
my npk values are 12.3, 45.7, 89.5, what type of crops can i grow?
It looks good! You can grow millets and rice. But first, may I know your location?
Ask me anything about Agrichain...


AGRICHAIN
Agrichain
12.3, 45.7, 89.5
85.7, 89.5
Crowl crop recommed ons crop
Suittability for crops, crops?
Ponur

CHAPTER7

USERINTERFACE

ProductSearch:

The product search feature provides a user-friendly interface that dynamically displays products based on semantic search. Customers can find relevant items using natural language queries , making the shopping experience more intuitive. The system leverages AI-powered embeddings to process queries and enhance search accuracy, ensuring precise and context-aware results. Products are displayed in real time, improving discovery and engagement

Fig7.1 ProductSearch

Product Recommendations:

The product recommendation feature offers a user-friendly interface that dynamically displays personalized suggestions using semantic search. By analyzing user intent and context, the system delivers highly relevant product recommendations tailored to individual preferences.AI-powered algorithms process browsing history and interactions to enhance accuracy, ensuring a seamless and engaging shopping experience. This approach helps customers discover new products effortlessly, improving satisfaction and retention.

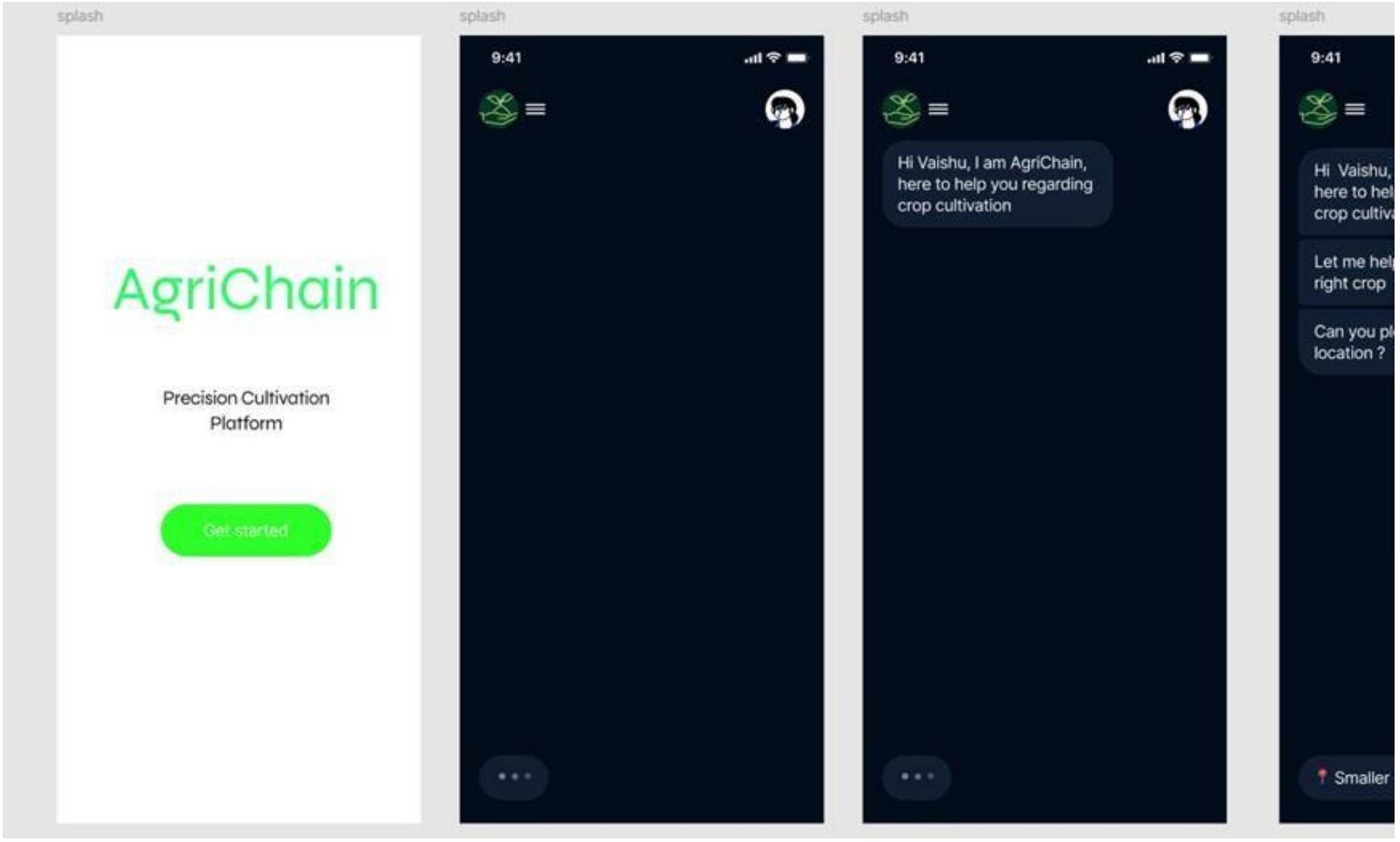


Fig7.2 ProductRecommendations

ProductComparison:

The product comparison feature provides a sleek and intuitive UI that presents side-by-side comparisons using DeepSeek V3. Leveraging AI-driven analysis, it offers detailed insights into product features, prices, and customer reviews. This enables users to make well-informed purchasing decisions by evaluating key attributes efficiently. The seamless interface enhances the shopping experience by simplifying complex product assessments.

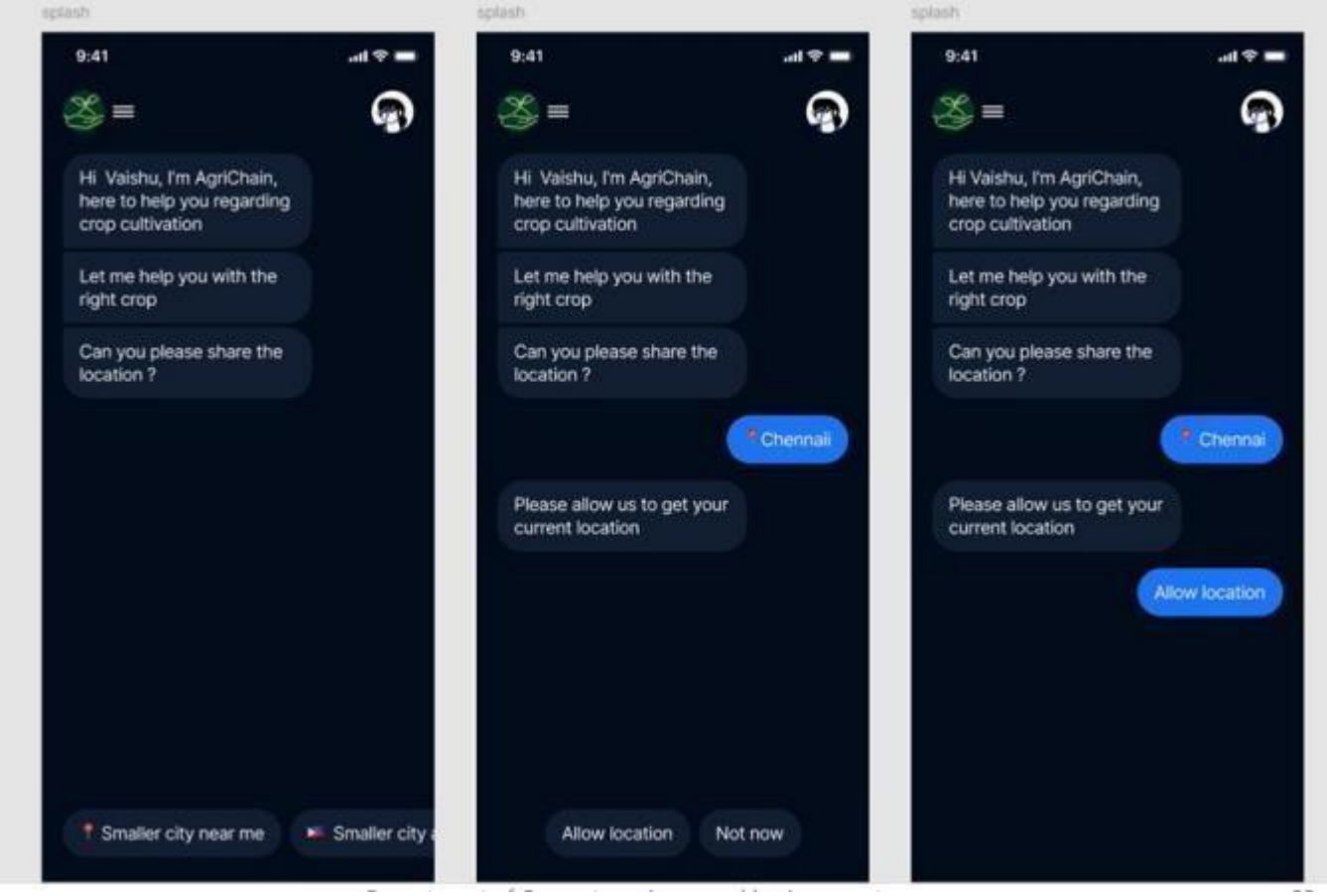
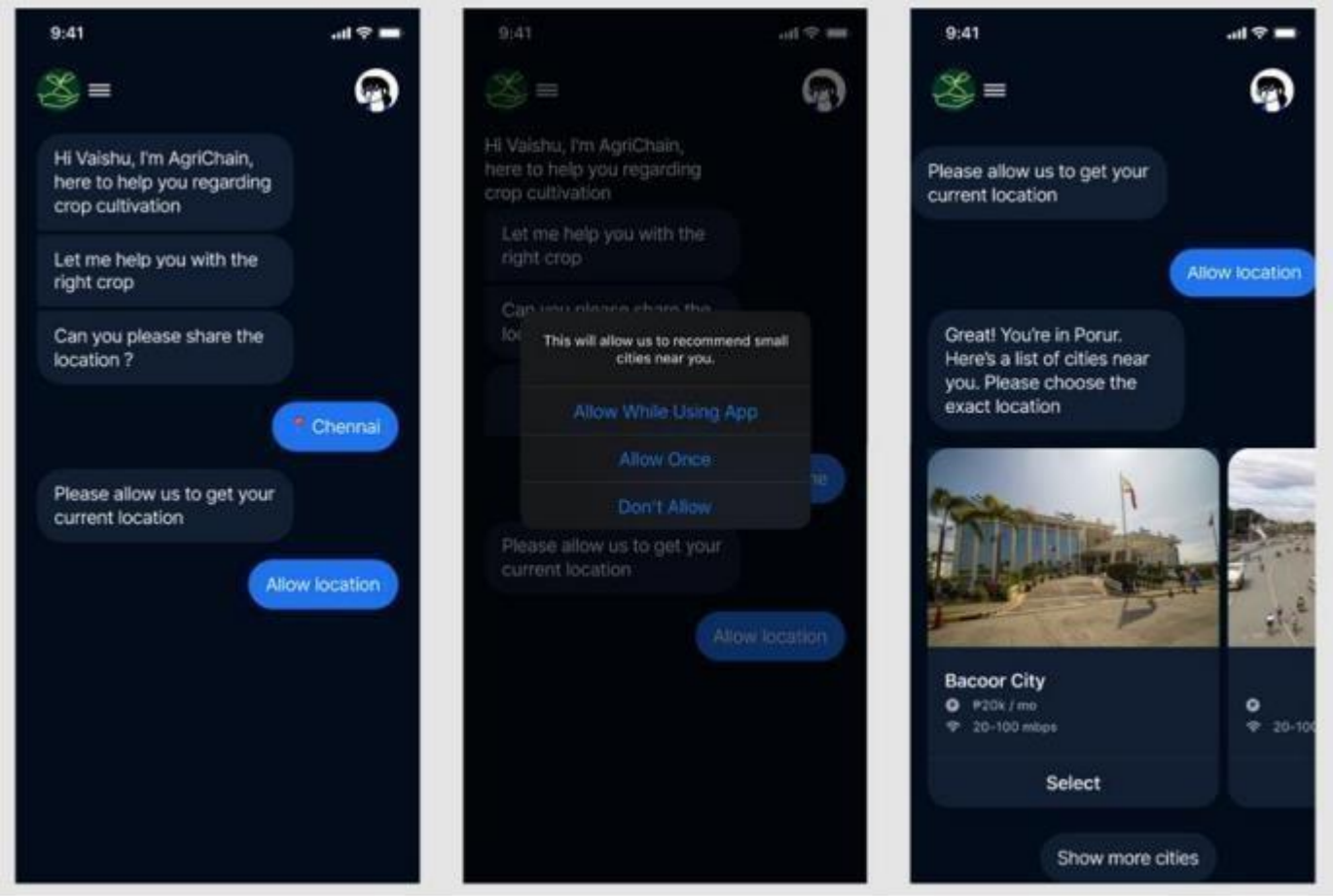
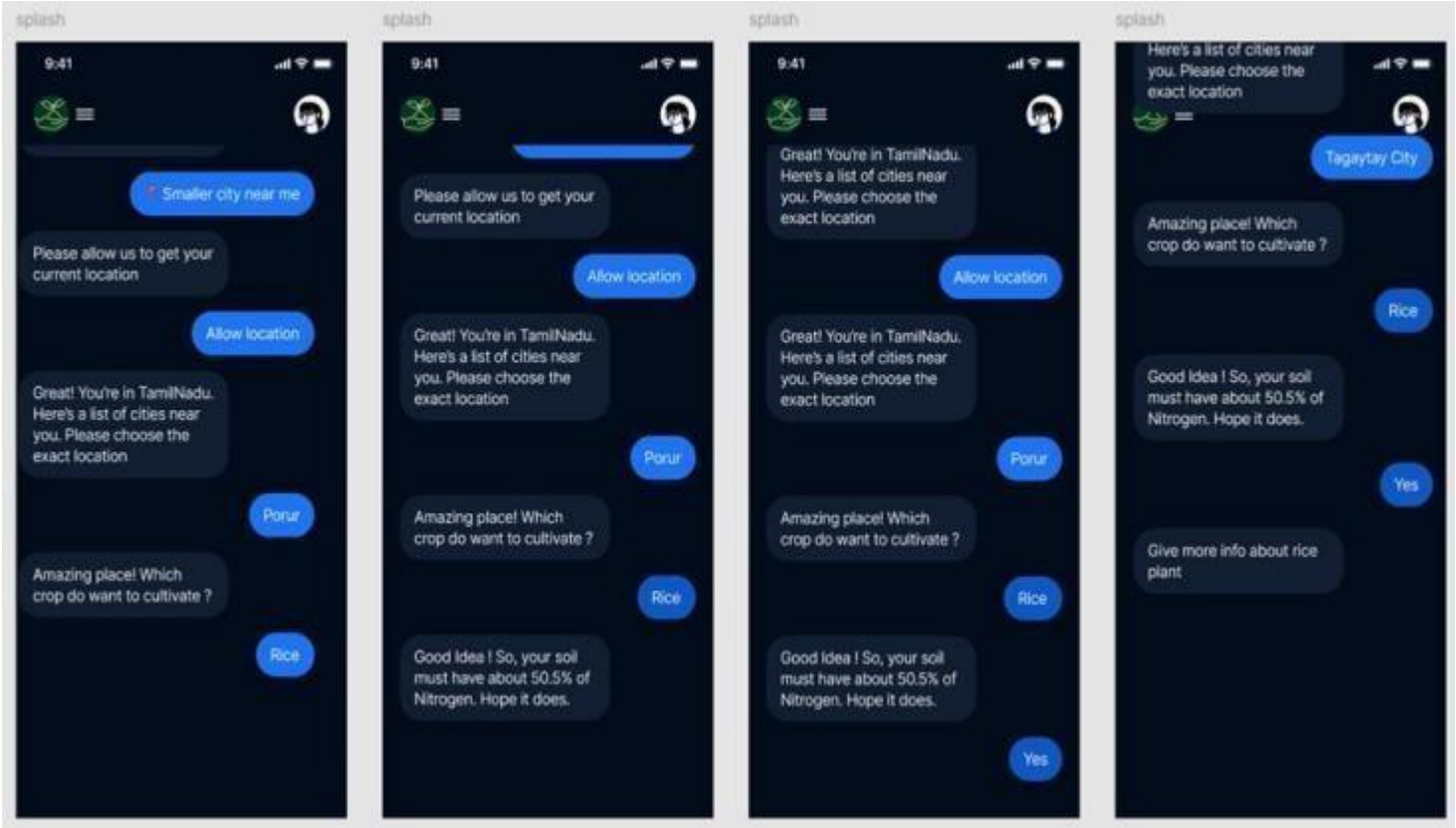
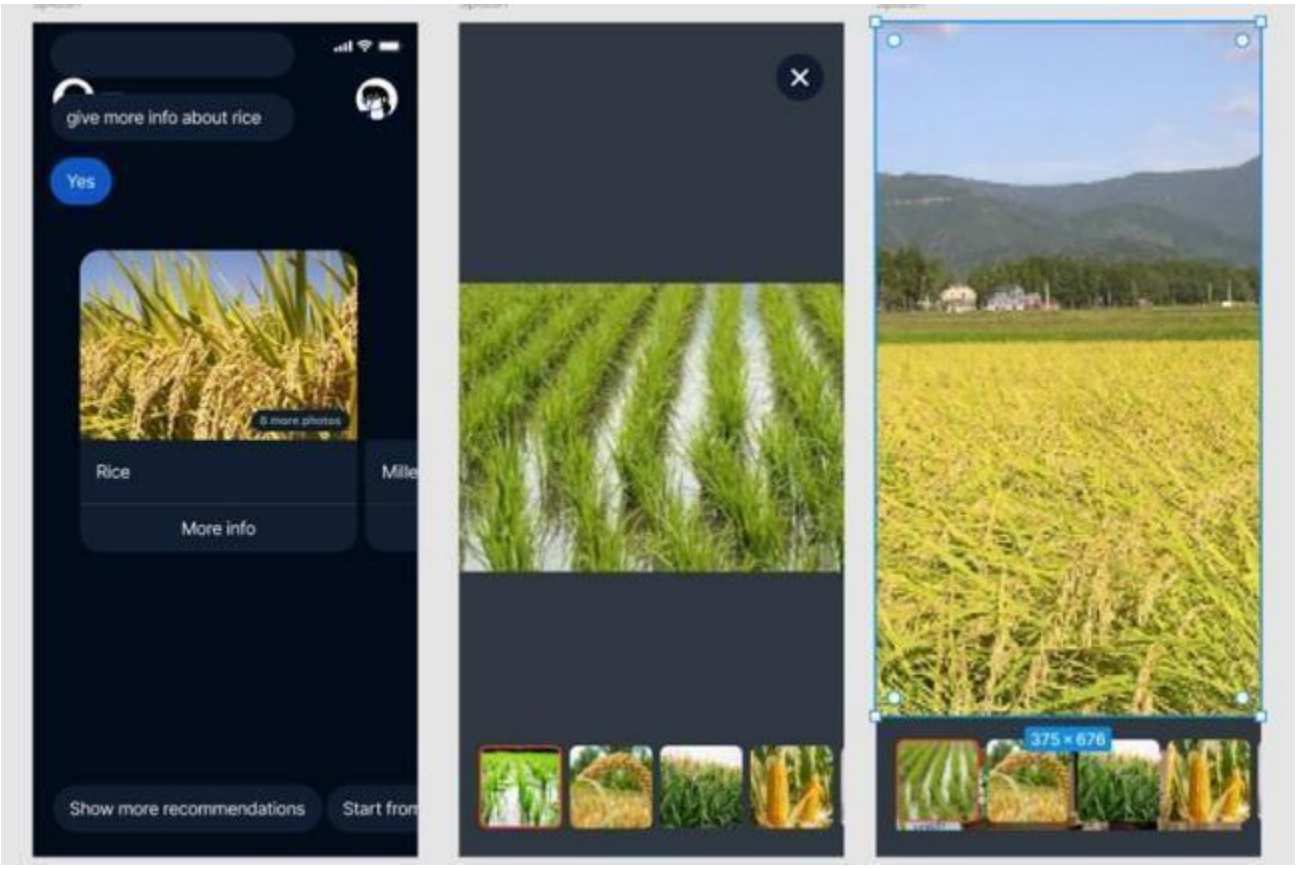
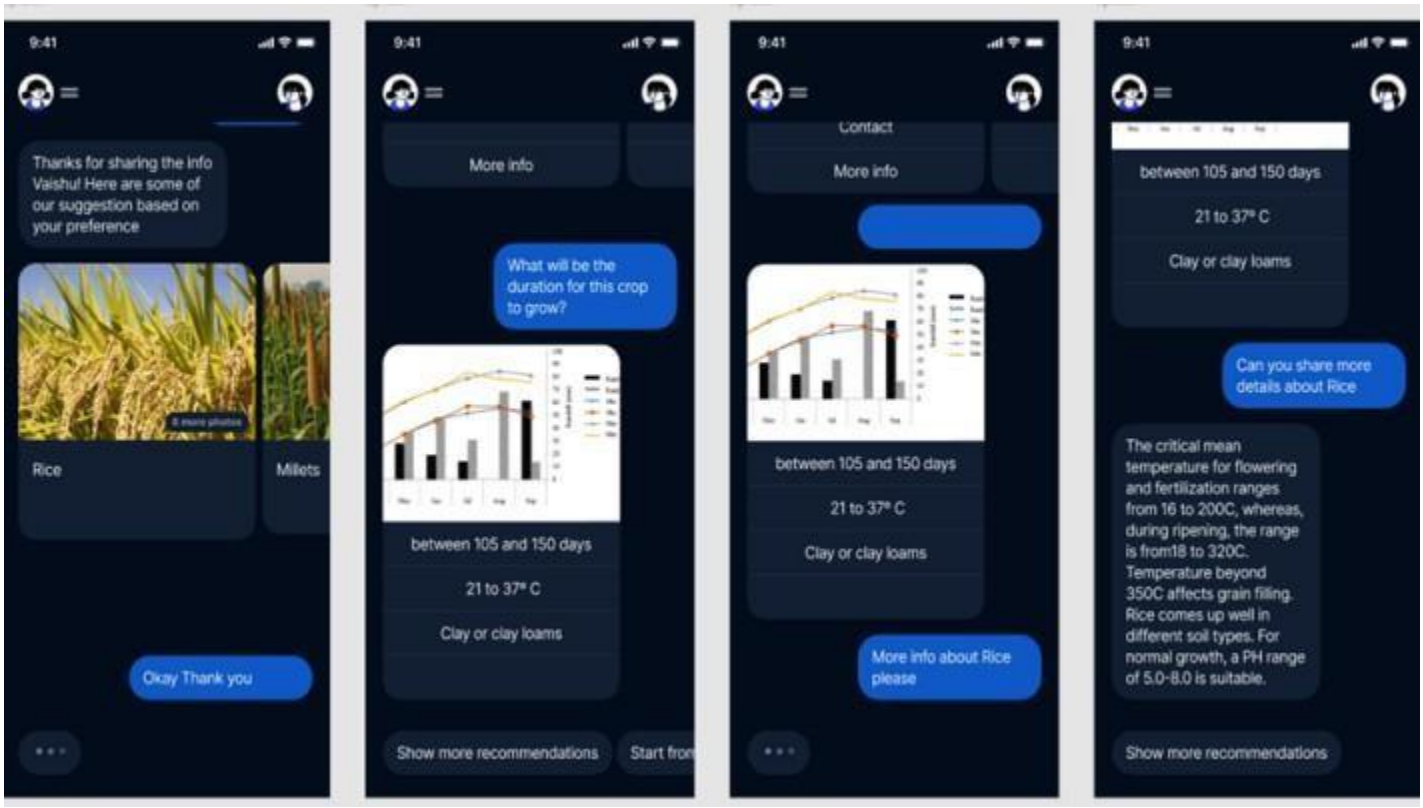


Fig7.3 ProductComparision


9:41
Hi Vaishu, I'm AgriChain, here to help you regarding crop cultivation
Let me help you with the right crop
Can you please share the location ?
Chennai
Please allow us to get your current location
Allow location
This will allow us to recommend small cities near you.
Allow While Using App
Allow Once
Don't Allow
Please allow us to get your current location
Allow location
Please allow us to get your current location
Allow location
Great! You're in Porur. Here's a list of cities near you. Please choose the exact location
Bacoor City
₱20k / mo
20-100 mbps
Select
Show more cities


splash
splash
splash
splash
9:41
Smaller city near me
Please allow us to get your current location
Allow location
Great! You're in TamilNadu. Here's a list of cities near you. Please choose the exact location
Porur
Amazing place! Which crop do want to cultivate ?
Rice
Please allow us to get your current location
Allow location
Great! You're in TamilNadu. Here's a list of cities near you. Please choose the exact location
Porur
Amazing place! Which crop do want to cultivate ?
Rice
Good Idea ! So, your soil must have about 50.5% of Nitrogen. Hope it does.
Great! You're in TamilNadu. Here's a list of cities near you. Please choose the exact location
Allow location
Great! You're in TamilNadu. Here's a list of cities near you. Please choose the exact location
Porur
Amazing place! Which crop do want to cultivate ?
Rice
Good Idea ! So, your soil must have about 50.5% of Nitrogen. Hope it does.
Yes
Here's a list of cities near you. Please choose the exact location
Tagaytay City
Amazing place! Which crop do want to cultivate ?
Rice
Good Idea ! So, your soil must have about 50.5% of Nitrogen. Hope it does.
Yes
Give more info about rice plant


give more info about rice
Yes
Rice
More info
Show more recommendations
375 × 676


Thanks for sharing the info Vaishu! Here are some of our suggestion based on your preference
Rice
Millets
Okay Thank you
More info
What will be the duration for this crop to grow?
between 105 and 150 days
21 to 37° C
Clay or clay loams
Show more recommendations
Contact
More info
between 105 and 150 days
21 to 37° C
Clay or clay loams
More info about Rice please
between 105 and 150 days
21 to 37° C
Clay or clay loams
Can you share more details about Rice
The critical mean temperature for flowering and fertilization ranges from 16 to 200C, whereas, during ripening, the range is from18 to 320C. Temperature beyond 350C affects grain filling. Rice comes up well in different soil types. For normal growth, a PH range of 5.0-8.0 is suitable.
Show more recommendations

CHAPTER8

CONCLUSION&FUTUREENHANCEMENT

CONCLUSION:

TheAI-BasedPersonalShoppingAssistantrevolutionizese-commercebyleveraging advanced AI techniques such as semantic search, embeddings, and natural language processing (NLP). Unlike conventional search engines that rely on keyword matching, this system understands user intent, processes complex queries, and provides meaningful product recommendations. By combining MongoDB for structured product storage, FastAPI for a scalable backend, and a React-based frontend, the system ensures seamless user interactions . The chatbot-driven interface enhances the shopping experience by offering product explanations, comparisons, and personalized recommendations, ultimately making product discovery more intuitive. The integration of AI-powered search significantly improves accuracy and relevance, bridging the gap between customers and the products they seek. This project showcases how AI can transform online shopping into an intelligent, user-friendly, and highly personalized experience.

FUTUREENHANCEMENT:

While the current system effectively provides AI-driven shopping assistance , future enhancements can further refine and expand its capabilities. Implementing a voice-based assistant will allow users to interact with the system hands-free, improving accessibility and user engagement. Additionally, incorporating a visual search featureusingcomputervisioncanenableuserstofindproductsbyuploadingimages, making shopping even more interactive. Adaptive learning mechanisms can be introduced to analyze user behavior over time, ensuring more

Accurate and personalized recommendations . Real-time inventory tracking and price fluctuation alerts can be integrated to keep users informed of the best deals. Moreover, extending the system to support multiple languages will enhance global accessibility . By continuously improving the AI model with user feedback and data-driven insights , the shopping assistant can evolve into amore sophisticated , efficient, and indispensable tool for online shoppers.

CHAPTER9

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