THINK INDIA (Quarterly Journal)

ISSN: 0971-1260
Vol-22-Issue-4-October-December-2019

A Novel Approach For Massive Yield In Agriculture Using Iot

S. Sethuramalingam[1], S. Arumuga Peruaml[2], A. Venkat Subramanian[2]
Assistant Professor, Department of Computer Science,
Sri Paramakalyani College, Alwarkurichi, Tamilnadu[1]
Professor and Head, Department of Computer Science,

S. T. Hindu College, Nagercoil, Tamilnadu[2]
IEEE Member, Nagercoil [2]

Abstract:

Agriculture is the main source that meets the food demand of living beings. The growth of a nation is predicted from the outcome of its Agricultural contribution. Population explosion, Climate change and poor environmental factors decreases the agriculture yield gradually. Smart Agriculture is the only solution to these challenges as it is focused on the modernization of existing agricultural methods. This can be implemented by adopting Internet of Things (IoT) in agriculture. Smart Agriculture focuses on data collection from various sensors such as Temperature, Humidity, Soil Moisture, Soil pH, and Soil Nitrogen. The main objective of this paper is to monitor the aforementioned factors that directly influence the growth of crops. The collected data from the farm lands are stored in a cloud database for analytics and predictive actions. Smart Agriculture provides a mechanism for efficient observation, measurement and response to changes in environment. It provides better water irrigation, appropriate fertilizers management and efficient soil nutrition and directly influence the productivity. It is also used to enhance quality and profitability in agriculture by using minimum resources with less environment pollution.

Keywords: Sensors, IOT, Cloud database, analytics and predictive actions

1. INTRODUCTION

Agriculture is the prime indicator of Indian economy. India is the second largest agriculture country that supplies various grains, vegetables and fruits that satisfy the demand of several nations. Most of the Indian population livelihood depends on the yield of agriculture. Although agriculture is the base bone of Indian economy, the yield in agriculture gradually decreases in the past decades due to several environmental factors. Agriculture sector is severely affected by unpredictable monsoon, improper usages of natural resources. The farmers could not predict the parameters that causes loss in a precise manner. Agriculture field is not improvised after green revolution. There is a mismatch between production and demand. Farmers should increase their yield to meet global food demand. Arable land in India is diminishing over the past two decades due to farmers migration from rural area to city.

Traditional Agriculture should be modernized by adopting ICT in agriculture. Massive food demand has urged us to adopt new technologies in agriculture to automate it. Adoption of ICT in agriculture will be useful for increasing food production to meet global food demand. The "Internet of Things (IoT)" is a new technology that holds potential for improving traditional agricultural activities. IoT has several applications and smart agriculture is one of the most important applications for mankind. IoT drives automation to next level with sophisticated decision making by use of connectivity and data. This paper presents an overview of IoT and its various technologies used in agriculture sector. It also summarizes the advancement in various environment sensors, embedded devices, and wireless sensor networks, cloud and Big data analytics.

Smart Agriculture (SA) is an innovation that adopts IoT for acquiring precise yield in agriculture. The main objective of smart agriculture is to map food demand and food supply. It will be the best strategy for enhancing the production in agriculture sector. It uses sensors, satellites and other IoT technologies to control and manage variability within farm fields to obtain maximum production. It enables the farmers to use crop inputs efficiently including fertilizers, pesticides and water irrigation. It focuses on conserving and enhancing natural resources at the same time maintaining the revenue. The crop growth deficiency will be eliminated through Smart Agriculture. It is used to enhance productivity by optimizing energy consumption, water utilization and the use of chemicals. The analytics capabilities support farmers to react quickly and dynamically for maximizing the production of crops. It uses cloud database and Big data techniques for providing efficient decision-making ideas to the farmers. This paper concludes with a discussion on impact of IoT in agricultural sector.

2. Literature Survey

Agriculture is the prime source of food production but the amount of cultivable land shrinks due to rise in global population. India has lot of small and marginal farms. The agriculture sector goes down in the past decade due to the complexities in process of agriculture. degradation of natural resources, poor income and climate change. The current methodology uses two methods which are manual method and analysis method. In manual method, farmers have to ensure the weather condition, soil moisture level and water level on day by day basis. The farmers are doing the entire agricultural processes such as land preparation, sowing,

ISSN: 0971-1260
Vol-22-Issue-4-October-December-2019

seed selection, seed treatment, weeding, water irrigation, fertilizers level and pest control on their own. The lack of knowledge in adopting new technologies in agriculture prevents farmers from predicting climate conditions, crops health, soil conditions and water level.

In analysis method, the farmers verify various parameters and record their readings manually without using any digital technologies. As a result, they could not meet their demand and supply in their yields. Farmers can only harvest their crops by inspecting the maturity of the crops by manual analysis. Most of the time the prediction will fail which leads to huge loss. Our proposed work provides an eco-system for smart farming by integrating various smart sensors, smart irrigation system through wireless communication technology. It uses agricultural inputs with respect to soil, weather and crop.

3. Proposed Work

3.1 Internet of Things (IoT)

Internet of Things (IoT) is concerned with the interconnection of physical and digital environment through internet. IoT is the network of physical devices embedded with sensors, software and electronics that enables these devices to communicate with each other and exchange data over a network. IoT is a system of interrelated computing devices, machines, sensors, objects that are provided with unique identifiers. The things in IoT refer to hardware devices uniquely identifiable through a network platform within the internet infrastructure. IoT provides a solution for modernizing our traditional agriculture. IoT makes a device to sense its surroundings, collect data from multiple sensors and send it to the cloud for interpretation. Devices connected with IoT rely on a nominal bandwidth of internet connection. The IoT is both hardware and software technology where many users can access the objects at same time over internet.

IoT can be used in various sectors. The major applications of IoT are

- Energy conservation
- Smart Transport
- Social Network
- Smart Agriculture
- Supply chain logistics
- Health care
- Home Automation
- Smart Environment
- Smart cities
- Industrial control

IoT architecture consists of three important stages, they are 1. perception 2. processing 3. storage. IoT uses 3 layers or 5 layers model for its implementation. The effective delivery of data in IoT depends only on the IP network. IoT uses the following technologies for its implementation.

- Hardware
- Communication technologies
- Protocols
- Software (IDE)
- Cloud database

IoT hardware devices are working at perception layer. These devices are mainly used for sensing the surrounding data. The collected data are sent to IoT gateway which is present in communication layer. This layer uses several communication protocols for transferring the data. The data are sent to the cloud database which is present in backend layer.

3.2 Smart Agriculture

Smart Agriculture helps the farmers to automate their traditional farm activities. Smart Agriculture is the technique of observing, measuring and responding to variability in crops with the goals of optimizing returns by preserving resources. The main objective of SA is to synchronize demand and supply. Suma et al predominantly explained the necessity of agriculture with minimum waste. The group urged the significance of agriculture by citing the migration of people leaving the agriculture at the bottom to urban areas. They used several environment sensors for collecting data from the farm for taking further decisions. [1] Gokul L.Patil et al, explained the importance of adopting new technologies in agriculture sector for maximizing the yield. The results of their project were sent to mobile phones of various farmers through their agro logger interface with mobile application.[2] Antonis Tzounis et al in their review work on IoT in agriculture emphasized the massive increase of Smart Agriculture works have been going on. [3] Smart Agriculture focuses on the usages of various IOT devices and technologies to control and monitor various agriculture activities. [4] Smart Agriculture will be more suitable for small and marginal size fields or farms. It is a dominant technology that modernizes the agriculture processes with minimum inputs for obtaining high yield. [5]

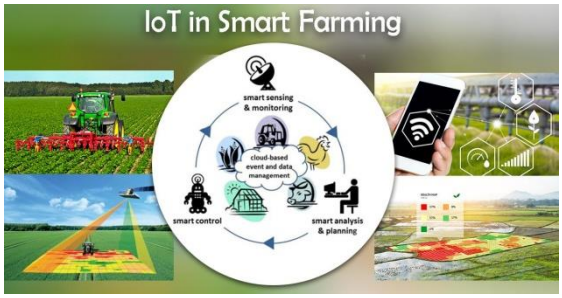


Fig 3.2.1 Smart Agriculture using IoT

Smart Agriculture uses various improved sensors, devices, actuators, processors, GPS, cloud database and other technologies for its implementation. [6] It uses information technology and management to control and manage variability within farm fields for obtaining optimum production. It provides an environment for sensor-based water irrigation, precise fertilizer management, and crop monitoring and market demand analysis.

Sensors such as Location Sensors, Temperature and Humidity Sensors, Optical Sensors, Electrochemical Sensors, Mechanical Sensors, Dielectric Soil moisture sensors and Air flow sensors are used in Smart Agriculture. These sensors are useful for identifying

ISSN: 0971-1260
Vol-22-Issue-4-October-December-2019

various problems that affect the crops directly. Sensors produce enormous amount of data for control unit. The sensor data are in a streaming fashion. [7]

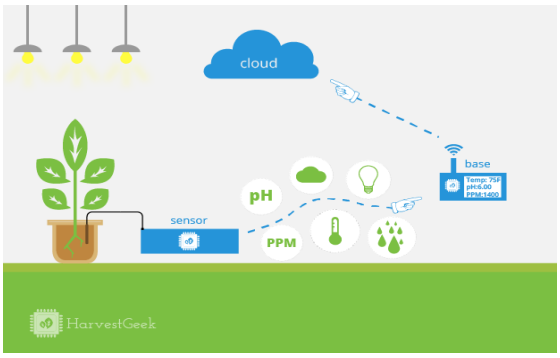


Fig 3.2.2 Sensors used in Smart Agriculture

Smart Agriculture uses agricultural equipment, GPS, GIS, variable rate farming equipment for its implementation. It also applies required quantity of water, fertilizer and pesticides depends on soil moisture and nutrient. It provides homogeneous water level, soil condition to all crops equally in the farm. The crop growth deficiency will be eliminated from the above technique. It restricts the excessive use of fertilizers and wastage of water in the farms. It also enhances the productivity by preventing soil degradation without any pollution. The inputs of above-mentioned sensors at various depths, rain fall, leaf wetness and humidity are recorded periodically. These kinds of system will help the farmers to determine the time for plantation, irrigation and harvesting.

3.3 System Overview

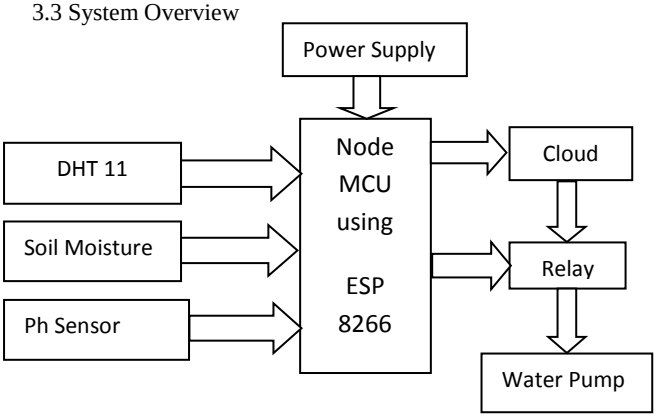


Fig 3.3.1 Block Diagram

3. 4 Implementation

Climate, weather and soil moisture condition are the most important factors in the production of crops. Sensing the environment in which production occurs, more recently, the responses of the crops to the climate is crucial for taking the correct and precise decision for increasing the production. Information on crop growth, development of crops at each location is obtained through several sensors in a streamed fashion. Massive amount of data is sent from various sensors continuously.

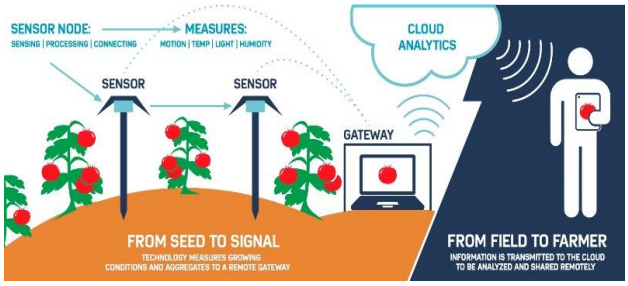


Fig 3.4.1 Overview of Implementation

Agriculture data collected from various sensors are sent to Node MCU ESP 8266 for further processing. All sensors, devices, GSM module and actuators are interconnected with ESP 8266. Data collected from sensors are recorded continuously then the data are sent to cloud database for taking efficient decision. Smart Agriculture defines Decision Support System by using big data techniques to maximize the agricultural yields by minimizing various valuable resources.

3.5 Benefits

- Optimized water usage
- Restricts the excessive use of fertilizers and pesticides
- Sustain high yielding
- Improves product quality, nutrients and taste
- Minimizes the environment pollution

3.6 Success parameters

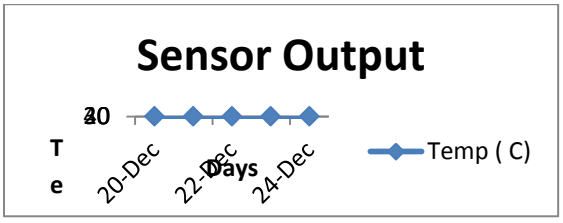
- Effective irrigation
- Improved soil fertility
- Crop protection

3.7 Outcome

Aforementioned sensors were deployed in a testbed and data is collected periodically. The output of the test result is show in the below table

Date	Temp(c)	Humidity (%)	Soil Moisture
Aug 20	33.2	44.5	21.1
Aug 21	31.5	42.5	20
Aug 22	32	41	19
Aug 23	30.5	43	20.5
Aug 24	29	40	21.5

Table 3.7.1 Sensor output



ISSN: 0971-1260
Vol-22-Issue-4-October-December-2019

Fig 3.7.2 Temperature Sensor output (c)

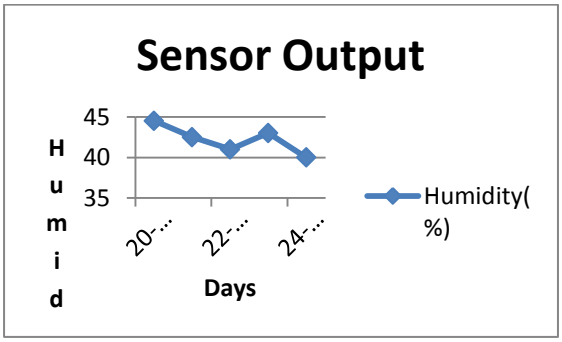


Fig 3.7.3 Humidity Sensor output (%)

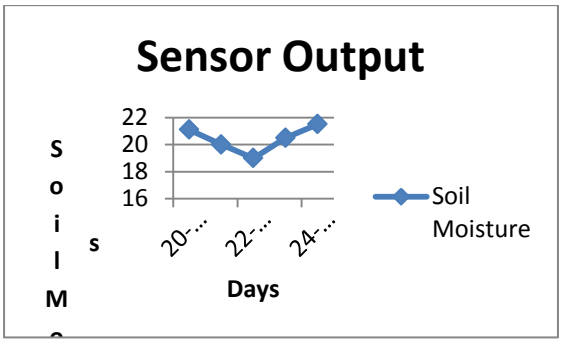


Fig 3.7.4 Soil Moisture Sensor output (15 cm (%))

4. Conclusion

Adoption of IoT technology in agriculture will create a big impact in overcoming the barriers in traditional agricultural process. IoT technology predominantly occupies a place in agriculture. The yield of agricultural products and the quality reach greater scales with minimum wastage of natural resources and benefits the farmers.

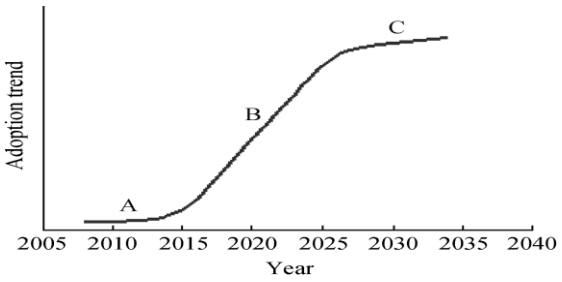


Fig 4.1 Proposed SA adoption trend in India

References

[1] Dr.N.Suma , Sandra Rhea Samson, S.Saranya, G.Shanmuga priya, R.Subha sri, "IoT Based Smart Agriculture Monitoring Syatem", International Journal on Recent and Innovation Trends in Computing and Communication, vol5, Issue 2, February 2017

[2] Gokul L.Patil, Prashant S.Gawande, R.V.Bag, "Smart Agricultue Sysyem based on IoT and its social impact", International Journal of Computer Applications, vol 176- No 1,October 2017.

[3] Antonis Tzounis, Nikolas Katsoulas, Tomas Bartzanas, Constantinos Kittas , "Review Internet of Things in agriculture, recent advances and future challenges", Bio systems engineering 164(2017) 31-48, www.elsevier.com/locate/issn/15375110

[4] Nikesh Gondchawar, Dr.R.S. Kawitkar, "IOT based smart agriculture", International Journal of Advanced Research in computer and communication Engineering(IJARCCE),vol5, Issue 6, June 2016.

[5] M.K.Gayatri, J.Jaya sakthi, Dr.G.S.Anandha mala, "Providing Smart Agriculture Solutions to farmers for better yielding using IOT", IEEE International conference on Technological innovations in ICT for agriculture and rural development (TIAR 2015)

[6] S.Rajeswari, K.Suthendran , K.Raj kumar,"A Smart Agricultural model by integrating IOT, mobile and cloud based Big data analytics", International Journal of pure Applied Mathematics, vol 118, No 8,2018,365-370

[7] Akshay Atole, Apurva Asmar, Amar Birdar, Nikhil Kothawade, Sambhaji sarode, Rajendra G.Khope,"IOT based Smart Farming system", Journal of Emerging Technologies and Innovative Research(JETIR),vol 4, Issue 4, April 2017.

[8] electronics FOR YOU," An EFY GROUP publication vol 50 No12 ISSN 0013-516X"