

PRECISION AGRICULTURE USING INTERNET OF THINGS: AN OVERVIEW

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Abstract

Now days, Internet of Things (IoT) is new buzzwords across the world. IoT has substantial impact on human life. IoT is a revolutionary technology that represents the future of communication & computing. These days IoT is used in every field like smart homes, smart traffic control, smart cities, smart agriculture etc. Agriculture plays vital role in the development of agricultural country like India. Issues concerning agriculture have been always hindering the development of the country. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. This paper overviews how IoT helps in better crop management, better resource management, cost efficient agriculture, improved quality and quantity, crop monitoring and field monitoring etc.

Keywords:

Smart Agriculture;
Crop management;
IoT;
Field monitoring

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1. Introduction

India is known as the largest agricultural country of the world, feeding the world's largest population. Majority of Indian population is directly or indirectly related to the agricultural. About 22% of the country's population helps feed the rest of the country. Even then, there are so many problems related to farming that needs to be addressed. For example, the crop environment which includes temperature, humidity, moisture content in soil, and other factors like the crop growth, suitable nutrients, etc. Apart from this, the economic and environmental factors have to be considered in order to maintain a judicious use of the crop yields. There are major problems being faced by the Indian agriculture in all of these areas.

Internet of things (IoT) is considered as the prospect or the next generation of internet. IoT connects daily used objects to the internet with a simple goal to provide the users with a smarter and efficient experience in various fields [1]. Numerous IoT applications include healthcare, smart cities, smart grid, water management, smart waste management, precision agriculture etc., In the near future, the IoT devices will become an important part of our daily life [2]. To address the demands of the ever increasing population, the concept of precision farming or smart agriculture needs to be immediately adopted. Improved agricultural techniques can enhance low productivity of the agricultural sectors of the developing nations to a great extent. The Internet of Things is converting the agriculture industry and solving the immense problems or the major challenges faced by the farmers today in the field

. This paper reviews the concepts of IoT. Section 2 of the paper gives the challenges faced by farmers now a days. Section 3 overviews how IoT helps in handling all these issues. In last, Section 4 concludes the paper.

2. Challenges / Issues faced by Farmers

For the good quality and productivity of crops, monitoring and controlling of temperature, humidity, light and CO₂ level are necessary requirements. Crop growth means the growth status and trend of various crops, which include such as cereal crop, horticultural crop, fruit etc., from planting crop seedlings to harvesting. It is very significant for a grower or owner to obtain the crop condition information such as weather condition, status of crop's growing, change of

maturity and quality, occurrence of damage to the crop, etc.[3] As a result, utilization of IT technology in agriculture has become common place than before and has been proven effective and productive. With respect to crop growing, it can be divided into two types of controlled horticulture and open field culture. Depending on the growing condition, requirements for IT technologies are somewhat different. Until now, main concerns for growing in controlled horticultural environments such as green house were the increase of quality and productivity. Therefore, requirement for IT technologies have been concentrated on how to collect more efficiently .

To increase the crop productivity, it is highly imperative to monitor individual crop growth deeply. The factors that have to be considered to monitor the crop growth are [4]

- i. Physical growth of crops
- ii. Rational water and light amount
- iii. Nutrient content
- iv. Fertilization preciseness
- v. External hindering factors such as birds and pests.

From survey of United Nations – Food and Agriculture Organisations, the world wide food production should be increased by 70% in 2050 for evolving population. Agriculture is the basis for the human species as it is the main source of food and it plays important role in the growth of country's economy. It also gives large ample employment opportunities to the people. The farmers are still using traditional methods for agriculture, which results in low yielding of crops and fruits [5]. So the crop yield can be improved by using automatic machineries. There is need to implement modern science and technology in the agriculture for increasing the yield. By using IoT, we can expect the increase in production with low cost by monitoring the efficiency of the soil, temperature and humidity monitoring, rain fall monitoring, fertilizers efficiency, monitoring storage capacity of water tanks and also theft detection in agriculture areas.

3. Review of work done

In this era of modern technology, where everything is dependent on data processing and information technology, Raspberry Pi proves to be a smart, cost-effective and efficient platform

for invoking the agriculture, and industry automation. Authors in [3] proposed a automation framework for smart agriculture using This paper Raspberry Pi. They analyzed the varingconditions of moisture, temperature and humidity level.Thus provide a method through which the farmers will be informed regarding the change in moisture, temperature and humidity. So that they willbe able to schedule the proper timing for water supply and allthe necessary things that required for proper growth of plants.

In [4], the authors proposed a framework using the concept of remote sensing. They combined theremote sensing technology with multispectral imaging, For data tramission, the authors used GSM network. The major factors under consideration were physical crop growth, nutrient contentmanagement, rational light and water needs andfertilization. Using this framework,crop productivity will increase which ismost concerned part of the agricultural sector.

The paper [5] proposed dynamic analysis methodbased on low-power mobile sensor node. Using the mobile sensor node, field analysis such as trend, correlation and summary has becomemore efficient by using dynamic data search and comparing.The proposedsolution is evaluated in large scale vineyard in Napa valleyfor 2 years.

A soil monitoring system [6] is proposed for smart farming. The soil is monitored for cultivationand providing more efficient crops byfrequently monitoring the temperature,humidity, soil moisture and pH range [13]of soil. pH range not only determines thetype of crop for cultivation but alsoreduces the usage of fertilizers. Enhancement electrochemical sensor areused todetermines the pH range ofeach nutrients separately .

A relaiable and efficient agriculture monitoring system [7] based on WSN has been proposed. This system allows user to see accuratechanges in crop yield. It is cheaper in cost andconsumes less power.It gives the information about the temperature,humidity of the air in agricultural field throughMMS to the farmer, if it fallout from optimal range.This system can be used in green house andtemperature dependant plants. The application ofsuch system in the field can definitely help toadvance the harvest of the crops and globalproduction.

A PA agriculture irrigation system[8] is developed with lowcomplex circuitry. A two sensors are used efficiently those are temperature and moisture of soil in the circuit to get thecalibrated information to the system. Implementation of such a system in the field can definitely help to improve the field ofthe crops and overall production. With the help of thisapproach the irrigation system completely automated also provides real-time information about the lands and crops thatwill help farmers make right decisions. Here two sensors are used to control the irrigationsystem so the troubleshooting easily done whenever itnecessary. Here proposed correlated data based algorithmreduce the hardware complexity compare to the otherproposed systems. The threshold voltages are chosenfor calibration of the sensors by considering past months oftemperature and soil moisture values. Threshold valuesmay be varying depends on the crop and plantation.

4. Conclusion

This paper reviews the concepts of IoT and overviews how IoT helps in handling the issues of smart farming. Farming can be made more efficient & accurate with the implementation of IoT device. IoT can be used in different domains of agriculture. Electricity and water are the main domains and their cost can improve or break the agriculture profession. Other domains in agriculture are insecticide, fertilizers and pesticides. By using sensors the crop field that is connected to internet, an appropriate decision can be taken. to enhance quality and quantity of production, to save resources like water and electricity, and to make economically efficient crop that costless and make more profit as in country like India farmers play a major role in GDP so this way the overall GDP can also be enhanced.

References:

- [1] Singh, Dhananjay, Gaurav Tripathi, and Antonio J. Jara. "A survey of Internet-of-Things: Future vision, architecture, challenges and services." IEEE World Forum Internet of Things (WF-IoT), 2014.
- [2] Atzori, and Morabito, "The internet of things: A survey", Computer Networks, 54(15), 2787–2805, 2010.

- [3] Boobalan. J, Jacintha. V, J. Nagarajan, K. Thangayogesh and S. Tamilarasu, “An IOT based Agriculture Monitoring System”, proceedings of International Conference on Communication and Signal Processing, pp:0594-0598, 2018.
- [4] G Garg, S Sharma, T Choudhury, PKumar, “Crop Productivity based on IoT”, proceedings *International Conference On Smart Technology for Smart Nation*, pp: 223-226, 2017.
- [5] Junwook Lee, HyunjoongKang,HyoChan Bang, “Dynamic Crop Field Analysis using Mobile SensorNode”, proceedings of ICTC, 2012
- [6] P.R. Harshani, T. Umamaheswari, R. Tharani, S. Rajalakshmi, J. Dharani, “ Effective crop productivity and nutrient level monitoring in agriculture soil using IoT”, proceeding of International Conference on Soft Computing and Network Security, 2018
- [7] Pratibha S. R., Anupama H, Jyothi M , “ IoT based monitoring system in smart agriculture”, proceedings of International Conference onRecent Advances in Electronics and Communication Technology, pp: 81-84, 2017
- [8] R Nageswar Rao, S Sridhar, “ IoT based Smart Crop Field Monitoring and Automation Irrigation System”, proceedings of International conference on Inventive Systems and Control, pp: 478-483, 2018