

Smart Farming Using Artificial Intelligence

Dhanamma Jagli¹, Seema Purohit², Tanmay Agale¹, Dinesh Kahar¹

¹ Vivekanand Education Society's Institute of Technology, Mumbai, India.

² Professor and Principal, Brihan Maharashtra College, Pune, India.

Abstract

Agriculture plays a very important role in the economy. The use of AI in Agriculture is a major and emerging topic worldwide. As the population grows day by day there is a huge increase in the need for food. The old methods used by farmers are not enough to meet the needs. Using AI in Agriculture will bring about change in the agricultural sector. Using AI will help protect plants from many problems such as plant diseases, climate change, and so on. The main purpose of this paper is to inform the world about agricultural Artificial Intelligence applications such as Irrigation, Weeding, Spraying with the help of sensors and other methods such as robots and drones. All of these technologies will help to conserve excessive use of water, pesticides, keep soil fertility, this will also help in the efficient use of human energy and increase crop productivity and quality.

Keywords

Artificial Intelligence, Pesticide, Automation, Herbicide, Irrigation

1. Introduction

Nowadays everything is faster and easier due to new emerging technology systems. It is estimated that the world's population will be around 10 billion by 2050. And to meet the food needs of this growing population, there must be growth in the agricultural sector. At the moment, it is true that Artificial Intelligence exceeds human activity. As AI is an emerging technology in the agricultural sector the equipment based on AI, has taken the modern agricultural system to another level. These technologies have improved crop production and real-time monitoring, harvesting, and processing of cultivated crops way much easier. Recent technologies for automated systems, like use of agricultural robots and drones have made a significant contribution to the agricultural sector. The various hi-tech computer-based systems are designed to determine a wide range of important parameters such as weed control, crop detection, crop quality and many other strategies. Currently total area used for crop production is around 37.8%. There is a rapid acquisition of AI in agriculture using a variety of techniques. Managing effective farming practices with the help of new technological developments and solutions, is a requirement of the current situation. The use of new technologies available in Artificial Intelligence will help farmers to produce high quality crop production. Developments in the agricultural sector will also contribute to rural development. Currently there are number of techniques used in the agricultural sector such as disease detection, diagnostics, depending on the soil which fertilizer should be used, and much more. These technologies will be improving crop production and real-time monitoring, harvesting, and more.

2. Literature Survey

Agriculture is the largest industry in our country and also plays an important social and economic role for world's growth. Before getting used to the technology in agriculture, farming is done using traditional techniques and methods. In India, we found different places, different climate, and different

ACM-2022: Algorithms Computing and Mathematics Conference, August 29 – 30, 2022, Chennai, India.

EMAIL: ghanamma.jagli@ves.ac.in (Dhanamma Jagli)

ORCID: 0000-0001-6356-352X (Dhanamma Jagli)

© 2022 Copyright for this paper by its authors.
Use permitted under Creative Commons License Attribution 4.0 International (CC BY 4.0).

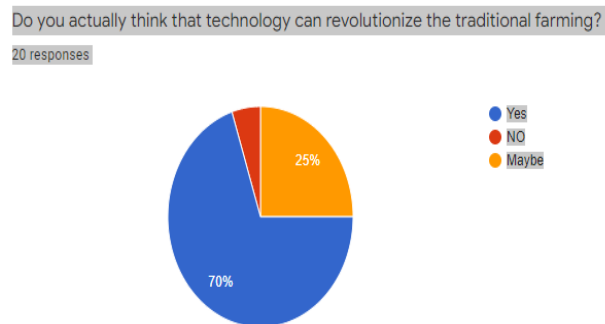


CEUR Workshop Proceedings (CEUR-WS.org)

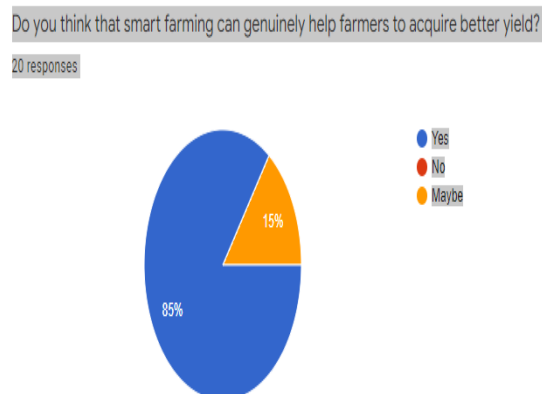
soils suitable for different plants in different areas. Farmers use to harvest a particular type of crop or cycle of plants. In India, in many regions, farming is dependent on rainfall or water availability. Few major work farmer has to do are crop choices, prepare the soil, seeds picking, sowing, watering, crop growth, composting and harvest. And all these work is done manually which requires more human and animal activity.

3. Survey on Smart Farming

The survey was carried for review purpose and got a great response. Many of them responded and reviewed. This survey was conducted to know what people think about implementation of new technologies or implementation of AI in farming whether it is useful to use technologies and make farming a smart farming or is it a bad idea of doing so. According to this survey few questions were shared and reviewed. Subsequently the questions are:



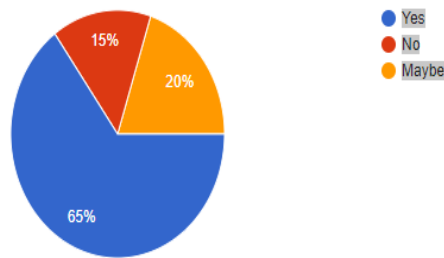
Many responses are positive approximately 70%, think that AI can revolutionize the traditional farming, whereas around 5% response is negative, they think that AI or Technology cannot revolutionize the traditional farming methods, while 25% has a neutral answer. According to the response it is clear that most of them think that this is the best idea of implementing AI or any Technology in Agriculture. Whereas there are very few are against the thought that AI can be very useful in farming. My personal opinion also goes with the majority that really technology can revolutionize the traditional methods of farming.



So here the responses are clearly visible, it came almost 85% positive and remaining are neutral. As we can see there are no negative responses, this means that there are 0% people who think that, smart farming can help to acquire a better yield. Majority of them think that it will be really helpful if smart farming can be implemented to acquire a better yield which can be done using Artificial Intelligence.

Particularly for small scale farming, will smart farming be beneficial?

20 responses



So as per this survey 65%, think that smart farming can be beneficial for small scale farming, whereas 15% think that it is not possible for implementing smart farming on small scale but there are still 20% who think that this may be a good option and also a bad option as they are neutral on this topic.

4. Importance of Artificial Intelligence in Agriculture:

Artificial Intelligence (AI) can be used in farming and it can also bring a change along the way for us to look at farming today. AI-enabled solutions will not only help farmers do more smart farming, but it will also help farmers to get higher yields, such as increased consumption. Agriculture is the most important factor in general life, since artificial intelligence is based on recovery and wisdom performance. Agricultural fields should be developed with open AI, low cost and easy processing. With Artificial Intelligence various agricultural problems are managed in a timely manner. In Smart farming using Artificial intelligence there are few techniques which are used to improve yields, like introducing indoor farming for better crop production rate. There are many applications of AI that will really help farmers for improving crop quality and accuracy of crops, etc. AI can also help as the weed sensor so that production target can be obtained, and can be able to detect diseases in plants, pests, etc.

5. Applications of AI in Agriculture

5.1 Monitoring of Plants

The most important factors in the production of plants are their health, both the quantity and quality of soil yield Micronutrients and Macronutrients. After that, after the plants have started to grow, it is necessary to monitor the growth stages of the plants in order to improve productivity. It is very important to understand the interaction between plant growth and the environment in order to prepare and improve plant health. Traditionally all these precautions are performed by farmers by observing and judgment, but sometimes these observations and judgments can be inaccurate.

Instead of these, we can use drones (UAVs) to capture aerial photographic data. This data can be used by computer vision models to intelligently monitor plant and soil conditions.

Visual Sensing AI can help analyses and interpret this data in:

- a. Monitor plant life
- b. Make accurate harvest forecasts
- c. Find plant malnutrition

These examples can help farmers with problem areas. So that they can take immediate action.

5.2 Irrigation System

Agricultural sector accounts for about 85% of the world's fresh water supply. Unfortunately, this is growing rapidly due to the growing population and the great need for food. When dealing with agriculture we often come across a few efficient irrigation systems that lead to water loss instead of soil moisture. With the help of sensors in measuring temperature, humidity, pH and soil moisture within the fields it will be able to irrigate only the regions or areas that need to be irrigated in a completely automatic way. Collected data is associated with each phase of the field is modelled to launch the valve at a specific location in the field.

In addition, there is a plant technique called Evapotranspiration, which is also affected by a large number of atmospheric parameters such as wind speed, solar radiation, and even plant characteristics such as plant growth, crop density, soil properties and insects.

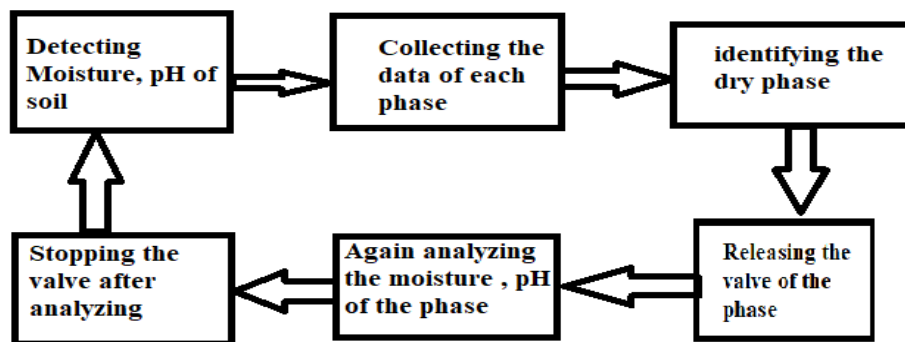


Figure 1: System Architecture

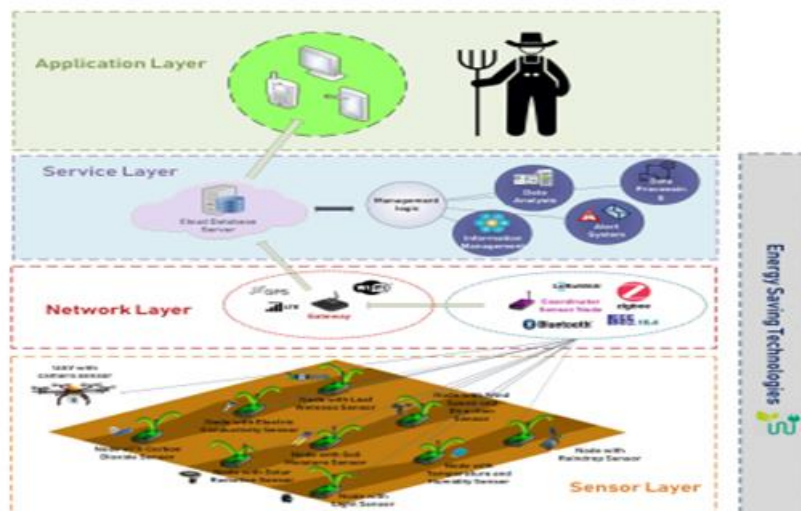


Figure 2: Four Basic Agricultural Layers

5.3 Disease Diagnosis

Plant diseases are a major threat to the environment, economy, and food security. Early detection of plant disease is necessary for disease management. Artificial Intelligence based image recognition systems can be used to recognize specific plant diseases with a high degree of accuracy using mobile devices, such as smartphones in scaling agricultural research with Artificial Intelligence, we have developed AI-based tools that leverage location-based science and big data to help farmers and

land managers make location-specific decisions. These tools provide early warning of plant disease outbreaks and facilitate the selection of sustainable cultivation practices.

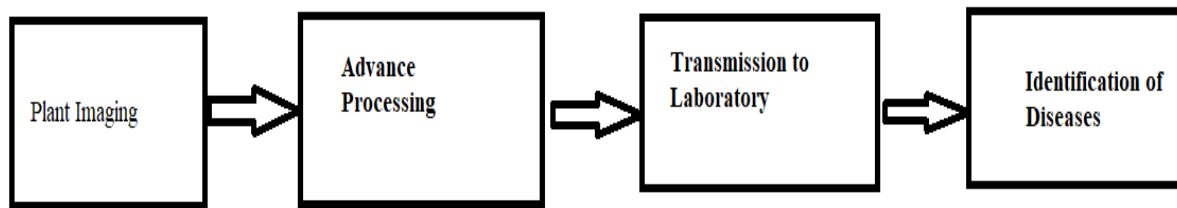


Figure 3: Workflow of Proposed System

5.4 Yield Mapping and Monitoring:

One of the key segments of agriculture is the exact cultivation framework, Mapping and Monitoring of yields, which enables farmers to work out on different variety of crops and with different techniques on a particular zone in future. The main important part is that it helps in gathering geo-referenced data on harvesting yield and its qualities. Few examples are displaying the fluctuation in soil moisture, along with soil moisture data, yield map empowers the arrangement which tells us about the present soil supplement levels comparing them with the collected data. Past results of the yield map helps of to know about the scope of the yield in the field. Past results are a guide for future decisions taken regarding the yield.

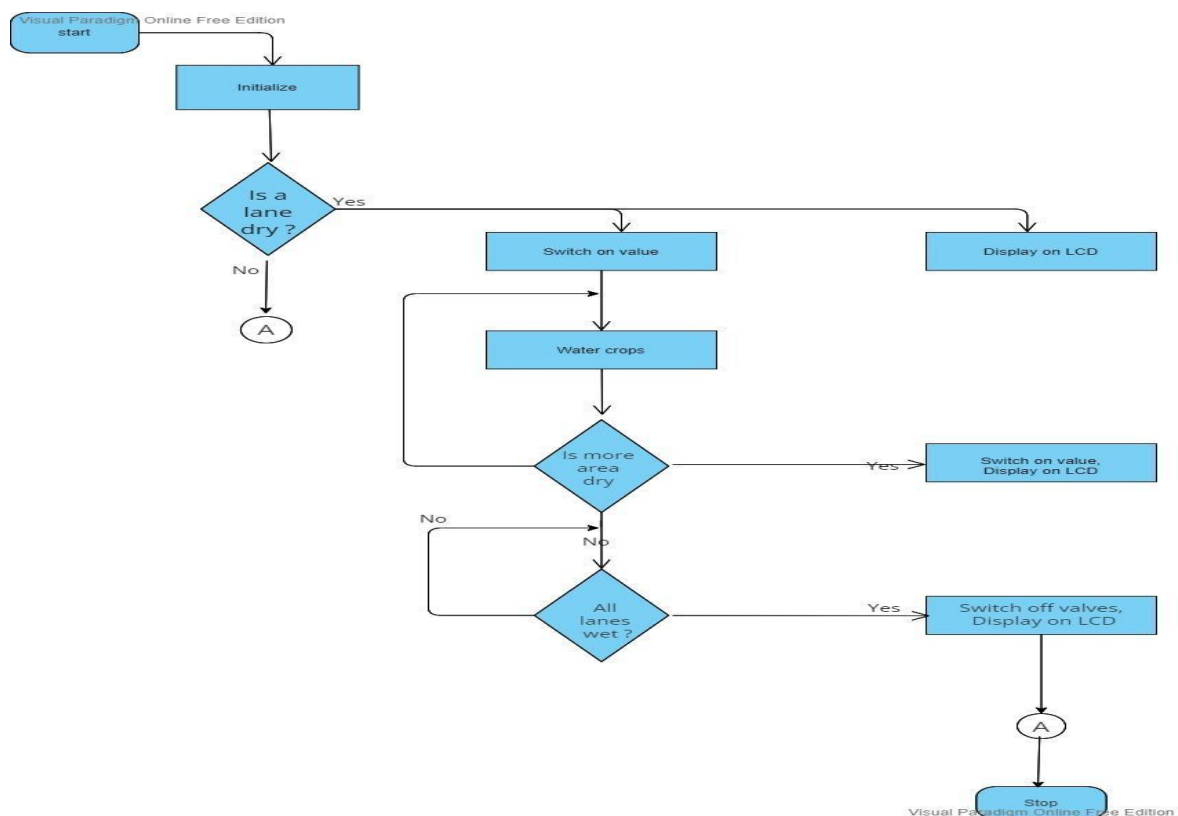


Figure 4: Working of Monitor System

5.5 Identify yield ready

Identifying the ripe green fruit is not as easy as it used to be sounds. It requires great skill and still has it the level of human error. By using AI we can get accurate results without the need for human intervention. We get pictures with an existing camera white light and UVA light that will be present at that moment processed on a computer. Results of the computer will be considered the end result.

5.6 Monitoring Soil

Identifying the soil moisture content in the soil was a very tough method. And according to that judgment and past experience the crop which is to be cultivated at that time was fixed. It used to take a long time, many a times while watering the crops some crops used to die because of excess amount of moisture present in the soil as the farmers don't know about the moisture already present in the soil. But with the help of AI sensors are used to check the soil moisture level so that proper amount of moisture is provided to the soil whenever and wherever necessary so the crops being cultivated will not be affected and a great yield would be produced.

5.7 Field Management:

Using different AI techniques to manage fields for extra profit, it is always better to take Security measures for anything, using AI we can do predicting climate change, a future need harvest and soil that will save the future failure.

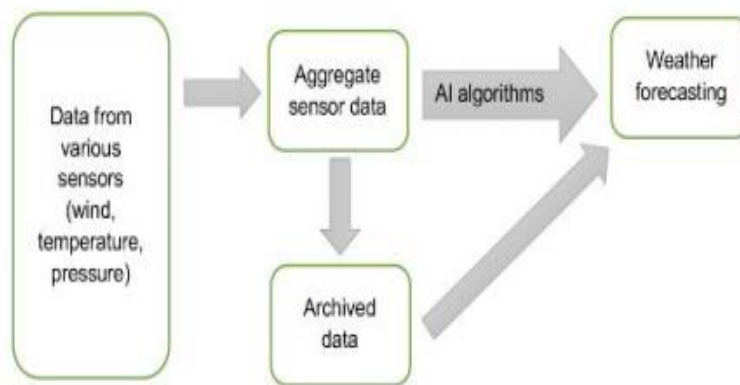


Figure 5: Field Management

6. Architecture of Smart Farming

A precision farming system consists mainly of the sensing agricultural parameters, the identification of sensing location and data gathering, the routing of data from crop field to the system for decision making, the actuation and control decision based on sensed data and the visualization of results to the grower through an application. According to these procedures four basic agricultural layers are defined in our model.

7. Comparison Table

Reno.	Purpose	Old Methods in Agriculture	New AI implemented methods in Agriculture
1)	Monitoring of Plants	Manually observing the Plants and Judging the results.	UAV Drones to capture images of plants.

2.)	Disease Detection	Manually going through the plants and checking on them about the disease according to past experience.	AI based Image Recognition System
3)	Soil Moisture Detection (For Crop Cultivation)	Manually inspecting the Soil and cultivating the crops as per traditional methods.	Soil Moisture Sensors kept near root part of crops which helps in accurately measuring moisture content in soil.
4)	Irrigation System	Manually letting the water in the farms with the help of pumps and pipes.	Different types of irrigation system like sprinkle, drip, surface irrigation, etc...
5)	Yield (ready or not).	Manually checking with crops and fruits and judging on the basis of experience	Use Of camera sensors, existing light and UVA light and taking pictures and checking the images on computer.

Here in this comparison table, we have compared the traditional farming methods with the new smart farming methods. The new methods are we can use drones for capturing images of drones, AI based image recognition, Soil moisture sensors, different irrigation methods, and so on. These methods will be very useful for smart farming purpose. As traditional methods are very time consuming and requires a vast amount of experience.

8. Challenges in adoption of AI in agriculture

When anything new comes out of the system it becomes difficult to do accept it from everyone, as there are many challenges in adopting Artificial Intelligence in Agriculture. Some applications may be easy to use if we already know about it and we already do know about it. Many farmers know about technology, they can use it but what about the rest of them. It would be difficult for them to understand what the use of technology can do to increase productivity in the Agriculture sector.

9. Conclusion

The agricultural industry faces various challenges like lack of effective irrigation systems, weeds, and issues with plant monitoring due to extreme climate. It can be improved with the help of various AI techniques like remote sensors for detecting moisture in soil and smart irrigation with the assistance of GPS. Besides this, farmers can spray pesticides and herbicides in their farms with the help of drones, and plant monitoring is additionally now not a burden. In traditional methods, huge amount of labor was required for getting crop characteristics like plant diseases, soil texture and content.

10. References

- [1] Shard parana mohan, david peter hughes, marcel sala the, "using deep learning for image-based plant disease detection", april 15, 2016
- [2] Kamba Sonar,"AI in Agriculture-Present Applications and Impacts", November 21,2019
- [3] DavidIleri,"A computer vision system for defect discrimination and grading in tomatoes using machine learning and image processing". 17 June 2019
- [4] Imran Ali Lakhari,Gao Jianmin,Tabinda Naz Syed,Farman Ali Chandio,"Monitoring and Control Systems in Agriculture Using Intelligent Sensor Techniques: A Review of the Aeroponic System",19 Dec 2018

- [5] K. Mufeedha, E. Abhilash Joseph, V. M. Abdul Hakkim, "Precision Farming: The Future of Indian Agriculture", November 2016
- [6] Joseph Byrum, "The Challenges for Artificial Intelligence in Agriculture", February 20, 2017