

Precision Farming using Mobile Application Development: SaaS and Internet of Things

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Abstract: More than 60% of the Indian population depends on agriculture as the primary means of livelihood. Due to the size of the agricultural sector however yields of crops in India are generally less when compared to international standards. Farmers in India still choose crops in the traditional manner. They depend on past experiences or knowledge passed on from their ancestors to determine what crops to grow in different seasons in the farm. This methodology is not that efficient. To increase crop productivity, they may approach experts to seek advice for quality seeds selection to know the growth conditions. Sometimes, farmers need to travel long distances to contact experts. Farmers might have little or no knowledge about the crops which are new which would grow in the farm and provide the maximum yield. There is a need to provide them with information concerning when to harvest the crops. There is a necessity to make available the right knowledge of the crops that would grow and increase the yield in respective farms is the main aim of the project. The information technologies used to accomplish the farmer's problem are Mobile Application Development, Cloud Computing (Software as a Service), Internet of Things (IoT) and Databases. The farmer will be able to choose the best and the right crops for their farm under different weather conditions, seasonal conditions and also, a farmer will be able to know the marketing condition such as Demand and Supply condition of the market before sowing the seeds in a farm. By meeting the Demand and Supply of the Market, a farmer will be able to increase the income which is achieved by farming on a farm. The farmer will be able to access the condition of a farm through historic records like the previous 10 years conditions of the farm. The farmer will know whether the Crops are ready to be harvested or not. The farmer will also be able to know the details of all crops. All crops details will be provided to the farmer. To help monitor and control the farm equipment remotely using the Internet of Things (IoT) technology for irrigation purposes.

Keywords: Precision Farming, Mobile Application Development, Cloud Computing, Internet of Things, Farmer, Demand and Supply, Weather Condition, Crops, Crop Details, Seed selection, Best Crops, Farm Conditions.

1. Introduction

More than 60% of Indian population depends on agriculture as primary means of livelihood. Due to size of the agricultural sector, however, yields of crops in India are generally less when compared to international standards. Farmers in India still choose crops in the traditional manner. To increase the crop productivity, farmers approach experts to seek advice for

quality seeds selection, to know the growth conditions. Sometimes, farmers travel long distances to contact experts. Even after travelling such long distances, the expert may not be available at that time or they maybe not able to advise the farmer appropriately. In such cases seeking the expert advice is very expensive and time consuming. Farmers might not be aware of the details of the land such as land conditions, previous owner of the land and so on. Farmers might not know what the demand and supply conditions of the market at the time of sowing the seeds in farms. Farmers might not be aware of the crops to be sowed in their field which would give the farmers higher yield with less resources and more efficiency. Farmers might have a little or no knowledge about the crops which are new, which would grow in the farm and provide a farmer with the maximum yield. Farmers might not be aware of the right time to harvest the crops in the farm. Farmers may harvest the crops too soon or delay the harvesting time. If a farmer is planning to purchase a new land, he might not be aware of the information about the owner of the land. Farmers may face economic loss due to market conditions, weather conditions, wrong crop selection or selection of crops which may not give them proper yield and more. Farmers might end up taking loans from banks, money-lenders and other financial organizations. The need to provide a farmer with the right knowledge of the crops that would grow and increase the yield is the main aim. A farmer will be able to choose the right crop under the different weather conditions, seasonal conditions and also, he will be able know the marketing condition such as Demand and Supply condition of the market before sowing the seeds. By meeting the Demand and Supply of the Market, a farmer will be able to increase the income which is achieved by meeting the demand and supply in the market. The farmer will be able to access the condition of the farm through historic records like previous 10 years conditions of the farm. The farmer will know whether the crops are ready to be harvested or not. The farmer will also have access to know the details of all crops. All crops details will be provided to the farmer. A farmer will also be able to monitor the farm remotely using the Internet of Things (IoT). Previously farmers used to depend on past experiences or knowledge passed on from their ancestors to determine what crops to grow in different seasons in the farm. This methodology is not that efficient. Farmers in India still use traditional farming

techniques. They are victims of past success. Seed is a major input for obtaining high crop yield and steady growth in agricultural production. When seeds for crops to be grown they choose them based on what crop was profitable the previous year. They usually do not consider the supply and demand of the crop. As the supply increases the demand decreases there by also decreasing price for their yield. Marketing still is major concern in agriculture. With not effective marketing strategies, the farmers have to depend on middlemen for selling their crops. As defined in [1] “Different techniques such as variable rate seeding is used in which soil analysis is done which determines the crops which will provide maximum yield in the farm. This technique uses historical data as well as satellite images and various digital sensors to determine where the productivity is low or more. Also, GPS has helped soil sampling become more accurate”.

2. Need for precision farming

As shown in [3] “Diverse nature of India, vulnerability in precipitation illnesses and weight on the yield can cause diminish in harvest creation. Sugarcane Industry stays one of the principle mainstays of the Indian economy, however it is confronting numerous issues. The zone of land under sugarcane development is yet noteworthy in numerous conditions of India. To expand the yield profitability, farmers approach specialists to look for their guidance for quality seeds determination, to realize the development conditions, to control diverse anxieties and illnesses. Occasionally they need to head out long separations to contact specialists. Indeed, even after travelling such long distances, the expert may not be accessible, or they might be not ready to help the agriculturist accurately. In such cases looking for expertise is extremely costly and tedious. To build the normal sugarcane yield per hectare with least expense, an alternative arrangement is to adjust the 'Hard' Precision Agricultural idea. This idea employments cutting edge innovations to expand the viability of the product inputs including Seed determination, Growth and Disease observing, Weed controlling, Fertilizers, Pesticides and Water system. The Precision Agriculture (PA) utilizes information from GPS, GIS, and Remotely Detected Images for observing, examining and controlling the pressure, infections and other issues. In provincial regions it is hard to get to these kinds of information and in India majority of farmers obtain loan, so the expense of these instruments isn't reasonable to those agriculturists. Presently drifts are going towards Precision Agriculture, for this situation the option arrangement is to utilize the CCD pictures as an information for harvest the board.

The upsides of this system over others are:

- Pictures have high resolution,
- Overcast conditions do not forestall capturing of images,
- Quick conveyance of data to the client,
- Cheaper”

3. Survey on agricultural applications

Although there are a number of applications which support for individual or different modules/functionalities in agriculture. These applications are still not reliable and efficient given the signification of agriculture. There is also lack enough information on when the best time is to harvest the crops. Some of these applications are not user friendly and are often complex which makes it difficult for the farmers to understand. Different farmers will have different capacity in terms of investment in buying seeds and there is lack of information regarding the alternatives seeds the farmer can buy based on his monetary strength.

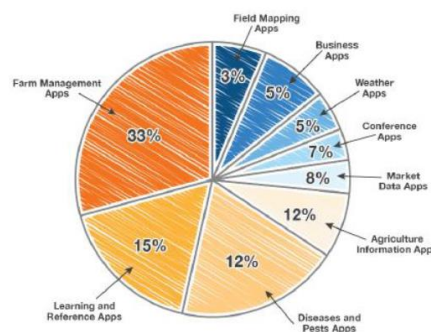


Fig. 1. Different applications for Agriculture [2]

Fig. 1 [2], shows the chart of different apps in agriculture. There are different applications for several activities. All the applications only provide a limited functionality and rely on other apps for additional functionalities.

Agriculture applications can be classified as [2]:

- Business applications
- Conference applications
- Pest and diseases applications
- Farm the board applications
- Learning and reference applications
- Location-based applications
- Market information applications
- Weather applications

From the survey it is evident that there is a need for single user-friendly application that can be used even by an uneducated farmer.

4. Study of various agricultural applications

The following table shows some of the most popular agricultural applications and their current functionalities and some of improvements that can be made to help the farmers even more.

5. Issues that need to be addressed

Limitations of Precision Agriculture (PA) are as discussed in [3] are as follows especially in developing nations like India:

- Perception of farmers and lack education in rural

Table 1
 Comparison of Existing Mobile Applications and Suggested System

Mobile Application Name	Description of the existing system	Description of the suggested system
Agri App	Agri App is a standout amongst the most enjoyed applications by farmers. It is a web-based cultivating commercial centre, bringing agriculturists, cultivating input/yield, taxpayer supported organization on an online stage. It likewise gives visit choice to agriculturists. Ranchers can without much of a stretch visit with a specialist of farming utilizing this application. This versatile application gives broadened recordings of agribusiness work.	Proposed framework is additionally, an android application which underpins the agriculturists on an online stage. It does not require any talk highlight to give ability to the agriculturists yet recommend the best products to the ranchers to be sowed in a farm as per the present area properties and the interest and supply in the market.
Iffco Kisan App	This android application gives data about the most recent agribusiness exhortation, most recent market costs, and different cultivating tips. It likewise gives climate figure data. The ranchers can without much of a stretch take help of agribusiness specialists utilizing this application.	This android application gives latest market costs to the agriculturist. It not just gives the anticipated climate estimate of the favoured region yet in addition think about the climate of the favoured territory with the past climatic states of that specific zone. All the yield subtleties are given through the informational collections which are as of now accessible on the web. It gives skill to the agriculturist with no talk bot.
Agri Media Video App	This android application gives mastery by reaching the specialists through the talk bot and furthermore enables the ranchers to transfer any related pictures to the issue. This cell phone application likewise gives different recordings identified with agribusiness practice, new advancements, effective ranchers, provincial improvement, farming news, new govt. plans identified with horticulture.	No visit bot is utilized in this versatile application. Since the horticulture procedures are now known to a rancher the application gives the data to the agriculturist which he probably won't think about it while cultivating because of absence of information. This application does not give any news through recordings to the ranchers.
FarmBee – RML Farmer	It gives rich farming substance and data at each phase of the yield life cycle. An agriculturist can browse 450 harvest assortments, 1300 markets, 3500 climate areas. It likewise gives advertise cost and climate figure dependent on a client area.	This android application gives insights regarding the yield is prepared to be gathered or not. A rancher can look over a ton of yield assortments, climate figure and additionally past climatic conditions. It likewise gives current market costs and climate gauge dependent on a ranch area.
Kisan Yojana	It gives data pretty much all Govt. plans to Farmers. It drives the data hole between the rustic individuals and Govt. It additionally gives the plans of the distinctive relative states Government. This versatile application likewise spares the time and travel cost of Farmer to achieve the state Govt. office is spared.	This android application gives the economic situations like interest and supply of the market, ebb and flow costs for the create, climatic conditions, climate conditions, regular climate conditions, and more zone properties are considered to recommend best products for a farmer cultivate which will yield progressively and give more economy to agriculturists.

areas,

- Smaller farm lands,
- Absence of examples of overcoming adversity,
- Traditional techniques used,
- Land possession, foundation and institutional requirements,
- Absence of expertise when needed,
- Accessibility, quality and cost of information.
- Lack of local technical expertise,
- Availability, quality and cost of data.

As discussed in [4] some of the following technical issues must be addressed:

- Generation of remote sensing dataset with high spatial & temporal resolution
- Identification of crop nutrition stress with remote Sensing
- Optimizing crop seeding date/order with remote Sensing
- Predicting crop mature date and optimizing harvest with remote sensing.

6. Conclusion

In Today's world mobile applications play a vital role in all aspects of life. Major progress is seen in financial applications, Educational applications, Entertainment, Social media applications and IT apps. But Agricultural applications haven't made enough progress given its economic importance in a country like India. Smartphones with more computing power is more affordable now. Even Internet services are cheaper. India is diverse country with a number of native languages but most of the agricultural applications in today's market are in English which farmers in India may find difficult to understand. There is a need for agricultural applications which can focus on peculiarities of specific geographical areas for providing more

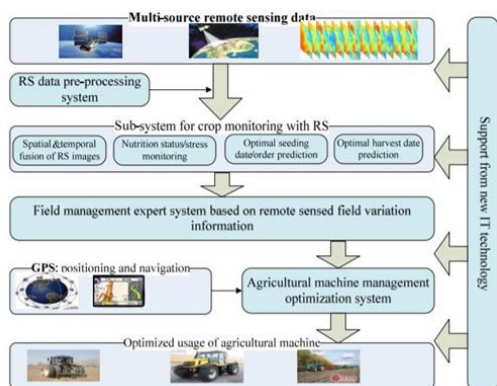


Fig. 2. Structure of a Satellite-based Field management system [2]

accurate and efficient information to the farmers. Also, we need applications that can help monitor farms dynamically in real time rather than static or outdated information. This can be done by adopting Precision Agriculture. If a single application can provide the necessary information on seed, crop estimation, pesticides, fertilizer, harvest time, estimation of yield that will be produced including weather conditions and can also connect the farmer with the market so that he can understand the demand and supply for the crops he grows it will immensely help the farmers.

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