EasyChair Preprint

№ 2157

# Automated Agriculture Supervision and Smart Irrigation System Using IoT: A Survey Paper

Shubham Swami, Somesh Uniyal, Utkarsh Gupta and Vishnu Sharma

EasyChair preprints are intended for rapid dissemination of research results and are integrated with the rest of EasyChair.

December 12, 2019

`

# Automated Agriculture Supervision and Smart Irrigation System Using IoT: A Survey Paper

Shubham Swami[1], Somesh Uniyal[2], Utkarsh Gupta[3], Vishnu Sharma[4]

[1,2,3] *Student, Dept. of CSE, GCET, UP, INDIA*

[4] *Dept. of CSE, GCET, UP, INDIA*

***Abstract- IOT and automation are the two emerging technologies revolutionizing the world today. Agriculture, being a major and important part of India's economy, needs to go hand in hand with the technology in order to save water and increase efficiency. The proposed system provides an efficient way to do this.***

***Keywords: IoT, automation, Agriculture, efficiency***

## I. Introduction

Agriculture sector has been a major part of India's economy and it still is. It contributes to 26% of the Gross Development Product (GDP)[1]. Be it raw material for industries or a source of income for grocery store agriculture plays a vital role. Such a vital sector should be given adequate focus. Crops such as rice need adequate amount of water. So, proper management is needed so that water wastage is least. Moreover with the decrease of level of groundwater, it has become necessary that we focus on efficient use of water. With the world trending towards advanced and new technologies, agriculture should also take its advantage. Use of modern technologies reduce the chance of human error which can reduce problems like crop damage, soil erosion, leeching of nutrients, spreading of pesticides, unwanted vegetative growth, loss of valuable water to the watertable[2]. Various researches done in the past show that there are various environmental factors that affect the yield of the crops. These factors include temperature, humidity, soil moisture, fire, etc. The issues faced due to these factors can be resolved by using sensors. Much of the work is currently done manually. With the help of sensors we would not only increase efficiency but can also reduce the cost. Appropriate sensors can be used for resolving the issues that need to be resolved by the farmers. By placing the sensors at appropriate places we can collect the data and monitor our field remotely. Hence, the paper proposes solution to some of the issues by the use of smart irrigation system. This system checks the soil moisture and accordingly irrigates the field.

### 1.Literature Survey

Rajalakshmi P.et.al., [3] described to monitor the crop-field using soil moisture sensors, temperature and humidity sensor, light sensor and automated the irrigation system. Wireless transmission is used for sending the data to web server and data encoding is done using JSON format to maintain server database. If the temperature or moisture of the agriculture field falls below the brink, irrigation system will be automated. The notifications are sent to farmer's mobile periodically so that farmers can monitor the field conditions at any given time from anywhere. The parameters used here are soil moisture sensor, temperature and humidity sensor DHT11, LDR used as light sensor and web server – NRF24L01 used for transmitter and receiver. This system will be more useful in areas where water is in scarcity and it is 92% more efficient than the conventional approach. PHP script is used for storing data produced by automation of irrigation system. Total average power consumption is 2 Ah per day for a single motor pump.

Nelson Sales et al., [4] this paper describes Wireless sensor Networks. The network performs three tasks i.e. acquisition, collection and analysis of data such as temperature and soil moisture. There are many benefits of irrigation process in agriculture such as decreasing water consumption

`

and other environmental aspects. Cloud Computing proposes as an attractive solution for high storage and processing of large amount of data by the Wireless Sensor and Actuator Network. This work aims to help agriculture, greenhouses, golf courses and landscapes. Architecture is divided into three main components namely, a WSAN component, a cloud platform component and a user application component. It contains three different types of nodes such as sensor node, a sink node and an actuator node. SimplitiTI is a simple protocol used for WSAN implementation in a cluster tree topology. The soil moisture is monitored to assess whether the plants need water for proper development and optimization of natural resources.

Nikesh Gondchawar et al., [5] proposed work on IoT based smart agriculture. The aim of the paper is to make agriculture smart using automation and IoT technologies. Smart GPS based remote controlled robot will perform the operations like weeding, spraying, moisture sensing etc. It includes smart irrigation with the help of smart control and intelligent decision making based on accurate real time field data and smart warehouse management. It monitors temperature and humidity. It also provides theft detection in the warehouse. All the operations will be controlled by smart devices and it will be performed by interfacing the sensors, ZigBee modules, camera and actuators with microcontroller and raspberry pi. This paper gives information about field activities, irrigation problems, and storage problems using remote controlled robot for smart irrigation system and smart warehouse management system respectively.

Tanmay Baranwal et al., [6] this project concentrates security and protection of agricultural products from attacks of rodents or insects in the fields or grain stores. Security systems are used to provide real time notification after sensing the problem. The algorithm is designed based on collecting information to provide accuracy in notifying the user and activation of repeller. Testing is done in an area of 10 sq. m. and the device is placed at the corner. The PIR sensor identifies heat and starts URD sensor and webcam. It will also be helpful to extend the security system to prevent rodents in grain stores.

Pratibha S R et al., [7] proposed work on automated smart agriculture. The aim of the paper is to automate agriculture using different sensors. The proposed system consists of microcontroller, network processor and Wi-Fi unit. Temperature infrared thermopile sensor- TMP007 is used in the system. It has built in digital control and math engine. It senses the temperature values in real time and humidity sensor- HDC1010 track the relative moisture of air within the farming field. Camera is interfaced with CC3200 camera booster pack via PCB using MT9D111 camera sensor. This is used to capture current images of the particular field. Those images are then sent to the farmer through GPRS.

Mrs.T.Vineela et al., [8] this project proposed a basic IoT based system for irrigation. The system uses DHT11 sensor to detect humidity and temperature and a soil moisture sensor to check the moisture content of the soil. It uses ThingSpeak to store and retrieve data. The system works on raspberry pi.

Ravi Kishore Kodali et al., [9] proposed system that consists of two sections. The first section consists of sensors and second section consists of MQTT server which receive and process data for decision making. In the first section, the Esp8266 is used as a network gateway which is connected to soil moisture sensor and relay using wired connection. The proposed system data is secured using Cryptographic Protocol for secure data transfer between server and microcontroller. The Esp8266 module is use to act as a gateway server for connecting to the Internet. Data is stored continuously in MQTT Server. The advantage of using MQTT protocol and transport layer security (TLS) cryptographic protocol is that no ambiguous data is stored along with the required data. Along with encryption proposed system uses username and password for providing authorised access to the data.

Andreas Kamilaris et al., [10] proposed a system composed of multiple layers. At each layer, specific operations are performed by various software components for tasks such as data acquisition, modeling, analysis or visualization. Each software component acts as a single entity thus providing a flexible distributed architecture.

Prof. K. A. Patil et al., [11] proposed system with three modules farm side, server side and client side. It senses local agricultural parameters, identifies sensor location and collects data. This data is

`

transferred for decision making. Actuation and control is based on this decision. A camera module is also used for crop monitoring.

Shruti A Jaishetty et al., [12] proposed a novel IoT sensor network for monitoring the environmental parameter in an agriculture field. The system mitigates this data to the cloud through a secured IoT hub (Thingspeak), and then run predictive analysis on the gathered data (matlab deployed at Thingspeak). The proposed system overcome the limitations of traditional GPRS based system through protocols like MQTT, secured HTTP, which not only ensures that the data is safe and secured, but the entire communication is over an authorized secured socket layer which provides immense security to the data.

Minwoo Ryu et al., [13] proposed an automated farming system which consists of three main components monitoring sensors and controllers, IoT gateway (called &Cube), and IoT service platform (called Mobius). Sensors and controllers are used for monitoring and controlling the environmental conditions of the farm. &Cube acts as a middleware which can be installed into IoT gateways. The Mobius is an IoT service platform which helps to create virtual representations of physical IoT devices. Each device is registered into the Mobius using &Cube so that every IoT device can have its virtual representation in the Mobius in the form of a resource type.

## 2.System Overview

The project consists of various components such as Raspberry Pi, relay, sensors etc. The block diagram for the system is as shown below:

Hardware Requirements:

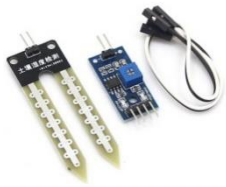
1. Raspberry Pi

Raspberry Pi is a powerful device. It is a low cost, small hand sized computer used for various computing purposes. It is one of the most important element in the field of IOT. It contains features such as Wi-Fi and internet which makes it to possible to remotely access the system. It helps in collecting the data coming from the sensors and accordingly performing the appropriate actions.

2. Relay

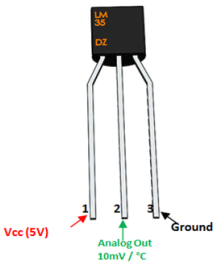
A relay is an electrically operated switch. It is used when it is necessary to control a circuit by an independent low-power signal, or when several circuits must be controlled by one signal.

3. YL-69 Moisture Sensor



The YL-69 sensor or hygrometer is used to detect the moisture of soil. This sensor enables our system to know whether the moisture level is within the threshold value or not.

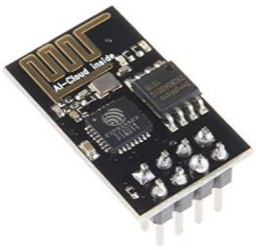
4. Temperature Sensor (LM-35)




The LM-35 sensor or temperature sensor is used to detect the temperature. It returns the analog value which is then converted to digital form with the help of formula.

`

5. ESP8266 Wi-Fi Module



It is a low cost microchip that helps in sending data remotely to the system. It is responsible for sending data from the sensor to the user so that he/she can monitor the field remotely.

Software Requirements:

1. Python

Python is an interpreted programming language that was created by Guido van Rossum. It is commonly used in artificial intelligence projects. The Raspberry Pi single-board computer project has adopted Python as its main user-programming language.[14]

2. ThingSpeak

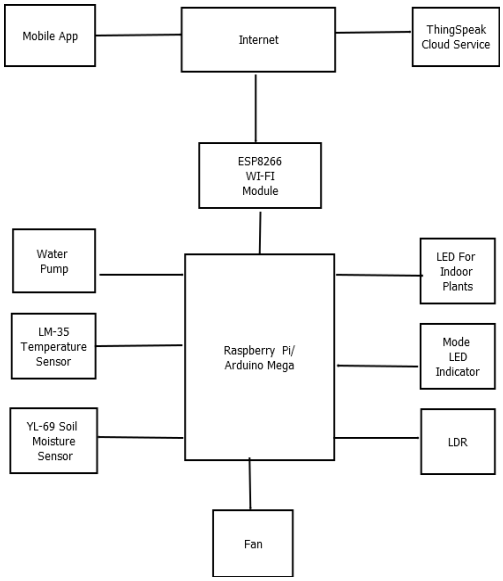
ThingSpeak is an IoT platform that provides different services such as aggregating and analysing data. With the help of thingSpeak we can collect data from sensors and analyse it.

## II. Proposed Work

We propose a novel method to solve the problem of water and electricity wastage. Our IoT based irrigation system would not only help in reducing the manpower but would also help in estimating cost of water and electricity.

Our irrigation system would basically work in two modes: automatic and manual. The manual mode would allow the user to enable and disable the pump and fan as per their choice. The user would be provided with the real time data from the sensors which would help in making the decision.

In automatic mode, the user will be asked to provide a threshold value for the data being collected. If the value goes beyond the threshold value, the appropriate function would be performed. Moreover, the data obtained from the sensors could be used to analyse the cost of water and electricity. This would help farmers to analyse the profits and the investment. We can also use the data from weather forecasting services for more efficient use of water.




Our irrigation system can be used for managing more than one field. This would result in better hardware utilization. This system can be applied for open field as well as green house. This system could be easily used for green house with the help of temperature sensor (LM-35), fan, LDR. Artificial lighting could be used for promoting plant growth.

The data obtained from the sensors will be transferred to the thingSpeak cloud platform. This data will then be provided to the user through an android app. The app will update the data at regular intervals of time.

## III. Conclusion

The sensors work successfully along with the raspberry pi module and wireless communication is achieved.

This project provides a solution to the problems in irrigation system. The implementation of such a system reduces water wastage and also increases the yields of crop.

`

## IV. Future Scope

This project can be further improved by using different other sensors to check the humidity and soil pH value. Further the data obtained from these sensors can be used to analyse the system and estimate the water usage. The soil pH value can help the farmer to use the fertilizer much efficiently. Thus, reducing the money spent on fertilizers.

## IV. References


1. https://www.nextgurukul.in/questions-answers-forum/question/academic/What-is-the-importance-of-agriculture-in-India/106137
2. http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water /irrigation/about-irrigation
3. Rajalakshmi.P, Mrs.S.Devi Mahalakshmi "IOT Based Crop-Field Monitoring And Irrigation Automation" 10th International conference on Intelligent systems and control (ISCO), 7-8 Jan 2016 published in IEEE Xplore Nov 2016.
4. Nelson Sales, Artur Arsenio, "Wireless Sensor and Actuator System for Smart Irrigation on the Cloud" 978-1-5090-0366-2/15, 2nd World forum on Internet of Things (WF-IoT) Dec 2015, published in IEEE Xplore jan 2016.
5. Nikesh Gondchawar, Prof. Dr. R.S. Kawitkar, "IOT based Smart Agriculture" International Journal of Advanced Research in Computer and Communication Engineering Volume:05 Issue:06
6. Tanmay Baranwal, Nitika , Pushpendra Kumar Pateriya "Development of IoT based Smart Security and Monitoring Devices for Agriculture" 6th International Conference - Cloud System and Big Data Engineering, 978-1-4673-8203-8/16, 2016 IEEE.
7. Prathibha S R1, Anupama Hongal , Jyothi M P "IOT BASED MONITORING SYSTEM IN SMART AGRICULTURE" 2017 International Conference on Recent Advances in Electronics and Communication Technology 978-1-5090-6701-5/17© 2017 IEEE DOI 10.1109/ICRAECT.2017.52
8. Mrs. T. Vineela, J. NagaHarini, Ch. Kiranmai, G. Harshitha, B. AdiLakshmi "IoT Based Agriculture Monitoring and Smart Irrigation System Using Raspberry Pi" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 01 | Jan-2018
9. Ravi Kishore Kodali and Borade Samar Sarjerao "A Low Cost Smart Irrigation System Using MQTT Protocol" 2017 IEEE Region 10 Symposium (TENSYMP)
10. Andreas Kamilaris, Feng Gao, Francesc X. Prenafeta-Boldu and Muhammad Intizar Ali "Agri-IoT: A Semantic Framework for Internet of Things-enabled Smart Farming Applications" IEEE World Forum on Internet of Things (WF-IoT) December 2016
11. Prof. K. A. Patil, Prof. N. R. Kale "A Model for Smart Agriculture Using IoT" 2016 International Conference on Global Trends in Signal Processing, Information Computing and Communication
12. Shruti A Jaishetty, Rekha Patil "IOT Sensor Network Based Approach For Agricultural Field Monitoring And Control" IJRET: International Journal of Research in Engineering and Technology Volume: 05 Issue: 06 Jun-2016
13. Minwoo Ryu, Jaeseok Yun, Ting Miao, Il-Yeup Ahn, Sung-Chan Choi, Jaeho Kim "Design and Implementation of a Connected Farm for Smart Farming System" 2015 IEEE Sensors November 2015
14. https://en.wikipedia.org/wiki/Python_(programming_language)