# Scarcity towards Smart Agriculture Using IoT

**[1]Pavankumar Naik, [2]Nagaraj Telkar, [3]Jagadeesh Meti, [4]Vishwanath Herigoudar**
[1234]Assistant Professor, [1]Computer Science and Engineering Department,
[1]SKSVMACET, Laxmeshwar, Karnataka, India

***Abstract— This review paper deals with IoT that can be used to improve cultivation of food crops, as lots of research work is going on to monitor the effective food crop cycle, since from the start to till harvesting the famers are facing very difficult for better yielding of food crops. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers even such information's are not enough for farmer so still lot of research work need to be carried out on current agricultural approaches so that continuous sensing and monitoring of crops by convergence of sensors with IoT and making farmers to aware about crops growth, harvest time periodically and in turn making high productivity of crops and also ensuring correct delivery of products to end consumers at right place and right time.***

---

## I. INTRODUCTION

Agriculture is the major source of income for the largest population in India and is major contributor to Indian economy. However, technological involvement and its usability have to be grown still and cultivated for agro sector in India. Although few initiatives have also been taken by the Indian Government for providing online and mobile messaging services to farmers related to agricultural queries and agro vendor's information to farmers. Based on the survey it is observed that agriculture contributes 27% to GDP, and Provides employment to 70% of Indian population [1].

Internet of Things (IoT) is a method of connecting everything to the internet - it is connecting objects or things (such as car, home, electronic devices etc...) which are previously not connected with each other. Main purpose of IoT is ensuring delivery of right information to right people at right time. With the rapid development of Internet and networking technology, people can chat, work, shopping, keeps pets and plants in the virtual world provided by the network. IoT can be used for monitoring and tracking of different domains such as Health domain, Environmental domain, Utility domain, Logistics domain, Agriculture domain by connecting group of things associated with sensors and internet from remote places and making automation and achieving desired quality result [2].

IoT is changing the agriculture domain and empowering farmers to fight with the huge difficulties they face. The agriculture must overcome expanding water deficiencies, restricted availability of lands, while meeting the expanding consumption needs of a world population. New innovative IoT applications are addressing these issues and increasing the quality, quantity, sustainability and cost effectiveness of agricultural production.

Lot of research need to be carried out on current agricultural approaches so that continuous sensing and monitoring of crops by convergence of sensors with IoT and making farmers to aware about crops growth, harvest time periodically and in turn making high productivity of crops and also ensuring correct delivery of products to end consumers at right place and right time [4, 5, 6].

According to survey made by IoT analysts based on the usage of different IoT applications (such as Smart cars, Smart city, Smart Home, Wearable Devices, Industrial internet, Smart grid, Smart health, Smart retail, Smart Agriculture, Smart Supply chain )through Google searches, LinkedIn, and Twitter records in 2015 , agriculture and supply chain management system have been given less priority compared to any other applications regarding their research areas, with the scope of 0.8% and 0.2% respectively.

India is the world's second largest producer of sugarcane and in a survey it is proved that sugarcane is the most remunerative crop and has a very high economic biomass to total biomass ratio in Indian economy. Sugarcane supports one of the largest agro-processing industries of India and more than 6 million farmers are engaged in its cultivation. Besides, about half a million skilled and semi-skilled workers, mostly from rural areas are also engaged in the sugar industry. By 2030 AD, India will require nearly 33 million tonnes of white sugar for domestic consumption alone [3].

Although India is second largest irrigated country of the world, most of farmers don't have an idea of modern agriculture because of illiteracy and also for following the traditional irrigation methodologies from past hundreds of years. Because of less knowledge towards use of manures and fertilizers lead to less productivity of crop yields, for this correct and automated guidance is needed for farmers to monitor their crops regularly. Large areas of fertile land suffer from soil erosion by wind and water, so this area must be treated and maintained to its original fertility. Agriculture also face the problem of sudden change of climate factors and High Need of fresh water supply, for this the farmers are made to withstand to any climate change by continuous Monitoring of environmental factors and managing of amount of water needed for fields. Agricultural marketing seems to be not good in rural India [7, 8]. In the absence of marketing facility farmers will sell their crops to Traders and brokers at least price. Indian agriculture need to increase productivity by leveraging technology, especially for high yielding and resistant variety seeds and efficient utilization of water, adapt latest IT to increase resilience to nature by phasing sowing, watering and harvesting and to increase the price benefits to the farmer by providing timely market information[9]. This research work aims at addressing some of the above mentioned issues related to agriculture domain, considering sugar cane crop as a case study.

## II. LITERATURE SURVEY

In the previous year's lots of research has been done on smart farming such as, Artificial neural networks method is proposed to predict crop yield by sensing soil properties and atmospheric parameters [10], using Big-data technology in agriculture domain it shows how to analyze and process useful data and in turn how it will affect the cost reduction and benefits is explained in [11, 12]. Challenges in agriculture sector and remote sensing applications are discussed in [13] which include crop estimation and cropland mapping Remote sensing techniques is widely used in agriculture and agronomy. The use of remote sensing is necessary, as the monitoring of agricultural activities faces special problems not common to other economic sectors. The production depends on the physical landscape (e.g., soil type), as well as climatic driving variables and agricultural management practices. All variables are highly variable in space and time. Moreover, as productivity can change within short time periods, due to unfavorable growing conditions, agricultural monitoring systems need to be timely. This is even more important, as many items are perishable [13]. WSN based on soil temperature, humidity monitoring system for agriculture using ZigBee and

GPS technologies and WSN based greenhouse environment monitoring system is explained in [14] which make use of temperature, humidity, CO2 and light detection modules. This combined WSN technology and greenhouse control technology provides automatic adjustment of greenhouse [15, 16].

As a proof of concept, Nie et al. (2014) proposed precision agriculture architecture based on CPS design technology that includes three layers: the physical layer, the network layer and the decision layer [4]. The architecture can be used for different agricultural applications. Dong et al. (2013) presented a proof-of-concept for a CPS application called Wireless Underground Sensor-Aided Center Pivot (WUSA-CP) irrigation system. This system will provide autonomous irrigation management capabilities by monitoring the soil conditions in real time using wireless underground sensors. Mehdipour (2014) proposed a "Smart Pest Control" based on CPS in order to provide an infrastructure for monitoring rats in the agriculture field. Ciprian-Radu RAD (2015) proposed precision agricultural management integrated system architecture based on CPS design technology [11].

Temporal behavior of soil temperature of sugarcane field under tillage and residue management was studied and Residue mulching significantly suppressed soil temperature during the extreme summer period, Residue mulching significantly increased soil temperature during the extreme winter period was studied in paper [17]. The distributed data acquisition system can be used in decision support systems for controlling the P. kuehnii and it may assist farmers to perform an intelligent chemical control. Such system is mainly based on mini-stations installed in sub regions of cultivation, which transmit the data daily, via Internet, to a central computer. To make experimental tests, one of the mini-stations developed was installed at the same place where an official meteorological station works, and the data were compared in order to validate the sensors of the mini-station [18]. In South Africa approximately 30% of sugarcane is grown under irrigation and there is increasing pressure to demonstrate efficient use of limited water resources. Agronomic practices such as the use of a crop residue layer, changed row spacing, growing suitable varieties and accurate irrigation scheduling could potentially increase water use efficiency (WUE) by saving water and/or increasing yield [19].

## III. OBJECTIVES THAT NEED TO BE RESOLVED

To monitor and scan the soil parameters (humidity, temperature, soil pH) and weather forecasting data, further this data is utilized by farmers to decide the correct time for plantatation of crops.

To ensure the correct and timely communication of real time data related to dynamic agricultural processes like plant growth, infecting parameters and harvesting time. It enables farmers to easily visualize data of crop and take action using pest control systems to reduce damage by pest on large scale.

To ensure periodic monitoring of supply chain management of crop products which involves heterogeneous actors such as farmers, agro marketing agencies, agro product vendors and agro banks which will facilitate distribution of products from farmers to buyers and from agro vendors to farmers. Logistics is that part of the supply chain process that plans, implements and controls the efficient, effective flow and storage of goods, services and related information from the point-of-origin to the point-of-consumption in order to meet customer requirements and satisfies the requirements imposed by other stakeholders such as the government and the retail community.

## IV. METHODOLOGY

For implementation of smart agriculture for sugar cane crop RFID sensors, Actuators and Microcontroller's are connected each other for monitoring soil humidity, temperature and NPK values.

The sensors with actuators are buried under soil in crop area to monitor soil conditions (humidity, temperature, soil pH etc…) and send the information to main sensor port for processing. Information received from sensors is processed and stored in the database servers,

Finally the stored data is processed for viewing, understanding and interpreting data to farmers through internet. Based on the information farmers can judge what areas of field are profitable and what steps to be taken to improve profits in affected area. The products obtained after harvesting can be supplied to end consumers by tracking the supply chain management which involves heterogeneous stakeholders (Farmers, Traders, and Consumers) by convergence of sensors with internet. In this Farmer registers with the application and sends the periodic crop data after harvesting to Traders, Trader register with application and sends and receives Crop details with farmer and consumers in both direction, Consumer register with application and sends the notifications regarding Crops prices and requirements with traders.

## V. POSSIBLE OUTCOMES

It will provide autonomous irrigation management capabilities by monitoring the soil conditions in real-time.

Through real time sampling of soil and crop details farmer will be able to get current fertilizer requirements for the crop and optimizing the use of pesticides by knowing the right doses to be used at right time, farmers will obtain large and quality productions of crops by continuous monitoring.

It will provide proper management of resource allocation such as Group of people (Gang) for the farmers to ensure the proper time for cutting up crops and in turn making large quality products with good market value.

Through smart supply monitoring an integrated food chain can be built that will allow data to be transferred bi-directionally in an automatic and simple way and ensuring the product moves efficiently through supply chain management making sure that everything is at the right place at right time.

## REFERENCES


**[1]** P.K Basu," Soil Testing in India", *Department of Agriculture &* Cooperation *Ministry of Agriculture,* Government of India 2011.

**[2]** Irena Bojanova, George Hurlburt, Jeffrey Voas, "Imagineering an Internet of Anything", Published by IEEE Computer Society, June 2014.

**[3]** L. S. Gangwar S. Solomon Pushpa Singh S. S. Hasan A. K. Sah ,"Socio-economic Impact of Sugarcane Production and Diversification in India", Indian Institute of Sugarcane Research,2014.

**[4]** Clement Atzberger, "Advances in Remote Sensing of Agriculture: Context Description, Existing Operational Monitoring Systems and Major Information Needs", Remote Sensing 2013, ISSN 2072-4292.

**[5]** Aline Marques Genu, Jose Alexandre Melo Dematte, "Prediction of soil chemical attributes using optical remote sensing", Acta Scientiarum Agronomy, Maringa, v.33,n.4,p.723-727,2011.

**[6]** Prof. S. G. Galande, Prof. G. H. Agrawal, Mrs. Londhe Shalaka Rohan, "Internet of Things Implementation for Wireless Monitoring of Agricultural Parameters " ,IJARECE Volume 4, Issue 8, August 2015.

**[7]** Hemlata Channe1, Sukhesh Kothari2 , Dipali Kadam3," Multidisciplinary Model for Smart Agriculture using Internet-of-Things (IoT), Sensors, Cloud Computing, Mobile-Computing & Big-Data Analysis",IJCTA | May-June 2015 .

**[8]** Alexandros Kaloxylos a,*, J Wolfertb, Tim Verwaartb, Carlos Maestre Terolc, Christopher Brewsterd, Robbert Robbemondb and Harald Sundmakere , "The Use of Future Internet echnologies in the Agriculture and Food Sectors: Integrating the Supply Chain. 6th International onference on Information and Communication Technologies in Agriculture, Food and Environment", (HAICTA 2013).

**[9]** Xiaohui Wang, Nannan Liu, "The Application of Internet of Things in Agricultural means of production supply chain management", Research Article, Journal of Chemical and Pharmaceutical Research, 6(7):2304-2310, 2014.

**[10]** N. Sakthipriya, "An Effective Method for Crop Monitoring Using Wireless Sensor Network" , Middle-East Journal of Scientific Research 20 (9): 1127-1132, 2014.

**[11]** Ciprian-Radu RADa*, Olimpiu HANCUa, Ioana-Alexandra TAKACSa,Gheorghe OLTEANU, "Smart Monitoring of Potato Crop: A Cyber-Physical System Architecture Model in the Field of Precision Agriculture", Agriculture and Agricultural Science Procedia 6 (2015) 73 – 79.

**[12]** Snehal S.Dahikar, Sandeep V.Rode, "Agricultural Crop Yield Prediction Using Artificial Neural Network Approach", INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN ELECTRICAL, ELECTRONICS, INSTRUMENTATION AND CONTROL ENGINEERING, Vol.2, Issue 1, January 2014.

**[13]** Steve Sonka, "Big Data and the Ag Sector: More than Lots of Numbers", International Food and Agribusiness Management Review Volume 17 Issue 1, 2014.

**[14]** Clement Atzberger, "Advances in Remote Sensing of Agriculture: Context Description, Existing Operational Monitoring Systems and Major Information Needs", ISSN 2072-4292, Remote Sensing 2013.

**[15]** G.V.Satyanarayana, SD.Mazaruddin, "Wireless Sensor Based Remote Monitoring System for Agriculture Using ZigBee and GPS", Conference on Advances in Communication and Control Systems 2013.

**[16]** Yongxian Song, Juanli Ma, Xianjin Zhang, Yuan Feng, "Design of Wireless Sensor Network-Based Greenhouse Environment Monitoring and Automatic Control System", JOURNAL OF NETWORKS, VOL. 7, NO. 5, MAY 2012.

**[17]** G.O. Awea, J.M. Reichert ,O.O. Wendroth, "Temporal variability and covariance structures of soil temperature in a sugarcane field under different management practices in southern Brazil", Elsevier 2015.

**[18]** Alex Lemes Guedes · Maurício Moreira · Maria Bernadete de M. França, "A Distributed and Wireless Data Acquisition System to Fight Against Sugarcane Orange Rust", Springer 2013.

**[19]** Francois C. Olivier, Abraham Singels , "Increasing water use efficiency of irrigated sugarcane production in South Africa through better agronomic practices", Elsevier 2015.