International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

# Precision Agriculture

*Anuradha[1], Girish S[2]*
*[1]PG- Department of Computer Applications, Dayananda Sagar College of Arts Science & Commerce, Bangalore, Karnataka, India.*
*[2]Professor, Department of Computer Applications, Dayananda Sagar College of Arts Science & Commerce Bangalore, Karnataka, India.*
***Email ID:*** *arya9148anu@gmail.com[1], girish.dsi2024@gmail.com[2]*

## Abstract
*Incorporating AI (IOT tools) into the Agricultural sector promotes environmental awareness while providing precision in agriculture to satisfy the wastage of agricultural resources demands. Farm land that use of IOT tools can lower resource expenses, can stop the wastage of agricultural resources, and promote environmentally beneficial behavior. Farm and agricultural land can set an example of precision and encourage farmers to embrace AI technologies by installing IOT tools and AI farm management systems. Furthermore, adaption of AI into agriculture gives farmers the information and abilities they need to tackle the agriculture land related problems. In addition to promoting AI in agriculture, this shift helps international objectives for a sustainable future. This article gives a detailed study about the Usage of AI in agricultural land across different parts of the country based on IOT tools and analysis at farm and land.*
***Keywords:*** *Analysis, Prediction, IOT tools, Sustainability.*

## 1. Introduction
AI is Artificial intelligence which acts like human like intelligence but based on past experience and trained model. AI is something which predict the future outcomes implementing it is most effective in agriculture development gives the better results to farmers helps in accurate usage of the natural resources. AI is used in agriculture through IOT tools which manually reads land through sensors which we convert gathered data into smart farming. By establishing these IOT tools in a piece of land and these attracts the Data and converts those into models for future usage. So, we have a lot of renewable resource over us by considering all the resources and their utilization we have bought this thought into Agricultural sector. All the below information considers how IOT tools are utilized into Agriculture.

### 1.1.About IOT tools and its types
The Four types of Essential IOT tools in Agriculture

- AI powered Drones (efficient, expensive).
- Soil moisture sensor(budget-friendly).
- Smart irrigation system(budget-friendly).
- Weather monitoring stations(effective)

The four major IOT tools are AI powered Drones (efficient, expensive), Soil moisture sensor(budget-friendly), Smart irrigation system(budget-friendly). And Weather monitoring stations(effective).as drones are most effective in monitoring the farm land and crop and also useful for irrigation purposes also. Soil moisture sensors help in reading the Ph level of soil and moisture content, smart irrigations help in providing the required amount of water to crops with accuracy, weather monitoring stations helps in monitoring the weather changes in the particular location. [1] Selection is based on space, location and requirement. There are several IOT tools based on the different functions and quality of the product several brand offers low quality and few offers high quality based on their price and Specifications based on

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

brands.

## 2. Literature Review

- A study by Wolfert, S. et al. (2017) indicates the smart farming, Data Analysis through IOT sensors, predictive and real time decision making across supply chain. [1]
- Kamilaris, A., Prenafeta-Boldú, F.X. (2018) argue the usage of computer and electronics in agriculture helps in crop disease detections, yield estimation tells use about the traditional methods and enables high-accuracy plant analyses. [2]
- Liakos, K.G. et al. (2018) emphasizes the role of the Machine Learning in agriculture as integration of sensors and crop management, livestock and water. helps in making real time decision making based on knowledge-based farming. [3]
- Benos, L. et al. (2021). Adoption of AI into agriculture gives better in providing the better results to farmers by integrating the IOT tools helps in AI optimizing pesticide use and resource allocation. [4]
- Akintuyi, O.B. (2024). have explained AI in agriculture in U S. tells about the ML and robotics helpful in resource use,crop monitoring and decision making. [5]

## 3. Images of IOT tools used in Agriculture lands of India

### 3.1.AI Powered Drones used in agricultural land

As Shown in Figure 1.

**Figure 1 AI Powered Drones**

### 3.2.Soil Moisture Sensor

As Shown in Figure 2.

**Figure 2 Soil Moisture Sensor**

### 3.3.Smart Irrigation System

As Shown in Figure 3.

**Figure 3 Smart Irrigation System**

### 3.4.Smart Irrigation System

As Shown in Figure 4.

**Figure 4 Smart Irrigation System**

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

## 4. Challenges In Implementing IOT Tools In Agriculture

The adoption of IOT tools in agriculture promotes the accuracy in agriculture by providing required resources to the crop for better development. As implementing IOT tools in agriculture land is also a challenging task there are several challenging aspects in installation of IOT tools into agriculture land they are many challenges facing during implementing the IOT tools main they should be high quality material must be hard and very mush built for rough use as it should withstand the harsh environment like heat, cold, rain, dust, chemicals, animals. The product should withstand all the harsh treatment network also challenging factors as the farm land lies in remote areas as the network connectivity is not quite good and stable as to access the IOT devices from the remote location the network is very much necessary IOT tools plays a major play as time-to-time maintenance is required to protect the IOT tools durability. lack of awareness among the farmers about the IOT devices which are help full for their day to day work is a challenging factors as the IOT devices are also cost effective because of the costly sensors used in it due to which the reach of IOT tools to the low scale farmers is challenging task power supply plays a major role as all the IOT devices required power supply for running the devices as the some farm land does not have proper power supply so it is difficult to install the IOT devices .there are several challenges these are the main challenges.

## 5. Important Things to Take into Account When Installing IOT Tools at Farm Land

Installing IOT tools at farm land involves a number of considerations, including,

### 5.1.Power Supply

Power supply plays a major role in installation of the IOT tools to the farm land as all the IOT tools power supply for working to generate the accurate data as required amount of power required to run the IOT devices to perform task .addition of solar panels and other power generating sources helps in supplying power to the devices

### 5.2.Environment Condition

While installing IOT devices to farm Environment condition is important to protect the IOT devices as the devices installed must be protect from heat, rain, dust, wind and should be kept away from animals and human reach to avoid any kind of damages to devices as the devices must be water resistance and must with stand the water leakage which will effects the electronic parts inside the IOT devices.

### 5.3.Initial Cost and Financing Options

One of the biggest obstacles for installing the IOT devices is the upfront is cost of installing. However, when taking into account the significant long-term advantages—like crop monitoring, yield forecasting and environmental sustainability-the initial installing may be unaffordable. The government subsidies will help you with this upfront expense. Trimble Inc and AGCO top companies for IOT tools installation services, companies will assist you receive your subsidy more quickly.[6]

### 5.4.Efficiency

To produce more Accuracy, use IOT devices with a high efficiency rating. Get in touch with technology, and a specialist will assist you in selecting the best devices for your Agriculture farm.

### 5.5.Ineffective Design or Installation

Inadequate design or installation practices can result in inefficiencies and pose safety risks. It is crucial to collaborate with skilled professionals who can guarantee that the IOT devices are installed properly and optimized for accurate output. Substandard installation may lead to diminished performance, higher maintenance expenses, and possible harm to Agricultural land.

### 5.6.Regulatory and Approval Challenges

Navigating the regulatory framework can be complex and labor-intensive. Agriculture related sector must adhere to local, state, and federal regulations, which may encompass permitting requirements, zoning regulations, and environmental evaluations.

### 5.7.Usage

Reviewing the IOT devices based on the requirement must be easy to use for farmers must be effective and result in gaining the high profit for farmer.

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

## 6. What are the Resources to Set Up the Solar Panels in Education Sector

### 6.1.Step 1: Conduct Agricultural Survey

The initial phase of transitioning to AI in agriculture involves assessing the feasibility of IOT devices at your agricultural farm. Collaborate with a reputable IOT tools provider to conduct a thorough, complimentary survey. This evaluation should encompass an analysis of your farms existing energy usage, monthly expenses, and the extent to which IOT devices could mitigate these costs. The provider should also present a preliminary device design customized to fit your farm and available space. Furthermore, the assessment will deliver an in-depth examination of potential expenses, power savings, and available incentives, such as local or state rebates, which can significantly lower installation costs. Additionally, the provider must consider any local regulations or utility factors that could influence the project's financial feasibility or operational efficiency.

### 6.2.Step 2: Explore Financing Options

There are various methods for financing IOT tools AI systems, and farmer generally don't have several avenues to consider. Common financing methods include bond issuances, debt certificates, or loan from government bank, which enable farmer to spread the cost of the system over time. Often, local, state, or federal rebates and incentives can further alleviate the initial installation expenses, making IOT devices more financially viable. It is crucial to engage with a knowledgeable IOT tools provider or financial advisor to gain a comprehensive understanding of which financing options best suit your farmers budget and long-term energy objectives. Selecting the appropriate financing structure will help the farmer optimize its energy savings while maintaining manageable upfront costs.

### 6.3.Step 3: Procurement

To proceed officially, the farmer must select a qualified IOT tools provider through a structured procurement process. This typically involves collaborating with the agricultural Board to develop and issue a Request for Proposal or Request for Qualifications to solicit bids from IOT tools companies. These documents should detail the project's objectives, timelines, and any technical or financial stipulations. They also outline the necessary qualifications for IOT tools providers to be eligible for consideration. [7] In certain instances, rather than issuing an RFP or RFQ, farmers may opt to choose a provider through a state or regional purchasing cooperative or a state procurement program. Such programs streamline the selection process, ensuring that the IOT tools provider meets specific qualifications while potentially offering cost savings. It is crucial that the RFP/RFQ contains explicit criteria for evaluating proposals and selecting a provider capable of fulfilling the farmers unique requirements.

### 6.4.Step 4: Choose IOT Tools Provider

After receiving the proposals, it is essential to evaluate them thoroughly and select the IOT tools provider that aligns best with the farmer's needs. When analyzing the submissions, consider aspects such as the company's qualifications, experience with comparable projects, and the proposed system design. Pay particular attention to the quality of the equipment recommended, as well as the overall project cost, which can differ significantly among providers. Furthermore, evaluate the provider's post-installation services, including warranties, maintenance, and system monitoring. A dependable provider will present a comprehensive installation plan, along with details on how the system's performance will be tracked and assessed. Some providers may also propose additional energy-saving measures, such as power-efficient lighting upgraded systems, which can enhance the overall effectiveness of your investment.

### 6.5.Step 5: Data storage and Analytics

Data generated from the sensors or IOT devices must be stored in a particular place where the data is used to predict or to analyses for future weather, soil Ph level, crop monitoring Etc. all data which are gathered from the sensors are stored at the particular storage devices for storing the data for further analytics

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

### 6.6.Concluding the Resources to Set Up the Solar Panels in Education Sector

Transitioning to AI powered Agriculture represents a long-term investment that can significantly lower a farmer's expenses and environmental footprint. AI powered agriculture generally includes a precision in agriculture, with many having an average profit in agriculture, allowing the farmers to benefit from considerable savings over decades from ai powered agriculture. Although the initial costs may appear substantial, the financial advantages accumulate over time, often rendering IOT tools one of the most economical energy solutions for farmers in the long term. Furthermore, the savings from reduced agricultural expenses can be reinvested to improve other agricultural resources, support new agricultural based programs, or fund other initiatives that benefit farmers. Adopting AI in agriculture not only aids farmers in cost reduction but also aligns with sustainability objectives, fostering a greener, more eco-friendly crops future for both the farmers community and the planets.

## 7. Graphical Representation of Different Sectors of Education

Here are some graphs representations of the usage of IOT tools in different states farmers are using certain amount of IOT tools which is mentioned in the below table:

### 7.1.Karnataka

As Shown in Figure 5 below.

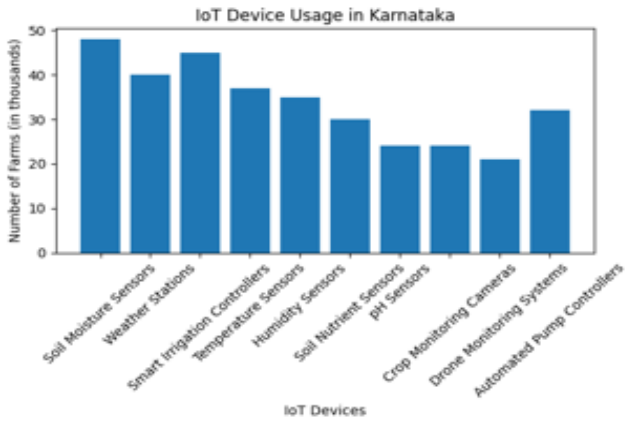



**Figure 5 Karnataka**

### 7.2.Tamil Nadu

As Shown in Figure 6 below.

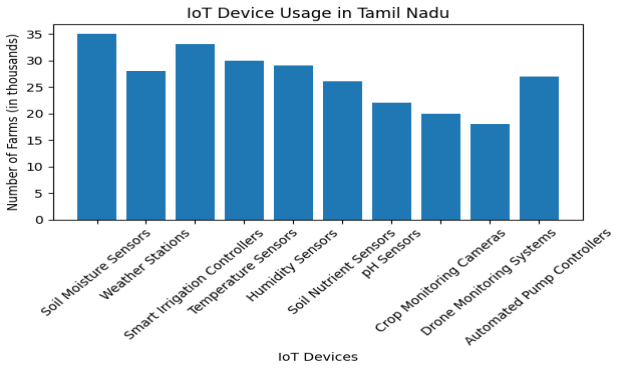
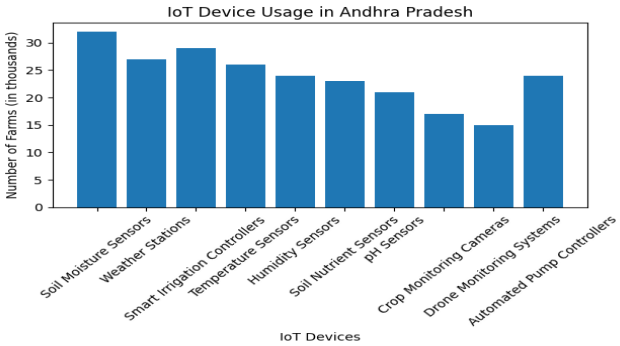



**Figure 6 Tamil Nadu**

### 7.3.Andhra Pradesh

As Shown in Figure 7 below.




### 7.4.Maharashtra

As Shown in Figure 8 below.

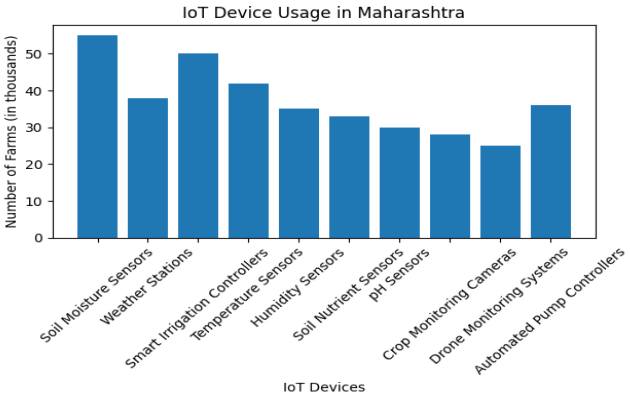



**Figure 8 Maharashtra**

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

### 7.5 Punjab

As Shown in Figure 9 below.

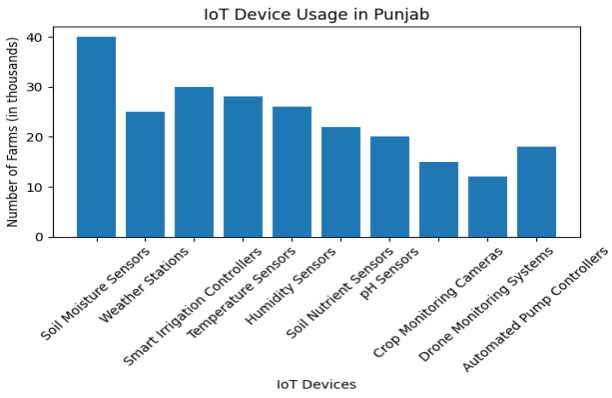



**Figure 9 Punjab**

### 7.6 Gujrat

As Shown in Figure 10 below.

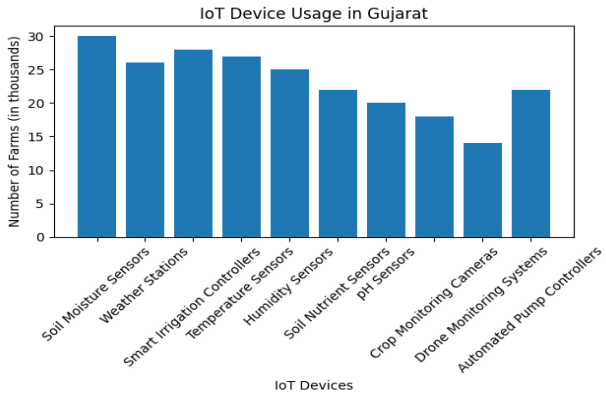



**Figure 10 Gujarat**

## 8. Benefits of IOT Tools on Agriculture

### 8.1.Increase in Crop Yield

IOT devices minimizes reliance on disease causing, contributing to lower disease causing. This supports the farmers to grow healthy crop which leads in increase in the crop growth.

### 8.2.Economic Advantages and Cost Efficiency

The decreasing costs of natural resources make IOT tools an effective viable option. farmers experience lower resource costs, and consumers benefit from reduced farmer expenses. Moreover, the agriculture sector generates more profit compared to natural growth, fostering economic growth.

### 8.3.Decentralized Crop disease and Weather Forecast

Decentralized IOT devices generates lessens dependence on other factors in disease detection crop, improving in crop growth. This distributed approach reduces the risk of crop disease helps in weather forecast for better crop harvesting.

## 9. Challenges and Possible Solutions

### 9.1.Addressing Connectivity and Coverage

Connectivity and Coverage plays a major role as farm land are located in remote areas where telecom infrastructure are limited rural coverage.to extend connectivity extend the 10km gateway or satellite network operators helps to overcome connectivity advantages

### 9.2.Power and Energy Concern

IOT devices requires power to run most of runs in batteries or solar power because of grid un availability to overcome power concern enable the lower power mode in sleep mode and good design products runs in fuel cells for device and plan maintenance to replace the battery again

### 9.3.Data Quality and Calibration

Raw data can be inaccurate due to manufacturing tolerances or environmental interferences to overcome this implement regular calibration for soil sensors or suggest manufacturers to increase auto - calibration during manufacturing

## 10. Result And Discussion

### 10.1. Results

This study explored the adoption of AI in agriculture sectors, analysing its impact on cost savings, environmental sustainability, and accurate farming. Data was gathered from various IOT manufacturers and farmers that have integrated AI powered agricultural solutions.

#### 10.1.1. Cost Efficiency

Farmers using IOT devices reported a reduction of 40-60% expenses in natural resources. Farmer using the AI in their agriculture farm generates more income compared to traditional farming.

#### 10.1.2. Environmental Impact

Adoption of IOT tools led to an estimated 20-30%

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2026.0222
e ISSN: 2584-2854
Volume: 04 Issue: 05
May 2026
Page No: 1478 - 1484

decrease in wastage of agricultural resources. Reducing fertilizers and more nutrients contributed to achieving sustainability goals.

#### 10.1.3. Implementation Feasibility

Although the initial investment remains a challenge, subsidies and grants provided financial relief.

Most farmers reported recovering their investment within 4-5 years through energy savings.

Maintenance costs were minimal, limited to occasional cleaning and routine inspections.

#### 10.1.4. Agricultural Advantages

The installation of IOT devices created hands-on development opportunities for farmers in greater disciplines.

Some farmers incorporated IOT tools topics into their day-day life, fostering awareness and greater development.

### 10.2. Discussion

The findings highlight that IOT tools adoption in agricultural sectors offers both economic and environmental benefits. Cost savings allow farmers to allocate funds to other agricultural resources, enhancing overall quality. Furthermore, environmental benefits support global sustainability efforts. Despite its advantages, challenges such as the initial cost of installation remain. Government incentives can ease this burden, but financial constraints persist for some farmers. Technical expertise is also necessary for installation and upkeep, emphasizing the need for collaboration with IOT tools providers. Integrating IOT into agricultural farms presents an opportunity to expand curriculum content. Incorporating energy studies can equip farmers with relevant helps and knowledge for future development in agriculture.

## Conclusion

To sum up, incorporating IOT tools into agricultural sector is essential to giving farmers the information, abilities, and attitude they need to accept and contribute to a sustainable growth. Utilizing our IOT resources and using them in all the farmland is important but involving them into agricultural sector is one of the main source utilization. AI enable farmers to develop into critical thinkers, problem solvers, and environmental activists by integrating IOT tools in agriculture. As taking all the points into consideration, this source utilization has so many advantages and there are so many benefits alt is impossible to overestimate the importance of IOT devices in tackling the world's agriculture crisis and promoting environmental sustainability.

## Acknowledgement

Authors thank the management of DSCASC for their enormous support in one subject of study. Also thank RSP HUB for their continued motivation and support render to the research community.

## References

[1]. Jinyuan Xu; Baoxing Gu; Guangzhao Tian Guangwen Wang," Review of the Internet of Things"PP 1016, 2022.
[2]. Tofael Ahamed. "IoT and AI in Agriculture: Smart Automation Systems". PP 978-981, 2024.
[3]. Prem Rajak; Abhratanu Ganguly; Satadal Adhikary; Suchandra Bhattacharya, "Internet of things and smart sensors in agriculture: Scopes and challenges."PP 197-233 2023.
[4]. Ruobing Liang, "communication technologies in smart agriculture and challenges" PP-189-245", 2025.
[5]. Emerson Navarro; Nuno Costa; António Pereira, "A Systematic Review of IoT Solutions for Smart Farming", PP 3390, 2020.
[6]. Ge, L. et al. (2025). Research Status and Development Trends of Artificial Intelligence in Smart Agriculture. Agriculture, vol-15, PP-642
[7]. Manono, B.O. et al. (2026). Precision Farming with Smart Sensors: Current State, Challenges and Future Outlook. Sensors, vol.26, PP 882.