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Integrated Mobile Solution for Farmers: Enhancing Plant Care and Food Production through Technology

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ABSTRACT

The study investigates an application that examines the various activities farmers undertake in the field, such as soil plowing, fertilization, herbicide application, and traceability of agricultural products. For real-time documentation, the application provides smartphones and tablets to farmers, thereby providing practical, financial, and environmental benefits. In addition, the application has decision support capabilities and mobile services to help implement a network of producing units. Mobile devices are widely used by farmers and countryside people, and mobile-enabled information services and mobile telephony have improved information sharing in knowledge-intensive agricultural areas. India has the largest public extension system globally, but there are gaps in transferring recent farm technologies to farm fields. The introduction of mobile phones has improved agricultural applications and portals for farmers and stakeholders.

I. INTRODUCTION

Agriculture is the backbone of the Indian economy, serving as a cornerstone for food security and rural development. It substantially contributes to the nation's GDP and plays a crucial role in improving the livelihoods of millions of farmers. Over 58% of rural households in India are either fully or partially dependent on agriculture. This means that the sector is not only a source of income but also a way of life for a significant portion of the population.

India boasts the largest public agricultural extension system in the world, with a robust network aimed at disseminating knowledge, innovations, and resources to farmers. During these years, information and communication technology (ICT) tools have changed traditional agricultural extension practice. ICTs allow end-users access to information about a host of agricultural activities in real-time, location-specific formats ranging from the choice of crop or type of crop, pest management, weather forecast, and even market trends. Of all these tools, mobile phones are perhaps the most significant, offering more avenues for improved communication and better access to agricultural applications, portals, and decision-making resources both for farmers and stakeholders.

While the advancement of technology is quick, this makes it more challenging to manage and share agricultural information. For example, integrated crop management requires knowledge about soil health, water management, pest control, and crop nutrition. For smallholder farmers, this maze of information often becomes challenging to navigate, thereby hindering the adoption of best practices. The success of agricultural technologies relies heavily on factors such as their perceived relative advantage, compatibility with existing values and practices, and the ability to address the specific needs and experiences of farmers. Besides, there are external factors such as biophysical and agro-climatic environment that greatly influence the effectiveness of these technologies.

There is an emergent need to have integrated management systems incorporating new and mobile technologies. They can revolutionize agricultural production if they support the use of data-driven insights by precision agriculture towards optimizing farming. Precision agriculture helps in productivity efficiency and sustainability since it optimizes resource usage for better production in agriculture. Finally, the overall approach to it provides a quality basis for evaluating agriculture production and giving farmers the prospects of producing a better yield while diminishing environmental impacts.

The adoption of these advanced tools and methodologies would help Indian agriculture overcome its current list of challenges, augment the resource bases of farmers, and enable general sectoral growth and sustainability. ICT along with mobile and precision agriculture integration forms a giant step toward the realization of the full potential of modern agricultural practices to ensure long-term success for Indian agriculture.

II. Problem Statement

Agriculture faces a growing array of challenges that threaten food security and sustainable development. Key issues include:

1. Climate Change: The effects of climate change, including unpredictable weather patterns, increasingly frequent extreme weather events, and shifts in growing seasons, have a profound impact on crop yields. These disruptions make it difficult for farmers to plan planting and harvesting cycles, often resulting in significant economic losses and food shortages.
2. Resource Constraints: Limited access to essential resources, such as water and fertile soil, poses significant barriers to agricultural productivity. Land degradation due to overuse, deforestation, and unsustainable farming practices further exacerbates the situation, making it difficult for farmers to maintain or increase yields.
3. Lack of Access to Information: Smallholder farmers, who constitute a large portion of the agricultural workforce globally, often lack timely access to critical information. Market data, weather forecasts, and expert agricultural advice are either unavailable or inaccessible in many rural areas, leaving farmers to rely on guesswork and

traditional knowledge that may no longer be sufficient in a rapidly changing environment.

4. Inefficient Practices: Many traditional farming techniques are labor-intensive, time-consuming, and environmentally damaging. These methods often result in low productivity, higher input costs, and long-term harm to the ecosystem, including soil erosion, loss of biodiversity, and greenhouse gas emissions.

Mobile technology has the potential to address these issues effectively by empowering farmers with real-time information, enabling them to make data-driven decisions. Through mobile applications, farmers can access accurate weather forecasts, market prices, and expert guidance, helping them plan their activities efficiently. Furthermore, digital tools can optimize resource use by promoting precision farming techniques, monitoring soil and crop health, and improving irrigation efficiency. By integrating technology into agriculture, we can transform traditional farming into a more sustainable, resilient, and productive system capable of meeting the demands of a growing global population.

III. Decision Support System (DSS)

DSS is a Computer based decision making system. A decision is a choice between two or more alternatives based on estimates of their values. Supporting a decision entails assisting farmers who are working alone or in a group in gathering information, generating alternatives and making decisions. DSS has therefore been considered and designed to provide farmer with the best possible options and decisions for present agricultural operations. DSS encompasses details on season, variety, soil, water, land preparation, management of nursery, nutrient, pests and diseases, details on the tools and Implements post-harvest ideas, value addition, and details about the other institutions and schemes.

1. Crop Doctor

Crop doctor is an integral part of the expert system which serves as a tool for Artificial Intelligence. This module depends on 'if and then rule' program. It is highly image and picture based system component. The core function of crop doctor is diagnosis of pests and diseases as well as nutritional disorders that are harming the crops selected. In the major visual signs, which is characterized by many phases, the primary symptom was evidenced as a series of thumbnail pictures with various stages. Utilizing the if and then rule program, the stages of the primary and secondary symptoms were recorded and uploaded to the expert system shell. Thereafter, the involved experts have tested the symptoms and come up with a solution output.

2. Agromarknet

AGROMARKNET is a e-network for marketing of agricultural products with correct and appropriate knowledge of prices and market arrivals by farmers and trading by stakeholders. It can be accessed via internet access. It is a central sector scheme that covers and collects information related to agricultural produce prices and details of market arrivals on a day-to-day basis. e-Alert is a way to inform common people about the price agricultural product through e-mail and SMS .

IV. Enhancing plant care

Gardening need not be kept in the same old era while technology interconnects every nook and cranny of life. First step to making successful plant care schedule is knowing exactly what each type of plant requires. There are some keypoints as follows:-

1. Watering Schedule and Reminders

Over-watering or under-watering must be one of the most common plant care mistakes. Fortunately, a smartphone can act as a significant assistant in preserving the perfect water schedule. These applications, namely Waterbot and Vera, make sure you send reminders to water, considering the demand of each kind of plant you have. The establishment of personal reminders would help in watering the plants appropriately and in sufficient quantities to make them reach at the right time to the correct amount to remove guesswork, thereby promoting healthy growth in the way they perform the role of Watering Schedules and Reminders.

2. Fertilization and Soil Health

Another important care part of the plant is when to fertilise your plants and how. Your cell phone is quite handy because the apps show which type of fertilizer your plant may need, even the interval needed for applying these fertilisers. Devices like the smart soil sensors can also connect to your smartphone to be monitoring the amount of moisture present, pH, or nutrient level. This real-time information will make for actionable input as you aim for the ideal growing conditions of the soil.

3. Proper Lighting

Bright Light: Most plants need bright, indirect light for 6-8 hours a day. Place plants near windows but avoid direct sunlight, which can scorch leaves.

Low Light: Some plants, like pothos and snake plants, tolerate low-light conditions and can thrive in shadier spots.

Grow Lights: If natural light is insufficient, consider investing in a grow light to mimic sunlight.

4. Share Plant Care with a Community of Other Enthusiasts

No one should face the journey of plant care alone. GrowIt! connects you to a global community of fellow gardeners and plant enthusiasts so that you share experiences, learn from others' successes and mistakes, and learn from the world's collective gardening wisdom-all in the palm of your hand. Discover tips on the best ways to propagate succulents or where to find the indoor plants that have people raving about them.

5. Ecological Gardening Practices

In an age where sustainability is of paramount importance, your smartphone can guide you towards more eco-friendly gardening practices. From water conservation tips to advice on organic pest control, apps can provide you with information on how to minimize your environmental footprint while maximizing the health and beauty of your garden.

6. Integrate Smart Home Devices

For those who are embracing technology in every area of their lives, smart home devices integrated into your phone really take plant care to a new level. For instance, the watering system, grow lights, and thermostats can all be controlled using your smartphone. You can control the perfect environment for your plants even when you are away from them.

V. Advantages of Mobile phone for farmers

Mobile phone technology has revolutionized agriculture through providing tools and resources that farmers could

hardly get access to previously. It offers various benefits to the benefit of the efficiency of the farm, its productivity, and profitability. With a mobile phone, the farmer can get all sorts of information on crops, soil conditions, climate, rainfall, seed varieties, and machineries at hand and in real-time. This localized and timely information helps farmers make well-informed decisions tailored to their specific needs and geographical conditions, enabling them to maximize productivity while minimizing risks.

One of the key benefits of mobile phone technology is the convenience it offers. Farmers can access organized and regularly updated information through various agricultural applications and platforms, eliminating the need for time-consuming searches or reliance on external sources. This ease of use not only saves time but also reduces the physical and financial burden associated with traditional methods of information retrieval. Whether it is learning about the latest agricultural techniques or finding solutions to pest infestations, mobile phones serve as a one-stop resource for farmers.

Market connectivity has also been significantly enhanced through mobile phones, bridging the gap between farmers, buyers, and sellers. Due to their better access and view of potential markets, farmers can directly communicate with the buyers and engage in price negotiations free from intermediaries; subsequently, their profit margins are expanded. Mobile phones offer live quotes on commodity prices that enable farmers to update their knowledge on the trends in those markets and thus sell their crops at the right time. This transparency enables them to avoid exploitation and get good prices for their crops.

The other very important advantage of mobile phones is their contribution towards improving logistics and supply chain management. Through mobile applications, farmers can monitor warehousing facilities, manage inventories, and track the movement of goods. If farmers can check the stock level, dead stock, and fulfill the purchase requirement, then produce will reach end consumers on time and in good quality. Further, mobile technology provides for better planning of storage and transportation that can minimize post-harvest losses and ensure effective delivery of products. Mobile phones also contribute to the overall comfort and precision of agricultural practices. By using applications that provide weather forecasts, planting schedules, and irrigation recommendations, farmers can align their activities with optimal conditions, improving efficiency and sustainability. Some applications even offer virtual advisory services, allowing farmers to consult experts and receive personalized guidance without having to travel.

This further becomes a means for the exchange of knowledge between farmers and gives the farmers a platform for being more socially integrated with one another. The exchange of best practices, tips, and success stories in social media groups, messaging apps, and farmer networks is very useful for more informed and connected agricultural ecosystems. In a nutshell, mobile phone technology has transformed agriculture by providing farmers with real-time, localized, and well-organized information. It enhances market connectivity, streamlines logistics, and facilitates precision agriculture, thus improving productivity and livelihoods. As mobile technology continues to evolve, its potential to further empower farmers and strengthen agricultural practices will only grow, making it an indispensable tool in modern farming.

Other advantages of Mobile phone on installed application

1. eMandi

eMandi is an online mobile application used for commodity trading across Agricultural Produce Market Committees (APMCs) in India. It connects major APMCs with key markets, provides transaction logging and streaming of market data and SMS-based authenticated trading, and allows direct transactions from trader to farmer without commission agents. It also allows stock and inventory tracking for each commission agent and traders. It has integrated mobility solutions over SMS, Windows Mobile, Android, and iOS. eMandi provides a transparent platform for farmers to sell their grains directly to traders, send trading tips and daily reports by SMS, and operate across all platforms. It ties together all stakeholders, thereby reducing the time to market.

2. Kisan Suvidha

Kisan Suvidha is an omnibus mobile app developed to help farmers by providing relevant information. The app provides information to farmers on weather, market prices, dealers, plant protection, IPM practices, seeds, expert advisory, Soil Health Card, godowns and cold storage. The information is currently provided in English, Hindi, Tamil, Gujarati, Odia and Marathi.

3. Pusa Krishi

This mobile app was launched for farmers in order to take the technology to farm□elds. Provides information related to new varieties of crops developed by the Indian Council of Agricultural Research (ICAR), resource conserving cultivation practices, farm machinery and its implementation and production technologies, to the farmers A feedback section enables farmers to have a real time conversation with the stakeholders.

4. ShetkariMasik Android App

"Shetkari Masik" is one of the popular monthly magazines in the Agriculture sector, published since 1965 by the Department of Agriculture, Maharashtra. The Android app for Shetkari magazine has a very simple interface and requires mobile internet or Wi-Fi connectivity to register and download the issues. Once downloaded, the magazine can be read without internet connectivity.

5. Krishi Vigyan

This app provides information in Telugu on modern scienti□c management practices for Agriculture & Horticulture crops growing in Andhra Pradesh, along with photographs. It helps farmers and extension workers in identi□cation of □eld level problems like nutrient de□ciency, pest & diseases and to take decisions at the right time.

6. Krishi Video Advice mobile app

Krishi Video Advice project aims to provide advisory services related to agriculture and allied sector on farming issues with the help of a mobile app/smartphone/tab. The project has been conceptualized by MANAGE to bridge the information gap between the farmer and the expert. The mobile app works on all smart phones or tabs having android operating system. Any farmer/extension of□cer can use the mobile app to capture three images of the crop live from the farmers □eld itself and upload the same. The Kisan

Call centre (KCC) expert will provide advice based on the crop images.

VI. How Beneficial are these Mobile Apps for Farmers?

Nowadays there are a lot of campaigns happening in rural areas to promote mobile apps for agriculture. They help farmers to learn and adopt the mobile phone to help in their daily farming. In the past few years, There have been many apps launched for farmers. However, many of them provide as many services as needed. There are the basic requirements that every farmer needs. Mobile applications offer great advantages to the farming community in overseeing land use, planning crops, and more. It can help a farmer make more judicious decisions about water use, fertilizer application, planting decisions, and others.

1. Providing correct and valuable information regarding planting, cultivating, harvesting, weather forecast, and more.
2. Weather forecasting: Farmers are thus able to gauge the weather and viability of their crops and act according to climate conditions.
3. Land management: Farmers are now able to make informed decisions in managing his/her land.
4. Crop planning: Helps farmers determine when to plant or harvest their crops.
5. Pest and disease management: Helps farmers react to the need for pest and animal disease control.
6. Resource management: Helps the farmer get the best out of available resources such as water, covering, fertilizer, and seeds.
7. Efficiency: Helps the farmer by reducing the time taken for him or her to conduct farm work and other farm operations
8. Every farmers need financial support like payments, loans, and insurance for their crops. Implementing these in your app will make your app a lot more reliable for farmers.
9. By providing an e-shop in your app for farming products.

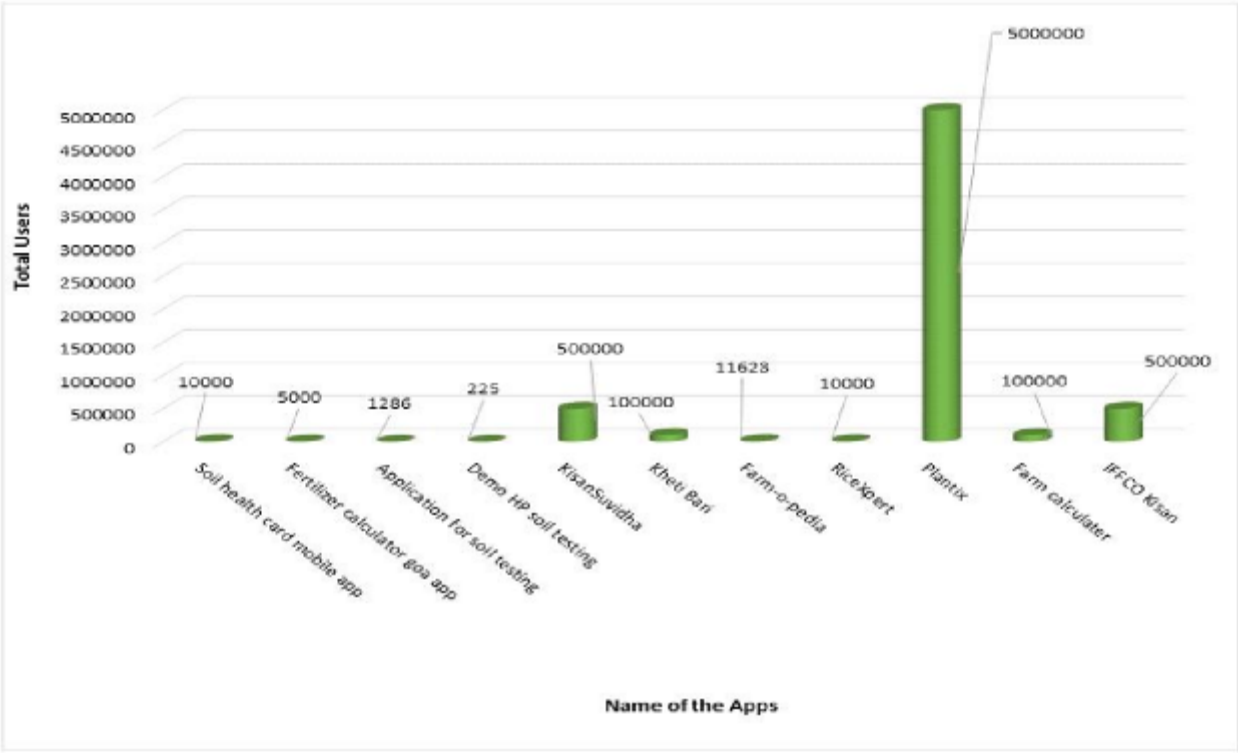

Fig:-1.1 Comparative graphical representation of total users in various agricultural apps in India.

VII. Conclusion

For farmers, an integrated mobile solution can provide a revolutionary means of improving productivity and sustainability. This solution integrates several tools into one platform and will give the farmer all information in real time, including live weather updates, pest control advice, crop management, up-to-date market prices, financial services, and expert consultations. Benefits come in the form of efficiency, less cost, better decision-making, and easy market access, though challenges in infrastructure development, digital literacy, and affordability must be addressed. Creating user-friendly platforms and collaborating with local institutions allows for the realization of full potential of integrated mobile solutions to enhance agricultural outcomes, income, and better livelihoods for farmers. Mobile apps have become crucial in the digital ecosystem, particularly in the agriculture sector. India, a heavily reliant country on agriculture, has introduced various new technology and government facilities to improve productivity. However, many farmers lack timely access to essential information and plans due to unfair management. To bridge this gap, researchers are developing a novel solution. The mobile app will define the necessary procedure and model to make farmers aware of new knowledge about agriculture and help them improve their farming practices. This will help bridge the gap between farmers and new technology and government aids.

Conclusion In the conclusion, the integration of mobile solutions in agriculture represents an important innovation in knowledge, access, and resource gaps and is thus an innovation for a more resilient and productive farming community.

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