# A Study On Smart Irrigation Systems For Agriculture Using Iot

**Dr. J. Jegathesh Amalraj, S. Banumathi, J. Jereena John**

**Abstract**: Agriculture plays an imperative role in the country's development. In our country, more than 72% of people depend upon farming which is one-third of the population invests in farming. Thus, the challenges and issues concerning agriculture need to be focused to hinder the country development. The only recommended solution to this issue is modernizing agriculture using smart technologies. IoT can construct agricultural and farming processes more efficient by tumbling human intervention through automation. In agriculture, irrigation is one of the processes which support crop production by supplying needed water to the soil. The irrigation methods involve a lot of time and effort in farming. A Sensor-based automated irrigation system provides a promising solution to manage agricultural activity. This research article provides a vast study on the irrigation system in smart agriculture.

**Index Terms**: Smart Agriculture, Smart Irrigation, Internet of Things, Sensors, Water Management, Crop Monitoring.

## 1. INTRODUCTION

Agriculture is the main source of food production in our country. In India, agriculture contributes 18% of the country's Gross Domestic Product (GDP) which employs more than half of the total population [6]. The Indian government has stressed and highlighted the need of innovations to be in above mentioned criteria's in agriculture, thus seeks an indication of technology exposure and innovative implementation practices to enhance the productivity. The productivity in agricultural, food security, erratic conditions in climates, soil conditions requires new ideas and innovations. While this is largely depends on irrigation system, and current techniques in irrigation which helps to achieve more productivity per drop of water. Automation in irrigation system helps to farmers to manage their work much easier and helps to take decisions even in the absence of farmers. IoT, sensors, smart phone tools are the technologies which helps farmers to know the status of their land, amount of water needed, temperature of soil, humidity, weather conditions, ph level [4]. IoT is the term was first coined by the Massachusetts Institute of Technology in the year 1999 [9]. Definitions focus on technical aspects of IoT when the other based on the applications and functionalities. A few definition defined IoT as "an extension of the current Internet to all objects that can communicate directly or indirectly with electronic equipment and connected to the Internet". Other defined as "a novel paradigm that is rapidly gaining ground in the scenario of modern wireless telecommunications. IoT is automating all the aspects of farming and agricultural methods to make the process more efficient and effective. The aim of this study is to analyze recently developed IoT technologies in the agriculture and farming industries to present summary of sensors, technologies, and sub-verticals such as water management and crop management.

Smart agriculture allows to farmers to produce yields using minimum resources such as water, fertilizer and seeds. Farmers can deploy sensors to understand their crops, conserve resources and reduces the influences of environment in crops [7]. The smart agriculture is also called as precision agriculture. A number of sensing technologies are used in precision agriculture, providing data that helps farmers monitor and optimize crops [17], as well as get used to changing environmental factors including location sensor, optical sensor, electro chemical sensor, Mechanical Sensors, Dielectric Soil Moisture Sensors, Airflow Sensors, Agricultural Weather Stations, humidity sensors, Proximity Sensor, pH Sensor. The Figure 1 illustrates the factors influenced irrigation system.

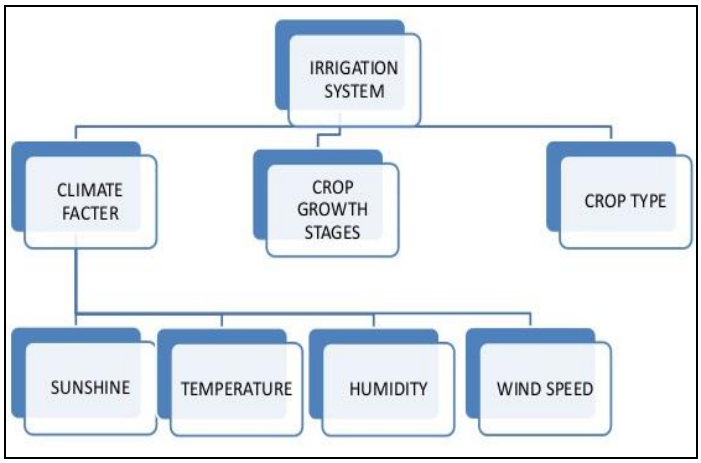


***Fig.1**. Factors influenced Irrigation system*

In smart agriculture, one of the main sensors is soil moisture sensor. It is used to measure the volumetric water content (moisture) presents in the soil. The threshold value is fixed, and the soil moisture value level measured and checks with threshold as above and below levels. The humidity sensors are helps to measure the surrounding air temperature and relative humidity. Relative humidity is the ratio of actual moisture in the air to the highest amount of moisture that can be held at that air temperature. Irrigation is the fundamental need of agriculture, there are three classic irrigation methods channel irrigation, sprinkler irrigation and Drip Irrigation according to the need of crops these three methods are being used. Regarding smart irrigation system, researchers [10] have proven that water usage is minimized when an automated irrigation system that relies on soil moisture as a parameter is implemented. Among this Drip Irrigation is the one where farmers can conserve more water as it will supply


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the water in the form of droplets directly on to the root of the plant on to the surface of the soil. But to irrigate the plants human continuous attention towards the crops is essential and also man power is needed to implement any irrigation method. To avoid this using sensors automatic method of Drip irrigation can be implemented and the status of the irrigation is updated to farmer using IoT. To implement these things RaspberryPi3 model B processor has been used with ESP32 module in order to avoid damage of RPi. A customized sensor-based system can be used which reduces the power consumption in the aspect of water source as well as the cost incurred during the irrigation process [11].

## 2 LITERATURE REVIEW

The proper utilization of water needs to be considered as most urgent issue in the current scenario of water decreasing and drying up of rivers and tanks. To come across from this issue the use of sensors such as temperature and moisture at appropriate locations for monitoring the crops [1] implemented. An algorithm developed and implemented with threshold values. The threshold values are applied in the temperature and soil moisture by using micro controller based gateway to monitor water quantity. The system can be powered and have communication link on cellular interface that allows data monitoring and irrigation scheduling through a web page. The innovative system with new technologies in agriculture helps to provide betterment for farmers in increasing the agricultural yield. A remote sensing and control irrigation system using distributed wireless sensor network was developed. The irrigation rate was measured in the field and linear moving of irrigation system used to maximize the productivity with minimal use of water was developed by author [2]. Wireless sensor networks and its development make possible to monitoring and control parameters in precision agriculture [8]. A day by day decrease in yields of agriculture needs research in agriculture field. The author proposed novel system where five in field sensors used and it collects all the data and send it to the base station using global positioning system. This system provides benefit in cost and remote controlling regarding irrigation in a precision manner [3]. The usage of technology in agricultural field helps to reduce extra man power efforts. The researchers measured soil related parameters such as temperature and humidity. The sensors were put down to the soil and the communication received from the sensors to the relay nodes with the help of communication protocol. The author developed IoT based system where sensors transmission done by hourly basis. The main drawback of this system is they used asynchronous receiver transmitter interface to receive the signals from sensors, but the sensors were placed in the down of the earth causes attenuation of signals [5]. The authors proposed system which helps the farmers to view their farm details from remote locations. The system predicts the disease appeared in the plant which reduces the agricultural commodity from the diseases. In which the disease identification is very challenging task do to physically by the human. And also the way of irrigation process is not much effective in earlier method of irrigation system. The systems with IoT implementation provided optimization in water usage and also monitor the irrigation system [12]. This proposed system deals with non linear analysis of soil disinfection. The author demonstrated the case with practical implementation which developed with optimal design technique. This system approach helps to assess the usefulness of the pest control by means of microwave heating of farmland with thermal equations. This system provides more realistic description of the heating process and approach suitable to the any kind of soil with different exposure time [13]. In this paper the author proposed approach highly aimed at the accurate detection and identification of crop for effectively controlling and preventing diseases for agriculture and security in food. This approach includes image processing technique such as image capturing and feature extraction with image pre-processing and applied classification using artificial neural network algorithms. The nominal level of accuracy achieved in the classification algorithm and in future the texture features can be considered [14]. New Spectral Indices (NSI) developed [15] and it used for determining various diseases on crops. The newly optimized indices were acquired from a weighted consolidation of a single band. And the value is adjusted using algorithm to differentiate the diseases which is not available in the existing system. This work is expecting the use of hyper spectral information to enhance NSIs will further improve the sensitivity of disease. Some researchers find the severity of the disease symptoms using spectral disease index [16]. This SDI exhibited high accuracy and sensitiveness in discerning disease levels. The author proposed a system [18] to make a alert using sensors and electronic gadgets. For producing result the authors took samples of grape plants and sensors used to identify the disease through the leaves of plant. Robotics based detection is used to identify the disease in agriculture. The authors [19] proposed a robotic based detection in the crops. The disease was monitored in the green house physically by the human experts. It expansion the green house yielding, quality and sustainability. In this system the disease detection in greenhouses is developed to the control of disease, to upgrade the yield, and decreases the fertilizer application. The author presents a study on the image processing techniques used in smart agriculture. Many diseases exhibit common symptoms caused in leaves of the plant and the images more probably used to diagnosis the disease even remotely. Farmers experience great complex and also in changing from one disease control policy to another the cost power, automatic correct apperception and classification of diseases based on their specific symptoms is very essential to farmers and also agriculture scientists [20].

## 3 COMPARATIVE STUDY

Table 1 illustrates the overall view and comparisons of various agricultural system techniques used.

***TABLE 1***

*Comparisons of various Smart Agricultural Systems*

| Existing System | Technologies used | Advantages | Cloud Implementation | Data Acquisition |
|---|---|---|---|---|
| Smart Irrigation System [11] | MATLAB, wireless sensor, IOT. | Optimizes the water usage, provides a remote | ✓ | ✓ |

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|---|---|---|---|---|
| | | controlling, monitor the system. | | |
| Non-Linear Analysis of Soil Microwave Heating [12] | Microwave antennas, electromagnet ethic heating. | Allows a very effective solution. | × | ✓ |
| Cucumber Disease Detection [13] | Artificial neural network, MATLAB. | Provides the Accuracy | × | ✓ |
| Identifying and Monitoring Winter Wheat Diseases [14] | Hyperspectrum | Diseases could be determined and Differentiated. | × | ✓ |
| Detection and Identification of Disease Stages [15] | ASD spectro radiometer, MATLAB. | This SDI exhibitedhigh accuracy and sensitiveness. | × | ✓ |
| Mega-Nano Detection of Foodborne Pathogens and Transgenes [16] | Quantum dots, DNA. | Established an on-the-plant design for detecting signature molecules. | × | ✓ |
| Robotic Disease Detection in Green Houses [18] | RGB camera, laser sensor, computer automation. | Overcome the threat in the crops or leafs in the agriculture. | × | ✓ |
| Identification and Classification of Fungal Disease [19] | Image processing, pattern recognition. | Monitor the crop for possible diseases and avoids upcoming loss of crops. | × | ✓ |

## 4 ADVANTAGES OF SMART AGRICULTURE USING IOT

Traditional irrigation strategies are not suitable for dealing with the shortage of irrigation water, this sector must benefit from modern technological advances. Hence the new smart agricultural irrigation system has following advantages.

- Increase the productivity: Productivity on farmland is going too increased.
- Reduce water consumption.
- No manpower required.
- Reduce soil erosion and nutrient leaching.
- Cost effective method.
- High quality crop production.
- System not damage by weathers and birds.
- Efficient use of water.

## 5 CONCLUSION

Nowadays innovations can be consolidated to let down the cost and maximize utilization of resources. Currently, farmers control irrigation method manually and irrigate their area at a systematic period. These mechanisms diminish high amount of water and the conclusion is water loss. While dry areas have less rainfall and irrigation is challenging. The smart agricultural system guarantees higher productivity with efficient use of water. Automation of the irrigation control process by using the detected environmental parameters to be needed. Smart irrigation can be automated with the help of current technologies presented above and its main advantages are increase in productivity, reduce water consumption and reduce soil erosion.

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