A

SEMINAR REPORT

ON

“Smart irrigation system based on internet of things (IOT)”

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Submitted By

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T.E. Division A

Under the Guidance of

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CERTIFICATE

This is to certify that **Mr. Jadhav Pratik Jayram** student in Third Year Division A, Computer Engineering has successfully completed his Seminar titled **"Smart Irrigation System Based On Internet of Things (IOT)"** at BSIOTR College of Engineering, Wagholi, Pune towards partial fulfillment of Seminar Work in Computer Engineering.

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Date :

Place : BSIOTR, Pune :

Abstract

Agriculture has become passion in developing countries like India. People are encountering lot of problems in the field of agriculture. Even today in India at many places traditional way of farming is being practiced which requires human intervention. Due to technological advanced the present people are interested towards Smart irrigation system than traditional farming. Due to lack of time, people are not able to spend time in traditional farming, to assist the people who are in urban and metropolitan cities, Hydroponic farming, an approach of Smart irrigation system is implemented. In the traditional framing technique water and space is abundantly required, this irrigation approach minimizes the use of water and reduces the space. This work aims to build an automated irrigation farming system that incorporates the data from all the sensors connected to the Raspberry pi and transferred to IOT server through the network. Meanwhile the stored data can be read to know the status of the system by the user on web based application. Knowing the status of the system the user can turn on/off the motor to water the plant when required. The plants growth can be predicted by collecting the data of sensor readings using machine learning technique.

Keywords- Hydroponic, automated irrigation, machine learning Smart Irrigation.

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JADHAV PRATIK
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Abbreviations

IOT: Internet of Things

WSN: Wireless Sensor Network

IMS: Integrated Management System

GSM: Global System For Mobile Communication

MQTT: Message Queuing Telemetry Transport

LORA: Long Range Radio

LED: Light Emitting Diode

IDE: Integrated Development Environment

Chapter 1

1. Introduction

India is a horticultural nation, where population is over 1.2 billion, out of which around 70% of the population relies upon horticulture. Agriculture is a major source of earning of Indians and agriculture also has made a big impact on India's economy. Agriculturists have an extensive variety of assorted variety to choose reasonable products of the soil crops. Be that as it may, the development of these crops for ideal yield and quality deliver is exceptionally specialized. It can be enhanced by the guide of innovative bolster. The administration of the water system can be enhanced utilizing programmed watering framework This proposes a programmed water system with framework for the terrains which will reduce manual labour and optimizing water usage increasing productivity of crops. Presently the computerization is one of the critical parts in the human life which gives comfort as well as lessen burden and helps us to save time and plan to develop a framework that helps the farmer to automatically provide water to the plant according to its need and current water moisture present in the soil. A keen water system is developed with the help of moisture sensors and Arduino chips. In the system, bury moisture sensor into the soil which would notify the system about amount of water present in the soil. With the help of a program, coded in C language, system will check the amount of water required by a plant, with predefined values in the program. If the moisture level is less than the amount of water needed by the plant, the program automates the flow of water from a submersible pump unless a threshold value is reached. This ensures that crop has been provided optimum amount of water without any manual labour or wastage. It improves efficiency of water usage, reduced cost of irrigation water, intelligent irrigation.

The main backbone of Indian economy is agriculture and traditional farming is practiced by many of them who are not aware of new emerging technologies. The main drawback of traditional farming is more consumption of water and space. Hydroponic technique is a new farming method which reduces the need of more water and space. Using this technique we can grow plants at home with less space and less water. Having a minimal knowledge about farming

one can use this technique and can grow plants by spending less time compared to traditional farming.

Chapter 2

2. Objective and Motivation

2.1 Objective:

The main objective is to apply the system for improvement of health of the soil and hence the plant via multiple sensors. Appropriate soil water level is a necessary pre-requisite for optimum plant growth. Also, water being an essential element for life sustenance, there is the necessity to avoid its undue usage And also use of this system is to detect the moisture content of the soil and depending on it sprinkle water . This entire information will be sent to the user's mobile phone.

- To save the water and reduce human intervention in the agriculture field.
- Continuously monitoring the status of soil through sensors and provide the signals for taking necessary action.
- To get the output of the sensor and provide water to crop/plant.
- To observe the parameter for better yield.
- Reduce the man power and conserve the water.

Chapter 3

1. Literature survey

- In irrigation field, soil moisture sensor, temperature sensors are placed in root of plant and microcontroller handles the sensor information and transmits data. One algorithm was developed to measure threshold values of temperature sensor and soil moisture sensor that was programmed into a microcontroller to control water quantity.[1]
- A lot of works have been done and is currently going on this topic. Low cost Smart irrigation system by Author [1] proposed a system whose objective was to control motor automatically and select the direction of flow of water. Which not only provide comfort but also reduced energy and time wastage. He used prototype for fully automation accessing of irrigation. Worked on ATMega-328 and raspberry pi controlling with Smart phone. IOT based low cost and intelligent module for Smart irrigation system by Author [1] This system developed an automated irrigation system for the farmer on the basis of wireless sensor network. This system continuously monitors the parameters temperature, humidity, and moisture of soil. An algorithm was used with threshold values of soil moisture to be maintained continuously. System starts or stops irrigation based on moisture content of the soil. This system proposes low cost moisture sensor based data acquisition system required for automated irrigation system. The authors have developed an impedance based moisture sensor. Sensors works on the change of impedance between two electrodes kept in soil [2].
- This paper represents irrigation management system using WSN and water pumps. Water level sensor is connected to main irrigation canals, and flow sensor is connected to water pump. These sensors are connected to wireless gateway which sends data periodically to web server. Database connected to web server monitors irrigation water level at all main. The web based IMS analyze the data stored in database and compares with specified

values. Then it (IMS) sends SMS to farmers and engineers to make aware of water requirement [3].

- This system is Smart irrigation techniques using internet of things (IOT).

Chapter 4

4.Problem Definition

4.1 Problem Statement:

Agriculture is the strength of Indian Economy. However, for agriculture water consumption is more than rainfall every year. Improving farm yield is essential to meet the rapidly growing demand of food for population growth across the world. An automated irrigation system is needed to optimize water use for agricultural crps. The technique can be used for application of accurate amount of water. By forming sensor network, good monitoring of water regulation in the agriculture field can be achieved. Advanced tools and technology can be used to increase farm yield. The microcontroller from the node controls relay switching unit and watering subsystem accordingly. In the present era one of the greatest problem faced by the world is water scarcity and agriculture being a demanding Occupation consume plenty of water. Therefore a system is required that uses water judiciously.

Waterlogging and salinization of soils are common problems associated with surface irrigation. Waterlogging results primarily from inadequate drainage and over-irrigation and, to a lesser extent, from seepage from canals and ditches. The Project 'Smart Irrigation System' is used for the optimization use of water in agricultural field without the intervention of farmer by using soil moisture Sensor that senses the moisture content of the Soil using Microcontroller that turn ON/OFF the pump automatically according t the need of water for irrigation Agriculture is the strength of Indian Economy. However, for agriculture water consumption is more than rainfall every year.

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forming sensor network, good monitoring of water regulation in the agriculture field can be achieved. Advanced tools and technology can be used to increase farm yield. The microcontroller from the node controls relay switching unit and watering subsystem accordingly

Chapter 5

5. IOT and Smart systems used in Irrigation

5.1 Communication technologies:

regards to the implementation of IOT devices, the used communication technologies could be considered as a vital and imperative point to attain successful operations. The communication technologies could further be regarded as being used in accordance with the environment where they will be applied. The main technologies that are used in IOT for irrigation could be classified into two categories. One could be regarded as the devices that function as nodes and lead to forward or transmit small data amount at short distances along with having low consumption of energy. Consequently, the other devices are the ones that have the ability to transmit huge amounts of data over long distances, having high-energy consumption. There are various wireless standards that could be used in the communication of IOT devices and they could generally be classified between devices that communicate at long or short distances.

One of the most used and effective communication technologies has been identified to be Wi-Fi due to the possible accessibility for it. It has further been identified that the current low-cost devices for IOT mostly lead to support Wi-Fi, and while it has its limitations (area coverage and reach), it is regarded an effective overall method. Global System for Mobile communication (GSM) further has been identified to be a widely spread wireless technology which provides long-range communication and all it requires is a mobile plan of the service provider which operates and functions in that particular area. Two other noticeable technologies that have been established more recently are Long Range (LORA) and Message Queuing Telemetry Transport (MQTT). LORA provides very long ranges, and this has led to make this technology highly feasible and useful for secluded areas that do not have any service. On the other hand, although

MQTT has also resulted in being a widely spread protocol as it have low overhead and low power consumption, it is not being highly used for an irrigation system as yet.

Chapter 6

6.Smart Irrigation System

The Smart irrigation system enhances the performance and is an emerging technique that automates irrigation systems and conserves water usage. This technique adjusts irrigation based on actual soil and weather conditions, therefore it allows farmers to meet their demand with a new adopted technique which conserves the water for irrigation process. Fig.6.1 shows the SMART irrigation system includes data acquisition (sensor), irrigation control, wireless communication, data processing and fault detection.

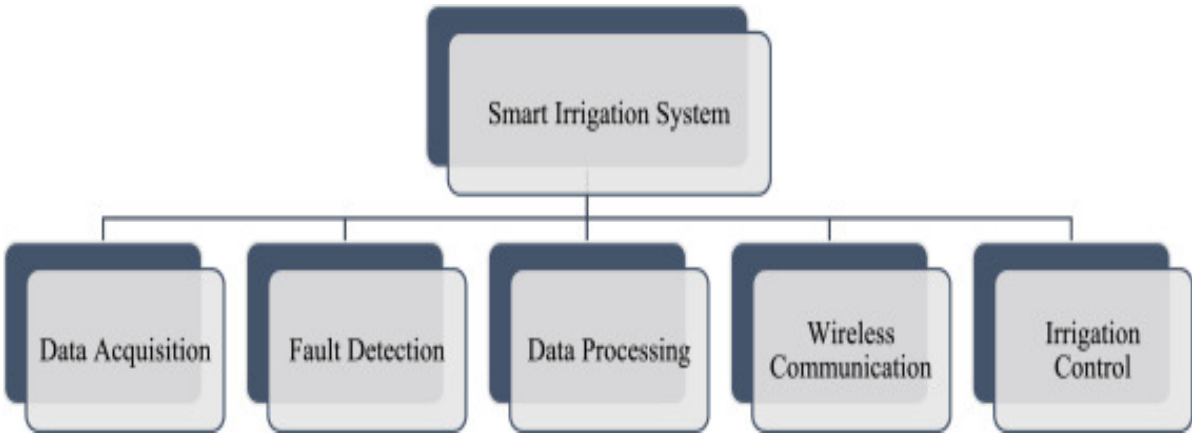


Fig 6.1 Smart Irrigation System

Each of these components can be used in IOT devices. Internet of Things (IOT), Smartphone tools, and sensors are technologies that further enable farmers to know the exact status of their

field, including soil temperature, amount of water required, weather conditions, and much more. IOT can be thought of as an extension of the current internet to all devices that can communicate with electronic equipment and are linked to the internet, making devices user friendly and easy to handle. Correspondingly, IOT is linked to automation of all areas of agriculture and farming processes in order to make the entire process more productive and efficient. The use of sensors is also important for farmers to better understand their crops, reduce the environmental impacts and conserve resources. There for by the usage of Smart agriculture, farmers are given the opportunity

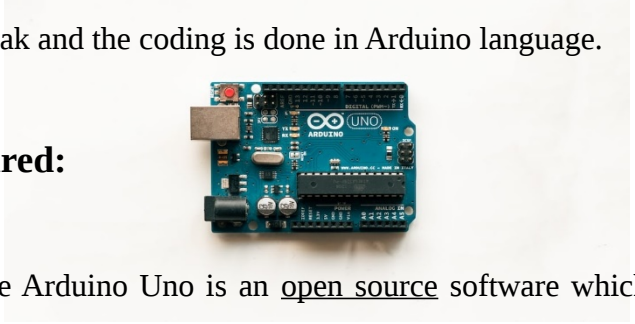
Chapter 7

7. Hardware and Software Components

Introduction:

The system is a composed of hardware equipment and software. In hardware used sensors, microcontroller, relay, motor, breadboard and wires. In software I have used open cloud website called thing speak and the coding is done in Arduino language.

7.1Software Required:

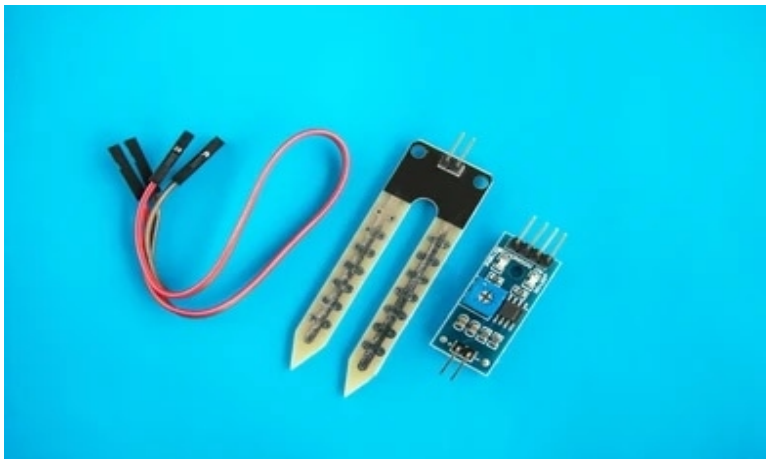


A. **ARDUINO**: The Arduino Uno is an open source software which is used for uploading the code into Arduino board. The working of all the sensor depend on the given code which is written in Arduino IDE.

Fig.7.1.1 Arduino Uno

B. **CLOUD WEBSITE**: the cloud website which is used is Thing Speak. The farmer can see all the data updates on this site, by just clicking the channel link. Details can be seen.

7.2 Hardware Required:



A. SOIL MOISTURE SENSOR:

The soil moisture sensor is used for calculating the volumetric content of the soil. The working of soil moisture sensor is relying on the working procedure of resistance. If the resistance between two dissimilar points of soil is diminution than there is increase in volumetric content of water in soil. If the resistance between two different points of soil is augmented than there is decrease in volumetric content of water in soil. The soil moisture sensor (fig.7.2) is composed of probe and circuit. The probes are injected under the soil surface which is used for measuring the volumetric content of the water. The second component of the soil moisture sensor is a circuit in which LED, Comparator, Potentiometer, LM293 and 3 Pins are integrated.

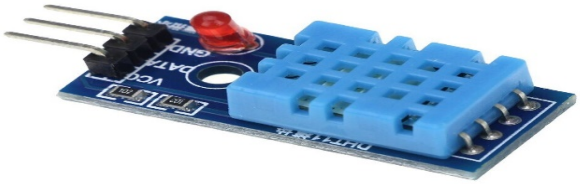


Fig.7.2.1 Soil moisture sensor

B. DHT 11:

The digital temperature and humidity sensor DHT11 (fig.2) is a composite sensor that contains a calibrated digital signal output of temperature and humidity. Three pins are available for use: VCC, GND, and DATA

Fig.7.2.2 DHT11

C. RELAY MODULE:

A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. This relay module has two channels (those blue cubes). There are other models with one, four and eight channels. This module should be powered with 5V, which is appropriate to use

with an Arduino. There are other relay modules that are powered using 3.3V, which is ideal for ESP32, ESP8266, and other microcontrollers.

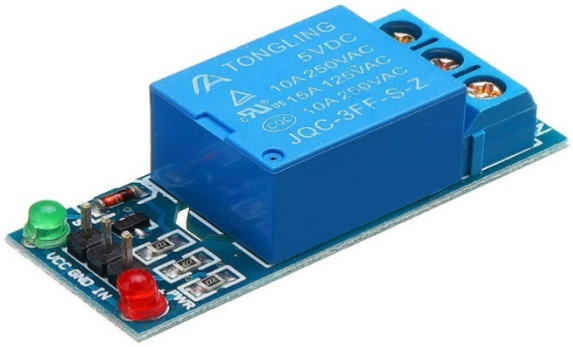


Fig.7.2.3 Relay Module

D. BREAD BOARD:

A breadboard is a solderless device for temporary prototype with electronics and test circuit designs. Most electronic components in electronic circuits can be interconnected by inserting their leads or terminals into the holes and then making connections through wires where suitable

Fig.7.2.4 Bread Board

E. MOTOR:

The **DC 3-6 V Mini Micro Submersible Water Pump** is a low cost, small size Submersible Pump Motor. It operates from a **2.5 ~ 6V power supply**. It can take up to 120 liters per hour with a very low current consumption of **220mA**. Just connect the tube pipe to the motor outlet, submerge it in water, and power it.

Fig.7.2.5 Motor

Specifications Features &

1. Operating Voltage : 2.5 ~ 6V
2. Operating Current : 130 ~ 220mA
3. Flow Rate : 80 ~ 120 L/H
4. Maximum Lift : 40 ~ 110 mm
5. Outlet Outside Diameter: 7.5 mm
6. Outlet Inside Diameter: 5 mm

Chapter 8

8. Methodology

8.1 Overview:

In this chapter, working principle of the Smart irrigation system and it's working and principle from sensing the moisture to activating a motor pump.

Irrigation can be automated by using sensors, microcontroller, Wifi module, android application . The low cost soil moisture sensor continuously monitors the field. The sensors are connected to arduino board. The sensor data obtained are transmitted through wireless transmission and are reached to the user so that he can control irrigation. The mobile application can be designed in such a way to analyze the data received and to check with the threshold values of moisture, humidity and temperature. The decision can be made either by the application automatically without user interruption or manually through application with user interruption. If soil moisture is less than the threshold value the motor is switched ON and if the soil moisture exceeds the threshold value the motor is switched OFF.

8.2 Algorithm:

The steps that the system undergoes:

Step 1: Soil moisture sensor senses the moisture level of the soil (less than or more than).

Step 2: If the moisture sensed value is greater than the fixed threshold value than no need to switch on the motor.

Step 3: If the Moisture level is less than the threshold value, then the water motor is switch-on automatically.

Step 4: Once moisture level comes equal to the threshold value, it moves to its initial state (switch-off the water motor).

Step 5: End the process.

8.3 Flowchart :

The working of the system can be understandable from the following diagram.

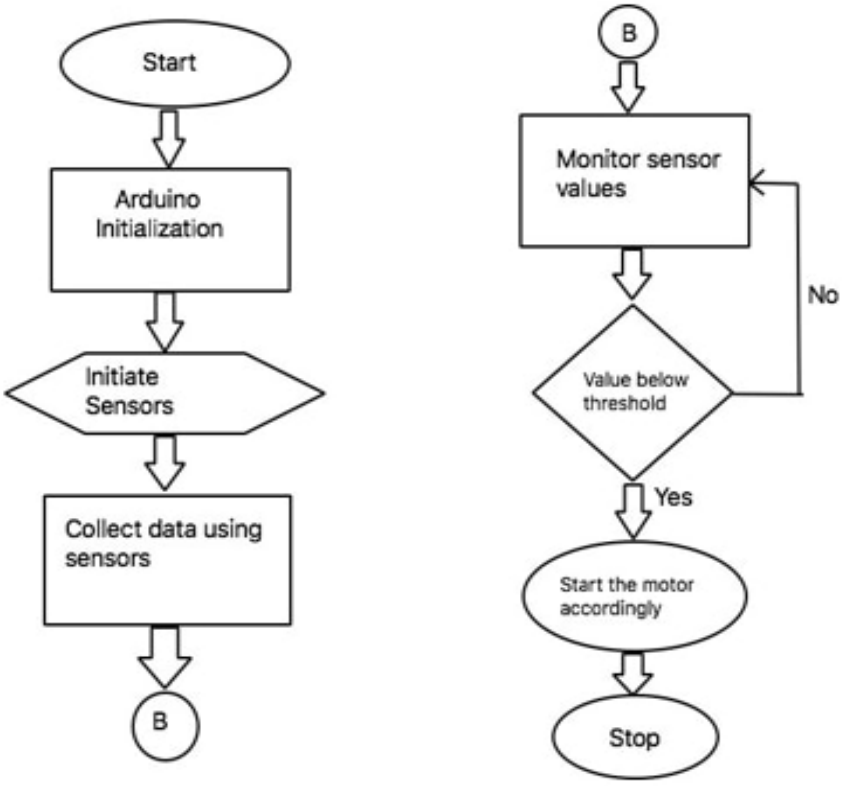


Fig 8.3.1 Flowchart of Smart Irrigation System

First of all we need to initialize all the hardware and software component of the given system. After initializing the component. the sensor collect the data from the soil and send it to the Arduino board.The Arduino board monitor the data send by sensor and compare this data with threshold value if the value is not below than threshold value then it will again going to monitor the threshold value.If the monitor value is less than threshold value then it will detect that the moisture level of water has been decreased and it automatically start the water motor, and after water level get equel or greater then threshold value then it will stop automatically the water motor.

8.4 Circuit diagram for this IOT Smart Irrigation System is given below:

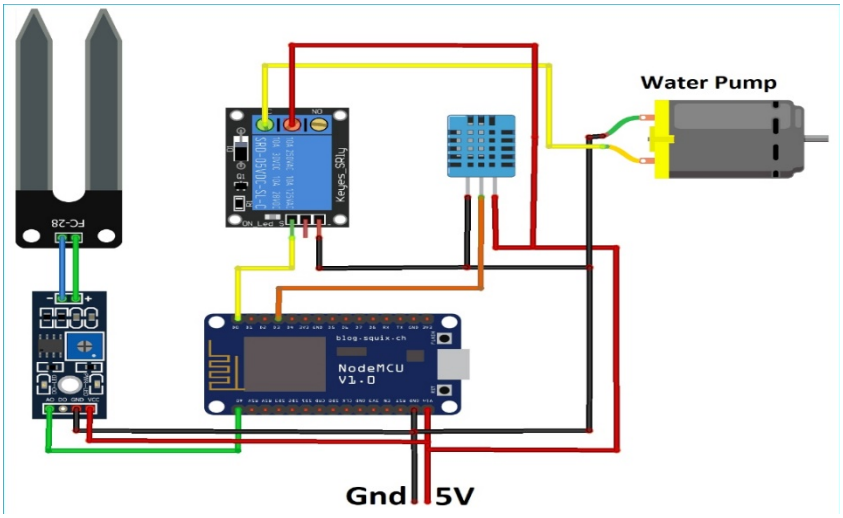


Fig 8.4.1 circuit diagram of Smart irrigation system

Chapter 9

9. Advantages:

Smart irrigation systems offer a variety of advantages over traditional irrigation systems. Smart irrigation systems can optimize water levels based on things such as soil moisture and weather predictions. This is done with wireless moisture sensors that communicate with the Smart irrigation controls and help inform the system whether or not the landscape is in need of water Additionally, the Smart irrigation controlled receives local weather data that can help it determine when a landscape should be watered. If you have ever returned home during a storm only to see your sprinklers spraying water you know how beneficial this is. Rather than wasting water resources and your valuable money on watering your landscape you can take advantage of

the nature moisture from the storm and save that water for another day when it is more needed. The advantages of these Smart irrigation systems are wide reaching.

Chapter 10

10. Disadvantages

- High power consumption of devices.
- Hardware equipment is exposed to harsh environment condition.
- Weak communication signal.
- Reliable internet connection not available in all location.
- Lack of IOT knowledge and applications to farmers.
- Low privacy and security on device and server.
- Short battery life for equipment.

Chapter 11

11. Current challenges and future prospects

The challenges and prospects of applying machine learning are covered in this section. There are several obstacles to overcome in the development of machine learning and digital software programs for Smart irrigation systems for managing various crops specially to help attain sustainable agriculture. The overall food production must be increased to address the fold shortages. In addition, more cash crops like cotton and rubber need to be grown to meet industrial demands, particularly if mixed with a sustainable materials to refrain from polluting the soil. Moreover, these problems present a number of difficulties, including the decline in agricultural manpower, the shrinking area of arable land, the scarcity of water supplies, the effects of climate change, etc.

The population of rural areas is ageing quickly and declining as the world moves toward urbanization. IOT techniques integrated in irrigation systems have a wide range of possible uses in farming and food production. There are numerous factors associated with IOT in Smart irrigation that needs further attention which includes, cost, autonomous operation, portability, low maintenance, effectiveness, robust architecture, and reliability. When integrated systems recognize the capabilities of artificial intelligence and big data, it is anticipated that agriculture will evolve into a dynamic industry. These integrated systems will combine a variety of agricultural tools, equipment, and management techniques that can be used for various activities ranging from planting to yield forecasting. A new era of IOT in the farming industry may be introduced by advanced machines like agricultural robots, cloud computing, artificial intelligence, and big data. These tools are deemed with high importance to ensure sustainable agriculture. There are several prospects for farmers and stakeholders who combine machine learning forecasting with portable software solutions. Water use efficiency can be enhanced by improving the predictions on irrigation needs, matching timing and volume to plant water needs, and adaptively compensating for water loss. Water use efficiency can be enhanced by improving the predictions on irrigation needs, matching timing and volume to plant water needs, and

adaptively compensating for water loss. This will result in increased yield while using less irrigation water. As the system becomes more advanced and intelligent, a better trained model will be deployed for better irrigation decision making.

Thus, much of the stress and burden associated with irrigation can be reduced for farmers and We are now living in the world of big data. Big data deals with collection, storage and analysis of data to understand the information not previously known. Implementing this Big Data Analytics in Agricultural/Irrigation System might be a great technological push. By making proper use of the large amount of data available, we could develop a new perspective by consideration of data or merging it with other useful information. This process could involve understanding crop records, precipitation maps, reports of diagnosis etc., along with continuous analysis of data streams about the specific area at every instant of time[7][9]. we will investigate the performance of the proposed model with long-term irrigation tests with more plants. Our initial tests were conducted in an indoor environment where temperature changes are negligible. Additionally,

we will extend our test bed to outdoor environments to observe the behaviour of the model in different environmental conditions.

Chapter 12

12. Conclusion

Technological innovations have become essential for businesses in today's environment, and organizations in every industry are making improvements to thrive and expand in size. In this regard, irrigation and its implementations can be improved to provide maximum operating efficiency while achieving the necessary performance results. While IOT has been associated with the automation of all aspects of agriculture and farming methods to make the entire process much more effective and efficient, sensory systems have been identified as being deployed by farmers to better understand their crops, reduce environmental impact, and conserve resources.

These technologies have been established over the past, not all organization have been able to successfully implement them and make use of it in the most adequate way. In the other hand, water scarcity is a critical issue that involves water stress, water shortage or deficits and water crisis. The concept of water management has occurred, and organizations have been attracted toward discovering solutions to save the resource while also improving their work efficiency. SMART irrigation system has become a need in today's environment when organizations are utilizing technology to achieve their performance goals.

The consequences of both IOT and sensor systems have been extremely imperative. IOT reduces the total cost of technology which allows the opportunity to manage the monitor system for irrigation processes.

The whole system is successful in building an end-to-end IoT application covering Getting measurements from an analogue input, Processing the data using node.js & Visualising the data using a 3rd party service. With the use be set to lower and upper thresholds to maintain optimum soil moisture saturation and minimize plant wilting. It can contribute to deeper plat root growth, reduced soil runoff/leaching, less favorable conditions for insects and fungal disease. It is also possible to control the nutrition levels in their entirety thus, lower nutrition costs. No nutrition pollution is released into the environment because of the controlled system. Hence will have great saving of irrigation water, stronger, healthier plants and stable, high yields. Hence definitely will have improvement in biological fertility. Also water level controller and automatic

irrigation controller with IoT prevents dry running of pumping motor, thus saves water, electricity, & the manpower needed to monitor the system.

Chapter 13

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