COASTAL CROP ASSISTANT SYSTEM FOR FARMERS

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Introduction:

Agriculture is the backbone of many economies, yet farmers often struggle to find skilled laborers when needed. Our project aims to bridge this gap by developing a Flutter-based mobile application that enhances job matching efficiency between farmers and laborers. The app integrates AI-driven matching algorithms using the K-Nearest Neighbors (KNN) model to connect farmers with suitable workers based on location, skills, and availability.

AgriHire aims to provide an innovative solution to improve job matching efficiency, optimize resource utilization, and offer AI-powered assistance for both farmers and laborers. Traditional hiring methods in agriculture are often cumbersome, leading to inefficiencies and delays in finding appropriate laborers. AgriHire addresses this by offering a user-friendly mobile platform for job postings and hiring, ultimately promoting sustainable agricultural growth.

The application features separate logins and dashboards for farmers and laborers, enabling them to manage profiles, job requests, and interactions. Farmers can hire

laborers based on their skills, availability, and location, while laborers can view and accept job offers directly through the app. The KNN algorithm is seamlessly integrated into the search functionality to ensure intelligent and efficient job recommendations.

Additionally, the AgriHire app provides personalized fertilizer recommendations tailored to specific crops and soil conditions, supporting optimal agricultural productivity. A rental portal is also included, allowing farmers to lease agricultural equipment, thereby reducing operational costs.

To enhance the user experience, the app features an offline AI chatbot, which assists users with queries related to job opportunities, farming techniques, and equipment rentals. This chatbot is backed by phpMyAdmin and the XAMPP server, ensuring smooth backend support and data management.

By integrating these advanced functionalities, AgriHire strives to empower both farmers and laborers, improve agricultural productivity, and contribute to a more connected and efficient agricultural ecosystem.

Objectives:

1. Bridge the Gap Between Farmers and Laborers: Provide a digital platform that directly connects farmers with skilled laborers, reducing dependency on traditional and time-consuming hiring methods.

2. Enhance Job Matching Efficiency**:** Utilize the K-Nearest Neighbors (KNN) algorithm to match laborers to job postings based on location, skill set, and availability—ensuring faster and more accurate hiring.

3. Optimize Resource Utilization: Introduce a rental portal that allows farmers to lease farming equipment, minimizing operational costs and promoting efficient use of shared agricultural resources.

4. Integrate Chatbot: Offers a chatbot backed by a PHP and phpMyAdmin-based backend to answer user queries related to farming, job opportunities and equipment rental.

5. Provide Personalized Fertilizer Recommendations: Employ the KNN model to suggest suitable fertilizers based on crop type, soil condition, and regional climate, thereby improving yield and promoting sustainable practices.

Methodology:

The AgriHire application is designed to connect farmers with appropriate laborers by leveraging AI-driven job matching techniques based on skill and geographical data. The development process begins with data collection and pre-processing, wherein structured information about both farmers and laborers is gathered. This includes critical attributes such as skills, locations, and availability. The data is cleansed and organized to ensure consistency, forming a solid foundation for further analysis.

In the feature extraction phase, two primary attributes are isolated: the skillsets possessed by laborers and their geographic locations. Skills are formatted into categorical variables for compatibility with machine learning algorithms, while location data—typically represented through coordinates—is retained to enable spatial computations. This refined dataset is essential for matching farmers with the most relevant laborers.

For data storage and management, the system employs phpMyAdmin as a database interface, running on the XAMPP stack. The backend schema includes key tables such as farmer, worker, and auth, which manage user profiles, job preferences, location information, and secure login credentials. This MySQL-based structure ensures reliable access and streamlined data operations during job searches and user interactions.

The core of the system's intelligence lies in its machine learning implementation using Python. Two algorithms are applied to enhance job recommendations: the K-Nearest Neighbor (KNN) model, which matches laborers to farmers by comparing skill compatibility and proximity in feature space; and KNearestPlace, a complementary logic that uses geographic distance calculations to prioritize nearby laborers. This combination ensures that laborers recommended to farmers are both well-qualified and conveniently located.

On the backend, API endpoints are built using PHP, integrated within the XAMPP environment. These APIs serve as a bridge between the machine learning module and the Flutter-based mobile frontend. They enable tasks such as user authentication, data retrieval, and job matching, ensuring seamless communication between components of the application.

By integrating these technologies, AgriHire offers an efficient and intelligent platform that simplifies the hiring process for farmers and empowers laborers with accessible job opportunities. The application promotes optimal use of agricultural labor, especially in regions where such matchmaking has traditionally been inefficient or informal.

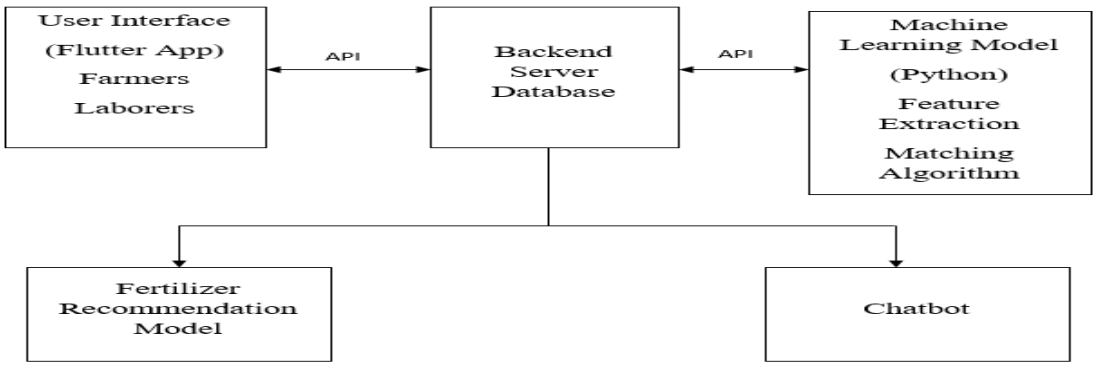

Figure 1: Flow of AgriHire: Bridging the Gap Between Farmers and Laborers

Result and Conclusion:

The AgriHire mobile application successfully addresses the challenge of job matching between farmers and laborers, utilizing AI-driven K-Nearest Neighbors (KNN) algorithms for efficient and accurate laborers recommendations. The app's capabilities, powered by Flutter, allow farmers and laborers to interact seamlessly with the app.

The backend, supported by phpMyAdmin and XAMPP, provides robust data management, enabling real-time updates and smooth user interactions. The KNN model integrates skills, location, and availability data to provide intelligent job matching suggestions. Additionally, the fertilizer recommendation feature and

agricultural equipment rental portal further enhance the app's utility, supporting sustainable farming practices.

User feedback highlighted the app's ease of use, with farmers appreciating the accurate laborers matching system and laborers benefiting from efficient job discovery. System performance metrics confirmed fast response times and high accuracy in job recommendations, contributing to a more streamlined hiring process.

In conclusion, AgriHire demonstrates the transformative potential of AI and mobile technology in the agricultural sector. It bridges the gap between farmers and skilled laborers, promotes resource optimization, and helps increase agricultural productivity. Future improvements will focus on refining AI-based job matching, expanding the app's crop and equipment database, and enhancing the overall user experience to maximize reach and impact.

Project Outcome & Industry Relevance:

The AgriHire project establishes a robust, AI-driven platform designed to streamline the job matching process between farmers and laborers, addressing a crucial gap in agricultural labor availability. By utilizing AI-driven K-Nearest Neighbors (KNN) algorithms, the app ensures accurate, efficient, and location-based job recommendations, offering a user-friendly experience for farmers and laborers alike. The integration of Flutter allows for seamless interaction with the app.

The real-world impact of AgriHire is significant. Farmers can now find and hire skilled laborers based on location, skills, and availability, while laborers benefit from real-time job listings that match their abilities and preferences. The app's ability to provide personalized fertilizer recommendations, in addition to its agricultural equipment rental portal, reflects its comprehensive approach to improving farming operations and optimizing resource utilization.

AgriHire's relevance to the agricultural industry is clear. The system addresses the persistent issue of labor shortages in farming, promotes efficiency, reduces operational costs, and supports sustainable practices by making equipment rental more accessible. Furthermore, the app's AI-driven job matching feature aligns

perfectly with industry needs, offering a cost-effective solution to the problem of finding suitable workers in a timely manner.

The potential for growth and scalability is immense. AgriHire's flexibility allows for future expansion into other services, such as weather forecasting, crop management, and market price predictions, further enhancing its value to farmers and laborers. The app's AI chatbot also opens doors for interactive support and personalized advice, making it a vital tool for agricultural extension services, government agencies, and agri-tech startups.

In conclusion, AgriHire exemplifies how AI and mobile technology can be leveraged to transform agricultural practices. By improving labor management, supporting resource optimization, and providing valuable farming insights, AgriHire is poised to become a key player in enhancing agricultural productivity, sustainability, and knowledge dissemination.

Working Model vs. Simulation/Study:

This project involved the development of a fully functional working model, not just a simulation or theoretical study. The AgriHire mobile application is built using Flutter for the frontend and phpMyAdmin with XAMPP for the backend. It integrates advanced AI components, specifically the K-Nearest Neighbors (KNN) algorithm, to provide accurate laborer recommendations based on factors such as skills, location, and availability. The app allows farmers and laborers to interact seamlessly through dedicated dashboards for posting and accepting job offers.

Project Outcomes and Learnings

The key outcome of the AgriHire project is the successful development of an AI-driven mobile application designed to optimize job matching between farmers and laborers. The app leverages the K-Nearest Neighbors (KNN) algorithm for intelligent laborer recommendations based on location, skills, and availability, alongside features like personalized fertilizer suggestions and agricultural equipment rentals.

Through this project, valuable insights were gained in several areas. The team learned how to integrate machine learning models (such as KNN) with mobile

application development using Flutter, which facilitated the creation of an intuitive, user-friendly interface for both farmers and laborers. Practical experience was gained in managing backend data systems using phpMyAdmin and XAMPP, ensuring that the app could handle real-time job postings and data retrieval efficiently.

Additionally, the project highlighted the importance of designing for accessibility and usability, particularly in rural areas with limited resources. Iterative testing played a crucial role in improving the app's functionality and ensuring that it met the needs of its target users. The integration of features like personalized fertilizer recommendations also provided valuable experience in creating tailored, context-aware services that directly impact farming productivity.

Moreover, the project underscored the significance of AI and mobile technology in transforming agricultural practices. By developing a solution that directly addresses labor shortages and enhances resource utilization, the project showcased how AI-driven applications can improve traditional agricultural operations. The experience gained in developing AgriHire will serve as a foundation for expanding the app’s functionality and scaling it to more regions and farming sectors.

.**Future Scope:**

AgriHire has significant potential for future growth, with plans to expand its functionality beyond job matching. Integrating data from agricultural institutions and adding features like satellite data for real-time soil and weather monitoring could enhance personalized recommendations for farmers. Additionally, expanding the app’s multilingual support to include more regional languages will make it more accessible to a broader audience across India, promoting inclusivity and improving user experience.

The future of AgriHire also includes the potential for integrating a marketplace within the app, allowing farmers to buy, sell, and rent agricultural products and services. Introducing interactive learning modules, crop calendars, and gamified features could transform the platform into an engaging educational tool for farmers. Enhancing offline capabilities and conducting field trials will help validate the app’s impact on

real-world agricultural practices, further strengthening its role in sustainable agriculture.