ISSN: 2366-1313

AN IOT BASED SMART WATERING SYSTEM USING SOIL MOISTURE CONCEPT

[1]A Divya Sree, [2]Bakkolla Sai keerthana, [3]GD Jonah, [4]Kalakonda vasavi

[1]Assistant Professor, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,

adivyasree29@gmail.com

[2]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,
saikeerthana775@gmail.com

[3]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,
jonah6679@gmail.com

[4]BTech student, Dept.of CSE, Teegala Krishna Reddy Engineering College, Meerpet, Hyderabad,
Kalakondavasavi879@gamil.com

Abstract: *India is mainly an agricultural country. Agriculture is the most important occupation for the most of the Indian families. It plays vital role in the development of agricultural country. In India, agriculture contributes about 16% of total GDP and 10% of total exports. Water is main resource for Agriculture. Irrigation is one method to supply water but, in some cases, there will be lot of water wastage. So, in this regard to save water and time we have proposed project titled smart watering system using soil moisture concept. In this proposed system we are using various sensors like soil moisture sensors which senses the various parameters of the soil and based on soil moisture value land gets automatically watered by ON/OFF the motor. The Smart watering system. Here we are building a IoT based Irrigation System using ESP8266 Node MCU Module and Soil moisture Sensor. It will not only automatically supply the water based on the moisture level in the soil but also send the Data to Thing Speak Server or ada fruit server or cayenne IOT Server to keep track of the land condition. The System will consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture. These sensed parameters and motor status will be displayed on user android application.*

Keywords: *Soil moisture sensors, IoT, Arduino, Android, Microcontroller, duplex communication*.

I. INTRODUCTION

ISSN: 2366-1313

Agriculture is considered as the basis of life for us as it is the main source of food and other raw materials. It plays vital role in the growth of country's economy. Growth in agricultural is necessary for the economic development condition of a country. The system designed to irrigate at a time of regular intervals for predefined period of time. n this technique, moisture sensor is placed at the root zone of the plant and near the gateway unit handles the sensor information and transmit data to the controller which in turn control the water pump. The system is used in many processes factors like soil moisture, salinity, humidity, temperature, intensity etc. This needs to repeat the task and have to work in abnormal weather conditions. Soil has to overcome the flaws in the irrigation system, the land based on the soil humidity and at the same time the status of irrigation is updated. 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 sustainable, there is vast necessity to avoid Its undue usage. Irrigation is a dominant consume of water. This calls for the need to regulate water supply for irrigation purpose. Fields should neither be over-irrigated nor under- irrigated. The objective of this thesis is to design a simple, easy to install methodology to monitor and indicate the level of soil moisture that is continuously controlled in order to achieve maximum amount of water in the land environment [1].

Despite the perception people may have regarding the agricultural process, the reality is that today's agriculture industry is data-cantered, precise, and smarter than ever. The rapid emergence of the Internet-of-Things (IoT) based technologies redesigned almost every industry including ''smart agriculture'' which moved the industry from statistical to quantitative approaches. Such revolutionary changes are shaking the existing agriculture methods and creating new opportunities along a range of challenges. This article highlights the potential of wireless sensors and IoT in agriculture, as well as the challenges expected to be faced when integrating this technology with the traditional farming practices. IoT devices and communication techniques associated with wireless sensors encountered in agriculture applications are analysed in detail. What sensors are available for specific agriculture application, like soil preparation, crop status, irrigation, insect and pest detection are listed. How this technology helping the growers throughout the crop stages, from sowing until

ISSN: 2366-1313

harvesting, packing and transportation is explained. Furthermore, the use of unmanned aerial vehicles for crop surveillance and other favourable applications such as optimizing crop yield is considered in this article. State-of-the-art IoT-based architectures and platforms used in agriculture are also highlighted wherever suitable. Finally, based on this thorough review, we identify current and future trends of IoT in agriculture and highlight potential research challenges [2].

Definition

The system which can be used to hydrate the soil and pump water while saving power at the same time is made in this project. We design the system by adding a solar panel and a submersible water pump externally to the Arduino board. This will help in maintaining the adequate moisture level in the soil. We immerse the pump in water which is connected to the arduino, if the moisture sensor detects the level of moisture being less than the required level then it makes the arduino run the pump which fills the gap of moisture in the soil.

At the present era, the farmers have been the conventional irrigation methods like overhead using irrigation techniques in India through manual control sprinklers flood type feeding systems usually wet the in which farmers irrigate the land at the regular intervals. Lower leaves and stem of the plants. The entire soil this process sometimes consumes more water or surface is saturated and often stays wet long after irrigation sometimes the water reaches late due to which crops is completed. Such condition promotes infections by leaf get dried. Water deficiency can be detrimental to plants mold fungi. On the contrary the drip or trickle irrigation is before visible wilting occurs.

Slowed growth rate, lighter a type of modern irrigation technique that slowly applies weight fruit follows slight water deficiency. This problem small amounts of water to part of plant root zone.

Water is can be perfectly rectified if we use automatic micro supplied frequently, often daily to maintain favourable soil controller-based drip irrigation system in which the moisture condition and prevent moisture stress in the plant irrigation will take place only when there will be acute with proper use of water resources. Drip irrigation saves requirement of water because only the plant.

The proposed system uses an embedded platform with a sensor and device which can do the work more accurately and quickly. We design the system using a

ISSN: 2366-1313

moisture sensor, IOT based integration with pump control [3].

II. LITERATURE SURVEY

Primary investigation is carried out under the following stages, such as Understanding the existing approaches, Understanding the requirements, developing an abstract for the system. In this paper, soil moisture sensor, temperature and humidity sensors placed in root zone of plant and transmit data to android application. Threshold value of soil moisture sensor that was programmed into a microcontroller to control water quantity. Temperature, humidity and soil moisture values are displayed on the android application. This paper on "Automatic Irrigation System on Sensing Soil Moisture Content" is intended to create an automated irrigation mechanism which turns the pumping motor ON and OFF on detecting the dampness content of the earth. In this paper only soil moisture value is considered but proposed project provided extension to this existed project by adding temperature and humidity values [4]. Remote Monitoring in Agricultural Greenhouse Using Wireless Sensor and Short Message Service (SMS). In this paper they are sending data via sms but proposed system sends the values to mobile application [5].

This proposed paper is arduino based remote irrigation system developed for the agricultural plantation, which is placed at the remote location and required water provides for plantation when the humidity of the soil goes below the set-point value. But in this we did not aware about the soil moisture level so to overcome this drawback proposed system included with extra feature soil moisture value and temperature value which displayed on the farmer mobile application [6].

“Irrigation Control System Using Android and GSM for Efficient Use of Water and Power” this system made use of GSM to control the system which may cost more so to overcome that proposed system used arduino yun board which already consist of in build Wi-Fi module [7].

“Microcontroller based Controlled Irrigation System for Plantation” In this paper old generation with lesser memory microcontroller is used to control the system but proposed system made use of arduino yun board which is user friendly and it helps to dump the programs easily[8].

“A wireless application of drip irrigation automation supported by soil moisture sensors” in this paper irrigation is carried out using soil moisture values but extend to this proposed system displays

ISSN: 2366-1313

temperature and humidity values [9]. By referring all above papers, it is found that no such systems are existed with all integrated features but proposed system includes these all features such as displaying temperature, humidity and soil moisture values and also automatic switching on and off of motor by considering soil moisture values.

1. Soil moisture, Temperature, Humidity, Gas [10] Soil moisture is the water stored in the soil and is affected by precipitation, temperature, soil characteristics and more. As moisture availability decline, the normal function and growth of plants are disrupting and crop yields are reduced. As climate changes, moisture availability is becoming more variable. Since moisture is critical and water weather prediction and numerous sensitivity studies investigating the impacts of soil moisture initialisation. Plants need four things to survive: light, water, soil and air. However, to raise healthy plants, the most important element is the effect of water Respiration in plants The Arduino Uno can be programmed to analyse some signals from sensors such as moisture, temperature and humidity. A pump is used to pump the water to fertilize and water the plants. This research work enhances to help the small-scale areas cultivators will be increased the yield of crops then will increase government economy. Automating farm or nursery irrigation permits farmers to use the correct quality of water at the correct time. Additionally, farmer's mistreatment automation instrumentation is able to scale back runoff from over watering saturated soils, avoid irrigating at the incorrect time in a day. They lack in an exceeding featured mobile application developed for users with acceptable user interface. It solely permits the user to observe and maintain the wetness level remotely in no matter of time. The process of water leaving the leaves through evaporation via the stomach on the underside of the leaves. A humidity sensor senses, measures and reports both moisture and air temperature. The ratio of moisture in the air to the Highest amount of moisture at a particular air temperature is called relative humidity. Relative humidity becomes an important factor when looking for comfort. Humidity Sensors work by detecting changes that alter electrical currents or temperature in the air. Soil temperature appears to be more critical than air temperature when irrigating during mid-summer. Irrigation water gets warm, but it's okay when the water is cold. There are two reasons for this, colder water holds more dissolved oxygen and colder temperature keeps demand for oxygen relatively low.

ISSN: 2366-1313

2. Soil Volumetric Water Content [11] Volumetric water content is a numerical measure of soil moisture. It is simply the ratio of water volume to soil volume. Another equally valid measurement is GWC, gravimetric water content, which measure weight rather than volume. Graphing the VWC for a soil sample is a simple. The gravimetric soil water content is expressed per unit mass of oven-dried soil. 3. Temperature, Moisture, ph value of soil, Humidity [3] Soil pH is used to indicate the acidity of soil, and is a measure of the concentration of hydrogen ions(H+) in the soil solution. pH is measured from 1(acidic)to14 (alkaine,with 7 being neutral and is measured on a negative logarithmic scale. The lower pH, higher the acidity. Most plants are favoured by a pH between 5.5 and 8. 4. Moisture, Temperature, ph content (T, M, P) [4] The pH of irrigation water should usually be within the range of 5.5 to 6.5 enhance the solubility of most micronutrients and avoids a steady increase in the pH of the growing medium. This pH range also optimize the solubility of nutrients in concentrated fertilizer stock solution. Moisture is a presence of a liquid, especially water, often in trace amounts. Small amount is water may be found in the air and in foods.

III. PROPOSED WORK

The proposed system uses an embedded platform with a sensor and device which can do the work more accurately and quickly. We design the system using a moisture sensor, IOT based integration with pump control

Benefits of Smart Irrigation:

1.Reduced Labour: As the irrigator is not required to constantly monitor the progress of an irrigation, the irrigator is available to perform the other tasks-un interrupted

2.Improved Life Style: The irrigator is not required to constantly check the progress of water down the bays being irrigated. the irrigator is able to be away from property, relax with the family and sleep through the night.

3.More Timely Irrigaion: Irrigatiors with automation are more inclined to irrigate when the plants need water, not when it suits the irrigator.

4.Assists In the Management of high flow rates: Many irrigators are looking to increase the irrigaton flow rates they receive through installing bigger channels and bay outlets. Such flow rates generally require an increase in labour as the time taken to irrigate a bay is reduced thus requiring more frequent changeover. Automation allows for these higher flows to be managed without an increase in the amount of labour.

ISSN: 2366-1313

5.More accurate cut off: Automation of the irrigation system allows cut-off of water at the appropriate point in the bay. This is usually more accurate than manual checking because mistakes can occur if the operator is too late or too early in making a change of water flow.

Fig.1 basic diagram of automatic irrigation system

A higher labour to turn valves on and off. In addition, farmers using degree of water control is attainable. Automation equipment are able to reduce runoff from over Plants can be supplied with more precise amounts of watering saturated soils, avoid irrigating at the wrong time water. Disease and insect damage is reduced because plant of day, which will improve crop performance by ensuring foliage stays dry. Operating cost is usually reduced. Adequate water and nutrients when needed. Automatic Federations may continue during the irrigation process Drip Irrigation is a valuable tool for accurate soil moisture because rows between plants remain dry. The capacity of soil to retain water is a function of soil texture and structure.

When removing a soil sample, the soil being evaluated is disturbed, so its water-holding capacity is altered. Indirect methods of measuring soil water are helpful as they allow information to be collected at the same location for many observations without disturbing the soil water system. Content without any need for soil density determination. The new soil moisture sensor uses Immersion Gold which protects he nickel from oxidation. Electrodes nickel immersion Fig. 1 Overview of Automated Irrigation System gold (ENIG) has several advantages over more conventional (and cheaper) surface plating such as The above fig 1 explains about important parameters

to be HASL (solder), including excellent surface planarity measured for automation of irrigation system are soil (particularly helpful for PCBs with large BGA packages), moisture.

The entire field is first divided into small good oxidation resistance, and usability for untreated sections such that each section should contain one contact surfaces such as membrane switches and contact

ISSN: 2366-1313

moisture sensor. These sensors are buried in the ground at points required depth. Once the soil has reached desired moisture a soil moisture sensor can read the amount of level the sensors send a signal to the micro controller to moisture present in the soil surrounding it. It's a low tech turn on the relays, which control the motor. Sensor but ideal for monitoring an urban garden, or you. In proposed system, automated irrigation pet plant's water level.

This is a must have tool for a mechanism which turns the pumping motor ON and OFF connected garden. On detecting the dampness content of the earth. In this sensor uses the two probes to pass current through domain of farming, utilization of appropriate means of the soil, and then it reads that resistance to get the irrigation is significant. The benefit of employing moisture level. More water makes the soil conduct these techniques is to decrease human interference. Electricity more easily (less resistance), while dry soil this automated irrigation project, the soil sensor senses conduct electricity poorly (more resistance). The moisture content by giving input signal to an Arduino board which operates on nodemcu micro-controller, is programmed to collect the input signal of changeable dampness circumstances of the earth via dampness detecting system.

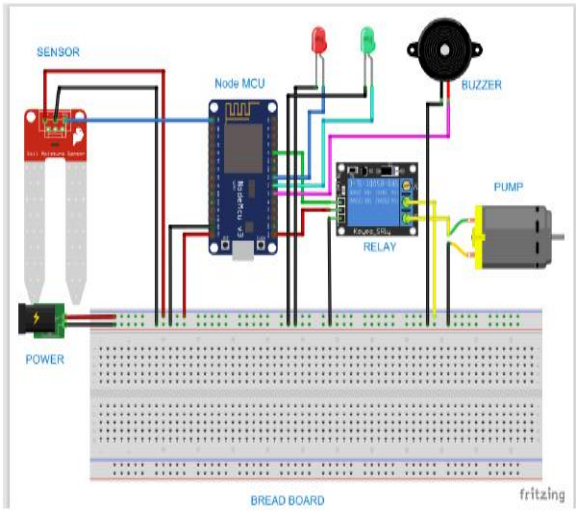

Fig.2 Bread board

BLOCK DIAGRAM

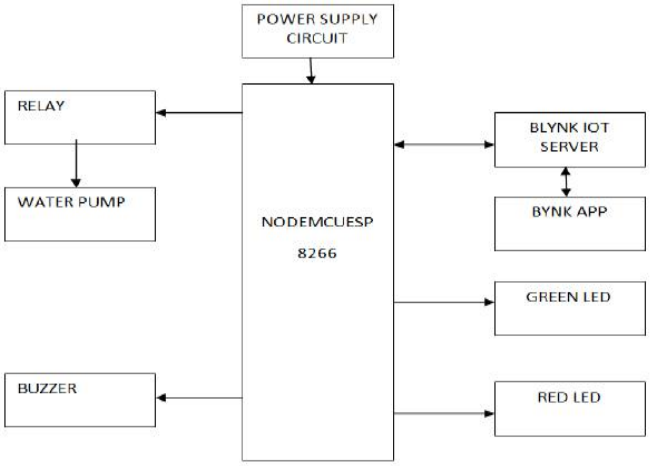

Fig.3 block diagram of automatic irrigation system on soil moisture concept

The block diagram of smart irrigation system with IoT. Farmers start to utilize various monitoring and controlled system in order to increase the yield with help of automation of an agricultural parameters soil moisture are monitored and control the system which can help the farmers to improve the yield. This proposed work includes an embedded system for

ISSN: 2366-1313

automatic control of irrigation. This project has wireless sensor network for real-time sensing of an irrigation system. This system provides uniform and required level of water for the agricultural farm and it avoids water wastage. When the moisture level in the soil reaches below threshold value then system automatically switch ON the motor. When the water level reaches normal level, the motor automatically switches OFF. The sensed parameters and current status of the motor will be displayed on user's android application.

IV. HARDWARE DESCRIPTION

NODEMCU:

The Node MCU is an open-source firmware and development kit that helps you to Prototype your IOT product within a few Lua script lines. The ESP8266 is the name of a micro controller designed by Espressif Systems.

This module comes with a built in USB connector and a rich assortment of pin-outs. With a micro-USB cable, you can connect Node MCU dev kit to your laptop and flash it without any trouble, just like Arduino. It is also immediately breadboard friendly

Features of Node MCU:

- Open-source
- Interactive
- Programmable
- Low cost
- Simple
- Smart
- WI-FI enabled

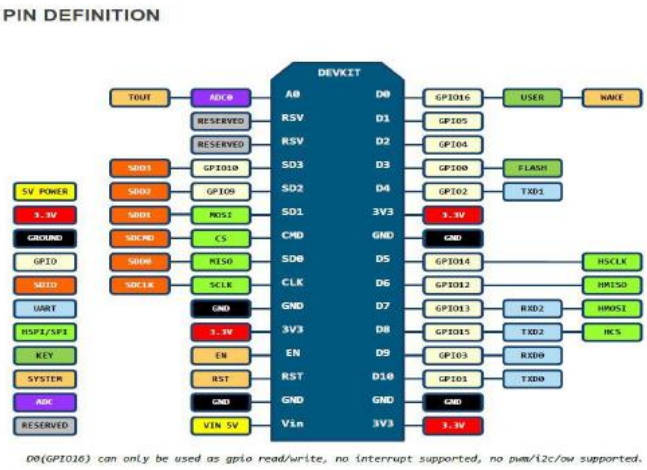

Fig.4 **Designator and Parameter**

Wi-Fi Module (ESP8266):

The ESP8266 is a low cost MCU with built in Wi-Fi. It can be paired with another host microcontroller, like an Arduino, to provide Wi-Fi networking capability for a basic IoT development platform. Additionally, the ESP8266 can be used as a stand-alone MCU, as it includes a 32-bit 80 MHz processor, 16 GPIO pins (4 PWM enabled) and a built in Analog-to-Digital converter, SPI and I2C interfaces and more. The MCU has a n operating voltage of 2.5V – 3.6V and average operating current of 80 ma

ISSN: 2366-1313

Fig.5 ESP8266 – ESP-12E version

An open source, full development board around ESP8266 has been designed by the Node MCU team that includes additional USB to Serial UART adapter, a micro-USB port for programming and a 3.3v regulator. The Node MCU board comes ready out-of-the-box for you to connect to your computer, install USB drivers, and start writing programs that connect to your Wi-Fi network! All of that at an average price of about $4 USD on eBay.

ESP8266 is the most popular and low-cost Wi-Fi SoC with TCP/IP stack and a low power 32-bit microcontroller manufactured by Espressif, a Shanghai based Chinese manufacturer. Nowadays IoT (Internet of Things) is an emerging field. This is the one of the most popular and low-cost solution for connecting 'Things' to internet via Wi-Fi.

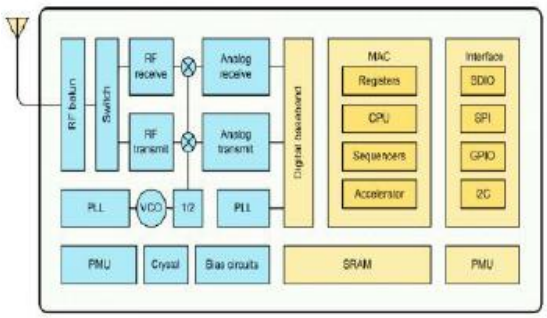

Fig.6 ESP8266 – Block Diagram

MOISTURE SENSOR

The **Moisture sensor** is used to measure the water content(moisture) of soil.when the soil is having water shortage,the module output is at high level, else the output is at low level.This sensor reminds the user to water their plants and also monitors the moisture content of soil.It has been widely used in agriculture,land irrigation and botanical gardening.

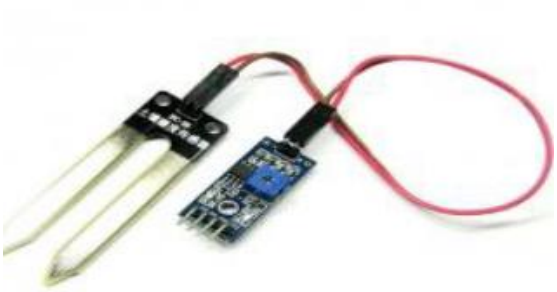

Fig.7 Moisture Sensor

Working Principle of Moisture Sensor

The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity,

ISSN: 2366-1313

and therefore the water content of the soil. The sensor averages the water content over the entire length of the sensor. There is a 2 cm zone of influence with respect to the flat surface of the sensor, but it has little or no sensitivity at the extreme edges.The Soil Moisture Sensor is used to measure the loss of moisture over time due to evaporation and plant uptake, evaluate optimum soil moisture contents for various species of plants, monitor soil moisture content to control irrigation in greenhouses and enhance bottle biology experiments.

a Soil moisture sensor FC-28 with Arduino. This sensor measures the volumetric content of water inside the soil and gives us the moisture level as output. The sensor is equipped with both analog and digital output, so it can be used in both analog and digital mode. In this article, we are going to interface the sensor in both modes. So, let's begin our tutorial on interfacing Arduino and Soil moisture sensor.

Working of Sensor

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value.

When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

This sensor can be connected in two modes; Analog mode and digital mode. First, we will connect it in Analog mode and then we will use it in Digital mode.

Specifications

The specifications of the soil moisture sensor FC-28 are as follows

Soil moisture sensor consist of two conducting plates which function as a probe and acting as a variable resistor together.

When the sensor is inserted into the water, the resistance will decrease and get better conductivity between plates

ISSN: 2366-1313

Input Voltage	3.3 – 5V
Output Voltage	0 – 4.2V
Input Current	35mA
Output Signal	Both Analog and Digital

V. RESULTS

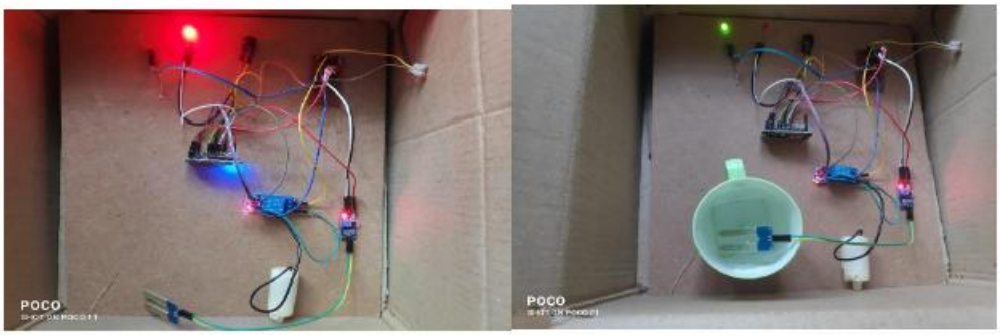

Fig.8 Implementation design

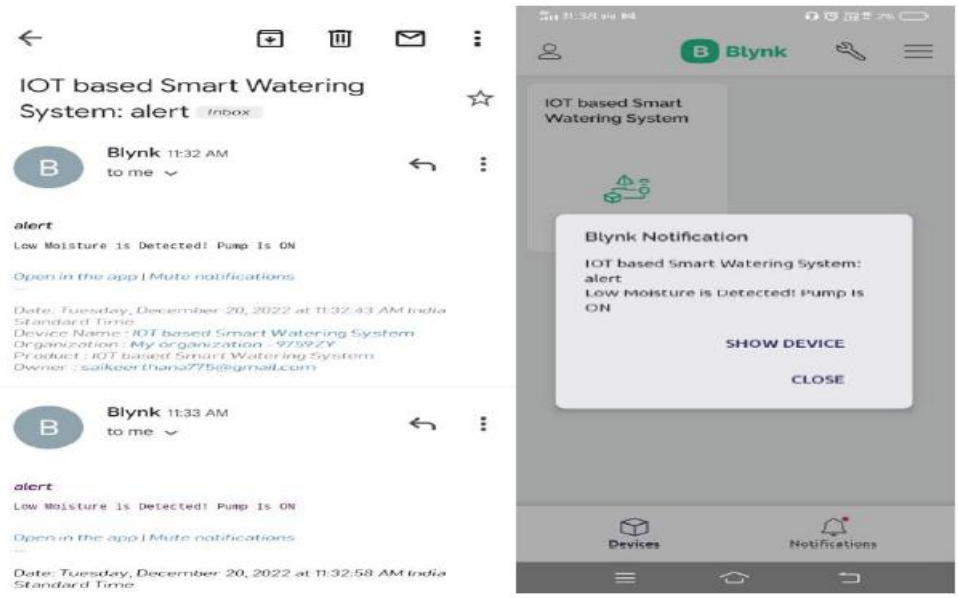

Fig.9 SMS alerting screen

ISSN: 2366-1313

Fig.10 Final results

VI. CONCLUSION

The primary applications for this project are for farmers and gardeners who do not have enough time to water their crops /plants. It also covers those farmers who are wasteful of water during irrigation. The project can be extended to green houses where manual super vision is far and few in between. The principle can be extended to create fully automated gardens and farmlands. Combined with the principle of rain water harvesting, it could lead to huge water savings if applied in the right manner. In agriculture lands with server shortage of rainfall, this model can be successfully applied to achieve great results with most types of soil.

REFERENCES

[1] Anurag D, Sikuli Roy and Somprakash Bandyopadhyay, “Argo-Sense: Precision Agriculture using Sensor-based Wireless Mesh Networks”, ITU-T “Innovation in NGN”, Kaleidoscope Conference, Geneva 12-13 May 2008.

[2] C. Arun, K. Lakshmi Sudha “Agricultural Management using Wireless Sensor Networks – A Survey”2nd International Conference on Environment Science and Biotechnology IPCBEE vol.48 (2012) © (2012) IACSIT Press, Singapore 2012.

[3] Bogena H R, Huisman J A, OberdÊrster C, etal. Evaluation of a low cost soil water content sensor for wireless network applications [J]. Journal of Hydrology, 2007.

ISSN: 2366-1313

[4] R.Hussain, J.Sehgal, A.Gangwar, M.Riyag“ Control of irrigation automatically by using wireless sensor network” International journal of soft computing and engineering, vol.3, issue 1, march 2013.

[5] Izzat din Abdul Aziz, MohdHilmiHasan, Mohd Jimmy Ismail, MazlinaMehat, NazleeniSamihaHaron, “Remote Monitoring in Agricultural Greenhouse Using Wireless Sensor and Short Message Service (SMS)”, 2008.

[6] Jeonghwan Hwang, Changsun Shin, and Hyun Yoe “Study on an Agricultural Environment Monitoring Server System using Wireless Sensor Networks”, 2010.

[7] Ning Wang, Naiqian Zhang, Maohua Wang, “Wireless sensors in agriculture and food industry—Recent development and future perspective”, published in Automation of irrigation system using IoT 87 Computers and Electronics in Agriculture 2006.

[8] Pepper Agro, “M-Drip Kit” Internet: www.pepperagro.i/mdripkitmanual.htmlSiuli Roy, Somprakash Bandyopadhyay, “A Test-bed on Real-time Monitoring of Agricultural Parameters using Wireless Sensor Networks for Precision Agriculture” 2007.

[9] Yiming Zhou, Xianglong Yang, Liren Wang, Yibin Ying, A wireless design of lowcost irrigation system using ZigBee technology, International Conference on Networks Security, Wireless Communications and Trusted Computing, IEEE 2009.

[10] Zhang xihai, Zhang changli Fang junlong. Smart Sensor Nodes for Wireless Soil Temperature Monitoring Systems in Precision Agriculture 2009.

[11] Priyanka Padalalu, Sonal Mahajan Kartikee Dhabir Sushmita Mitkaran Deepali Javale,”Smart water Dripping System for Agriculture/ Farming”,2nd International conference for Convergence in Technology (I2CT), Mumbai, India,pp.65

[12] Prasadu Peddi (2019), "Data Pull out and facts unearthing in biological Databases", International Journal of Techno-Engineering, Vol. 11, issue 1, pp: 25-32.