AgroHive

Dr.Rathina Kumar N[1], Dr.P.Sumathi[2], Sree Baarath B [3], Tharaneetharan M [4], Prince Abishek A [5], Nishannth R [6]

[1]*Assistant Professor , Artificial Intelligence & Data Science & SNS College of Engineering*
[2]*Head of the Department , Artificial Intelligence & Data Science & SNS College of Engineering*
[3] *4th Year , Artificial Intelligence & Data Science & SNS College of Engineering*
[4] *4th Year , Artificial Intelligence & Data Science & SNS College of Engineering*
[5] *4th Year , Artificial Intelligence & Data Science & SNS College of Engineering*
[6] *4th Year , Artificial Intelligence & Data Science & SNS College of Engineering*

ABSTRACT - Purchasing agricultural produce through traditional markets often presents challenges for farmers and customers. Farmers face reduced profits due to intermediary commissions, while customers encounter inflated prices and limited access to fresh, quality goods. The lack of direct trade platforms leads to uncertainty about produce quality, unreliable delivery, and concerns over transaction security, resulting in hesitation and dissatisfaction. Additionally, insufficient market trend insights and inefficiencies in supply chains further diminish trust and convenience in agricultural trade. Existing platforms provide basic e-commerce functionalities, such as produce listings, but often lack personalized trade recommendations or robust accessibility for rural users. Security measures are frequently inadequate, increasing risks of fraud, while limited focus on real-time data and logistics reliability hampers efficiency. These gaps highlight the need for a more innovative, farmer-centric solution to enhance trade transparency and accessibility. AgroHive addresses these challenges by integrating advanced AI and cloud-based technologies to deliver a personalized, secure, and efficient agricultural marketplace. Built on Android with Kotlin, Node.js, MongoDB Atlas, and Firebase, AgroHive eliminates intermediaries, enabling farmers to earn fair profits and customers to access affordable, fresh produce. A GenAI-powered chatbot analyzes user preferences and market trends to provide tailored trade recommendations, such as high-demand crops or budget-friendly deals. Multi-factor authentication via Firebase and AI-driven fraud detection ensures secure transactions. Real-time tracking and streamlined logistics improve delivery reliability, while offline caching and multilingual interfaces enhance accessibility for rural users. AgroHive also promotes sustainability by encouraging eco-friendly farming practices. This comprehensive approach fosters a trustworthy, inclusive, and environmentally conscious trade experience for farmers, customers, and marketers.

1. INTRODUCTION

Agricultural trade platforms are harnessing artificial intelligence (AI) and cloud-based technologies to bridge the gap between farmers, customers, and marketers, enabling direct trade without intermediaries. Using Android devices, farmers can list produce, customers can browse real-time catalogs, and marketers can analyze trade opportunities, all from anywhere. This technology gained traction post-COVID-19, as reliance on digital marketplaces surged to meet demands for fresh, affordable produce.

Innovative platforms like AgroHive are setting new standards in agricultural commerce. AgroHive, an Android app built with Kotlin, Node.js, MongoDB Atlas, and Firebase, offers a GenAI-powered chatbot that provides personalized trade recommendations, such as high-demand crops for farmers or budget-friendly deals for customers. By integrating Cloudinary for verified images and offline caching for rural accessibility, AgroHive ensures a seamless, inclusive trade experience.

At the heart of AgroHive's innovation is personalization. Modern users expect more than generic listings; they demand tailored suggestions that match their needs, budgets, and regional market trends. The GenAI chatbot analyzes user data such as trade history and preferences to recommend produce, like suggesting organic vegetables for health-conscious customers or high-yield crops for farmers based on local demand. These algorithms empower users to make informed trade decisions, increasing satisfaction and reducing inefficiencies, a critical issue in traditional markets.

For stakeholders, AgroHive offers benefits beyond streamlined trade. Farmers gain higher profits by bypassing intermediaries, customers enjoy affordable, fresh produce, and marketers access real-time analytics to optimize bulk deals. The platform enhances engagement through in-app messaging, fosters trust with secure Firebase authentication, and provides insights into user behavior, helping refine features. By creating an interactive trade experience, AgroHive stands out in the competitive agricultural e-commerce landscape, encouraging users to explore diverse produce options confidently.

As technology evolves, the potential for agricultural marketplaces continues to expand. Advances in AI-driven predictive analytics, IoT for crop monitoring, and blockchain for supply chain transparency promise richer trade experiences. These developments will deepen personalization and accessibility, enabling platforms like AgroHive to scale globally. AgroHive's integration of AI and cloud technologies not only addresses traditional trade challenges such as intermediary costs and rural connectivity but also delivers a forward-thinking, user-centric solution. By

combining smart personalization with robust functionality, AgroHive transforms how farmers, customers, and marketers engage in agricultural trade, setting a new benchmark for digital innovation and stakeholder satisfaction.

2.EXISTING SYSTEM

Most agricultural trade platforms today focus on enabling farmers and customers to buy and sell produce through basic e-commerce functionalities, such as online listings and payment systems. These platforms have gained traction due to the convenience they offer and the wide range of produce available to users. However, despite their growth, several significant limitations hinder their ability to deliver an optimal trade experience for farmers, customers, and marketers.

One major issue is the reliance on intermediaries, which reduces farmers' profits by up to 30% and inflates prices for customers. Existing platforms often lack advanced features to facilitate direct trade, leaving farmers dependent on brokers and customers uncertain about produce quality or freshness. Additionally, many platforms fail to provide personalized trade recommendations based on user preferences, market trends, or regional demands, resulting in frustration when users struggle to find suitable crops or deals.

Another limitation is the lack of comprehensive product information. Many platforms do not offer detailed insights about produce quality, farmer credentials, or real-time stock availability, leaving customers with unanswered questions about their purchases. Delivery and logistics processes are often unreliable or unclear, with limited tracking options, adding to potential dissatisfaction.

Furthermore, security concerns related to online transactions, such as inadequate authentication or fraud protection, deter users from engaging fully with these platforms. Accessibility is also a challenge, as many systems are not optimized for rural users with low-end devices or limited internet connectivity. Overall, while existing agricultural trade platforms provide a convenient way to buy and sell produce, their limitations intermediary dependency, lack of personalization, incomplete information, unreliable logistics, and security gaps compromise the effectiveness of the user experience, leading to hesitation and dissatisfaction among farmers, customers, and marketers.

3. OBJECTIVE AND SCOPE

The objective of this project is to develop an innovative Android-based agricultural marketplace, AgroHive, designed to deliver a highly personalized and interactive experience for farmers, customers, and marketers seeking to engage in direct trade. By leveraging cutting-edge artificial intelligence (AI) through a GenAI-powered chatbot and cloud-based technologies, AgroHive enables users to list, browse, and trade fresh produce seamlessly, eliminating intermediaries to ensure fair profits for farmers and affordable prices for customers.

Users can manage produce listings, explore real-time catalogs, and access trade analytics tailored to their roles farmers, customers, or marketers through an intuitive interface built with Kotlin and XML. The platform enhances accessibility with offline caching and multilingual support, catering to rural users with limited connectivity. To further enrich the trade experience, AgroHive's GenAI chatbot analyzes user preferences, market trends, and regional demands, offering personalized recommendations, such as high-demand crops for farmers or budget-friendly deals for customers.

Additionally, AgroHive simplifies the trade process by providing comprehensive listing details, including Cloudinary-verified images, farmer credentials, and pricing, all updated in real-time via MongoDB Atlas. Users can access market insights, communicate directly through in-app messaging, and rely on secure transactions powered by Firebase Authentication with phone-based OTP and Google OAuth.

The overall goal is to create a seamless, secure, and inclusive trade experience that exceeds modern stakeholder expectations. By combining advanced technology with user-centric design, AgroHive aims to redefine how agricultural trade is conducted, making it more accessible, efficient, and equitable than ever before. Below are the essential components and features within the project's scope, designed to deliver a complete and satisfying trade journey for all users.

4. SOFTWARE REQUIREMENTS

4.1 PROGRAMMING LANGUAGE

AgroHive leverages Kotlin and XML for its dynamic and component-based Android frontend, enabling rapid updates and smooth rendering of interactive features like produce listings, trade recommendations, and the GenAI-powered chatbot. This structure ensures a responsive user experience, optimized for low-end devices common in rural areas.

For styling, AgroHive employs Material Design principles to create a consistent, visually appealing interface that adapts seamlessly across various Android screen sizes. Material Design's component-based approach accelerates development while maintaining a cohesive aesthetic, with green-and-white themes reflecting AgroHive's agricultural branding.

Additionally, the platform integrates a GenAI API for real-time trade analysis and natural language processing (NLP), powering the chatbot to deliver personalized crop suggestions and market insights, enhancing the user experience for farmers, customers, and marketers.

4.2 SYSTEM REQUIREMENTS

- Platform: Android (App)
- RAM: 2GB (minimum), 4GB (recommended)
- Processor: Quad-core 1.4 GHz or higher
- Storage: 100 MB free space
- Network: 2G/3G/4G or Wi-Fi (offline caching supported)

4.3 SOFTWARE SETUP:

AgroHive is designed to provide a seamless and personalized agricultural trade experience, connecting farmers, customers, and marketers directly. The platform uses a load balancer on Render to manage traffic across three core components: the Frontend System, Backend APIs, and AI Services.

The frontend, built with Kotlin and XML in Android Studio, offers features like dynamic produce listings, in-app messaging, and role-specific dashboards. Offline caching ensures accessibility in low-connectivity areas, while Material Design enhances usability. The backend, powered by Node.js and Express, manages listings, orders, and user data through RESTful APIs, hosted on Render for scalability. The AI services leverage the GenAI API, incorporating NLP and predictive analytics to deliver contextual trade recommendations, such as high-demand crops or budget-friendly deals. All data is securely stored in MongoDB Atlas, a NoSQL database that ensures scalability and reliability. Cloudinary handles image validation for produce visuals, enhancing trust.

A Recommendation Engine combines user preferences, trade history, and market trends to suggest tailored produce options, such as organic vegetables for customers or profitable crops for farmers. This modular design promotes efficiency, accessibility, and personalization, delivering a robust trade experience.

4.4 SYSTEM INTEGRATION AND TESTING:

AgroHive features a secure authentication system via Firebase, supporting phone-based OTP, email, and Google OAuth for seamless logins. Multi-factor authentication (MFA) protects critical actions, such as payment processing, ensuring user data security. Social logins via Google streamline onboarding, particularly for rural users with limited digital literacy.

For trade personalization, the GenAI API analyzes user behavior and market data to provide real-time recommendations, such as suggesting trending crops like quinoa for farmers or affordable greens for customers. The system also displays popular produce based on regional demand, enhancing relevance.

The platform integrates Cloudinary for verified produce images, ensuring accurate visuals that align with listings. Interactive features, like in-app messaging and filter panels, boost engagement, allowing users to negotiate deals or refine searches by price, crop type, or location, even offline.

4.5 DEPLOYMENT AND MAINTENANCE:

AgroHive is a tailored e-commerce solution designed to deliver a seamless and engaging agricultural trade experience. Its intelligent components enhance the overall journey for farmers, customers, and marketers.

The Product Listing and Selection Module provides an interactive interface for farmers to list produce and customers to browse catalogs, with real-time updates via MongoDB Atlas and verified images from Cloudinary. Features include advanced filters and smart sorting for efficient trade discovery.

The AI Chatbot Assistance Module, powered by GenAI, offers real-time trade support, answering queries about crop trends, pricing, or app navigation, ensuring users receive personalized guidance. The Order Management and Tracking Module streamlines transactions, providing real-time order updates and secure payments through a commission-based system.

To build trust, the Feedback and Review Module enables users to rate farmers and produce, fostering a community-driven marketplace. The User Profile and Authentication Module supports secure logins and personalized dashboards, tailored to user roles (farmer, customer, marketer).

Additional features include a Recommendation System Module for tailored crop suggestions, a Favorites Module for saving preferred listings, and a Market Insights Module to highlight trending produce and trade opportunities. AgroHive's modular, scalable architecture, deployed on Render with MongoDB Atlas, ensures adaptability, reliability, and a user-centric trade experience, ready for future enhancements like doorstep delivery.

5. IDEATE

5.1 PROPOSED SYSTEM

AgroHive offers AI-driven recommendations personalized for each user based on their trade preferences, purchase history, and regional market trends. Powered by the GenAI API, this feature creates a trade experience that feels unique and tailored to individual needs, whether users are farmers listing produce, customers buying fresh goods, or marketers seeking bulk trade opportunities.

As users navigate the app, recommendations update in real-time, ensuring a responsive and engaging interaction. For example, a farmer might see suggestions for high-demand crops like organic spinach, while a customer receives deal alerts for locally sourced mangoes. The system also showcases trending produce, such as seasonal vegetables or sustainably grown grains, keeping users informed about popular items and encouraging exploration of new trade options.

AgroHive's recommendation engine learns from user behavior over time, analyzing trade patterns and feedback to improve suggestion accuracy. For instance, if a customer frequently buys organic produce, the system prioritizes similar listings. Additionally, the platform highlights complementary trade opportunities, such as suggesting bulk packaging options for marketers or eco-friendly farming tools for farmers, ensuring users are aware of value-added possibilities that enhance their overall trade experience.

5.2. SOURCE CODE

```
package com.example.agrohive
import android.content.Intent
import android.os.Bundle
import android.view.LayoutInflater
import android.view.View
import android.view.ViewGroup
import android.widget.TextView
import androidx.appcompat.app.AppCompatActivity
```

```
import androidx.recyclerview.widget.LinearLayoutManager
import androidx.recyclerview.widget.RecyclerView
import
com.google.android.material.bottomnavigation.BottomNavi
gationView
import retrofit2.Call
import retrofit2.Callback
import retrofit2.Response
class MessageActivity : AppCompatActivity() {
   private lateinit var recyclerView: RecyclerView
   private lateinit var chatAdapter: ChatAdapter
   private var firebaseUid: String? = null
   override fun onCreate(savedInstanceState: Bundle?) {
      super.onCreate(savedInstanceState)
      setContentView(R.layout.activity_message)
      recyclerView = findViewById(R.id.recyclerView)
      firebaseUid = intent.getStringExtra("firebaseUid")
      chatAdapter = ChatAdapter(emptyList()) { chat ->
         startActivity(Intent(this,
ChatDetailActivity::class.java).putExtra("chatId", chat.id))
      }
      recyclerView.apply { layoutManager =
LinearLayoutManager(this@MessageActivity); adapter =
chatAdapter }

RetrofitInstance.getRetrofitInstance().create(ApiService::cla
ss.java).getChats(firebaseUid ?: "").enqueue(object :
Callback<List<Chat>> {
         override fun onResponse(call: Call<List<Chat>>,
response: Response<List<Chat>>) {
            if (response.isSuccessful)
chatAdapter.updateChats(response.body() ?: emptyList())
         }
         override fun onFailure(call: Call<List<Chat>>, t:
Throwable) {}
      })

findViewById<BottomNavigationView>(R.id.bottomNavig
ationView).apply {
         setOnItemSelectedListener { item ->
            when (item.itemId) {
               R.id.nav_home ->
startActivity(Intent(this@MessageActivity,
HomeActivity::class.java))
               R.id.nav_chat -> true
               else -> false
            }; true
         }
         selectedItemId = R.id.nav_chat
      }
   }
}
class ChatAdapter(private var chats: List<Chat>, private val
onChatClick: (Chat) -> Unit) :
RecyclerView.Adapter<ChatAdapter.ChatViewHolder>() {
   inner class ChatViewHolder(itemView: View) :
RecyclerView.ViewHolder(itemView) {
      fun bind(chat: Chat) {
itemView.findViewById<TextView>(android.R.id.text1).te
xt = chat.otherUserName ?: "Unknown";
itemView.setOnClickListener { onChatClick(chat) } }
   }
   override fun onCreateViewHolder(parent: ViewGroup,
viewType: Int): ChatViewHolder =
ChatViewHolder(LayoutInflater.from(parent.context).inflate
(android.R.layout.simple_list_item_1, parent, false))
   override fun onBindViewHolder(holder:
ChatViewHolder, position: Int) =
holder.bind(chats[position])
   override fun getItemCount(): Int = chats.size
   fun updateChats(newChats: List<Chat>) { chats =
newChats; notifyDataSetChanged() }
}
data class Chat(val id: String, val participants: List<String>,
val otherUserName: String?)
```

4.3 ADVANTAGES

AgroHive offers a robust feedback system where customers can assign star ratings (1 to 5) and submit reviews for purchased produce, promoting transparency in the agricultural marketplace. Post-transaction feedback prompts encourage users to share their experiences, increasing platform engagement and fostering a trusted community. These ratings and reviews, stored and updated in real-time via MongoDB Atlas, are displayed on product listing pages, empowering future customers to make informed decisions based on quality, freshness, and farmer reliability.

6. RESULT AND SCREENSHOTS

Fig 6.1 - Login page

Fig 6.2 – Home page

7. CONCLUSION

AgroHive successfully meets its primary objectives of creating an intuitive and user-centric agricultural marketplace tailored for farmers, customers, and marketers in the competitive e-commerce landscape. A key feature is its dynamic product listing system, enabling farmers to showcase produce with Cloudinary-verified images, addressing the challenge of unreliable visuals and empowering customers to make informed purchasing decisions.

The platform enhances the trade experience with personalized recommendations driven by a GenAI API, leveraging natural language processing (NLP) to analyze user preferences, trade history, and market trends. This ensures tailored suggestions, such as high-demand crops for farmers or cost-effective deals for customers, aligning with individual needs and regional demands.

AgroHive also offers an intuitive navigation system, simplifying produce discovery through filters and real-time MongoDB Atlas updates. Users can browse diverse crops categorized by type, price, or location, while the seamless transaction system enables effortless purchases and sales, supported by secure Firebase Authentication with OTP.

Behind the scenes, a robust backend built with Node.js and Express on Render ensures efficient transaction management, fast processing, secure payments, and reliable order tracking. RESTful APIs integrate seamlessly with Cloudinary and GenAI services, enhancing scalability and performance.

By incorporating feedback from beta testing, AgroHive addresses critical industry challenges, including intermediary commissions, lack of personalization, and transaction security concerns. It delivers a comprehensive solution for farmers seeking higher profits, customers desiring fresh produce, and marketers expanding trade opportunities. AgroHive stands out as a transformative platform, blending AI-driven innovation with user-focused design to redefine agricultural trade, fostering trust, efficiency, and inclusivity.

8. FUTURE ENHANCEMENT

AgroHive's future plans focus on scaling to support a growing global user base by expanding to multiple regions and optimizing Render's cloud infrastructure to handle high traffic. This will ensure seamless produce listings and transaction processing for millions of farmers, customers, and marketers.

To enable cross-regional trade, AgroHive will introduce features for interstate and international transactions, streamlining logistics and currency conversions.

Advanced functionalities, such as blockchain integration, will be implemented to enhance trust and transparency in produce transactions, ensuring verifiable farmer-to-customer chains. Machine learning algorithms will refine the GenAI chatbot's crop recommendations and trade personalization, elevating the user experience.

Additionally, AgroHive plans to integrate IoT-based crop monitoring for real-time quality updates and predictive analytics, providing farmers with actionable insights and customers with fresher produce, fostering a more efficient and sustainable agricultural marketplace.

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