RESEARCH ARTICLE OPEN ACCESS

Automatic Drip Irrigation System by Deploying IOT On Agriculture

Naveen N [1], Deepashree R K [2], Hemashree K [3], Sirisha V [4], Kiran Kumar R [5], Shiva Reddy M V [6]

[1] Lecturer, [2][3][4][5][6] Student, Dept. of CSE, Government Polytechnic, Chintamani

ABSTRACT

We intend to deploy internet of things (IOT) on agriculture commonly in the agriculture field. The drip irrigation system is using which allows water to drip slowly to the roots of plants and it minimizes evaporation. A farmer/human operates the drip irrigation system manually when electricity is available. In case if the electricity is unavailable then the drip irrigation system cannot be operated. Hence the farmer should wait until the electricity power gets available. So the farmer would face some difficulties in the above case. To overcome this problem we are deploying IOT in this paper to automate the drip irrigation system based on soil moisture content using sensors. It helps to operate the drip system automatically either in presence or absence of the farmer, since the control system is connected with UPS along with the power supply. It allows the farmer to avoid difficulty facing about improper electricity and we have add-on that the drip irrigation system can also be operated remotely through mobile device using GSM system.

Keywords **—** IOT, drip irrigation system, soil moisturing sensor, PH sensors, solenoid valve, arduino.

I. INTRODUCTION

The term *Internet of Things (*often abbreviated *IoT)* was coined more than ten years ago by industry researchers but has emerged into mainstream public view only more recently. Some claim the Internet of Things will completely transform how computer networks are used for the next 10 or 100 years, while others believe IoT is simply hype that won't much impact the daily lives of most people.

Internet of Things represents a general concept for the ability of network devices to sense and collect data from the world around us, and then share that data across the Internet where it can be processed and utilized for various interesting purposes. The Internet of Things is not limited to industrial applications, however some future consumer applications envisioned for IoT.

Internet of Things immediately triggers questions around the privacy of personal data. Whether real-time information about our physical location, or updates about our weight and blood pressure that may be accessible by our health care providers, having new kinds and more detailed data about ourselves streaming over wireless networks and potentially around the world is an obvious concern. Supplying power to this new proliferation of IoT devices and their network connections can be expensive and logistically difficult. Although many mobile devices are optimized for lower power usage, energy costs to keep potentially billions of them running remains high. [1]

Agriculture is the art of cultivating the soil, growing crops and raising live stocks. It includes the preparation of plants and animals products for people to use and their distribution of market.

Agriculture provides most of the world's food and fabrics. In the process of agriculture, most of would use drip irrigation system which is the most efficient water and nutrients delivery system for growing crops. It drips the water and nutrients directly to the plants root zone in the right amount at the right time. So each plant gets exactly what it needs, when it needs it to grow optimally.

Let us consider a drip irrigation system in the open farming. Here the drip irrigation system would directly connect from the bore well pump through pressure controlling valve. When the power supplied to bore well pump, it lifts the water from bore well and starts delivering the water to plant roots through drip system pipes. The bore well pumps consume high amount of electricity. We should notice that the bore well pump lifts the water from well if and only if the electricity is available but it doesn't work if no electricity. So the farmer cannot operate the drip irrigation system without electricity. Hence it leads to some difficulties to the farmer where he cannot deliver the water and nutrients to the plant in specified period of time.

By observing the above problem the manually operating drip irrigation system is not much effective. So to overcome these hazards and difficulties we are deploying an IOT to automate the drip irrigation system using sensor technology. Here the sensor helps to detect the soil

moisturing based on soil moisturing report, the drip irrigation system functions automatically and it is controlled by microcontroller/ardiuno system. The system functions all the times either in the presence or absence of the farmer as if it is connected to UPS along with the electricity power supply. Hence the farmer can avoid the difficulties regarding with improper electricity.

We also enhanced the automated drip irrigation system to operate remotely through the mobile device using GSM technology by exchanging the messages between a farmer and the control system.

In this paper we have discussed about related works, proposed architecture, advantages of proposed system and conclusion.

II. NEED FOR THE SYSTEM

A drip automation system integrates electrical devices in the field of agriculture and the devices may be connected through a computer, sensors or a smart phone through GSM. GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access and digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot.

Since many GSM network operators have roaming agreements with foreign operators, users can often continue to use their mobile phones when they travel to other countries. SIM cards (Subscriber Identity Module) holding home network access configurations may be switched to those will metered local access, significantly reducing roaming costs while experiencing no reductions in service.

This technology is used to control the appliance like fans, lights and water heater, buzzer, AC motors in real world which are connected to the microcontroller/arduino and this microcontroller will be connected to the PC or Mobile device with Android Support which has Internet, from anywhere we can easily switch ON or switch OFF the device, then it will avoid the wastage of energy.

Object of paper

This paper concentrates mainly on automating the drip irrigation system towards open farming in the field of agriculture using soil moisturing sensors and GSM Module from the perspective of internet of things (IOT).It senses the soil moisturing level of the land using soil moisturing sensor and it determines whether to operate the drip system or not .this will be processed by the microcontroller or Arduino controller. The data is then sending to the GSM Modem through serial port. On the other side, another GSM modem receives message and sends to personal computer. Finally analyses the data in centre server, give the accurate response after knowing the working status of local device. The system is safe, economic, high precision and real time and worth promoting.

In this technology mainly we are using the Internet of things; The Internet of Things (IOT) refers to uniquely identifiable objects and their virtual representations in an Internet-like structure. The concept of the Internet of Things first became popular when it includes a billion of devices in future if all objects and people in daily life were equipped with identifiers, they could be managed and inventoried by smart phone.

III. RELATED WORKS

A. *GSM*

GSM, which stands for Global System for Mobile communications, reigns (important) as the world's most widely used cell phone technology. Cell phones use a cell phone service carrier's GSM network by searching for cell phone towers in the nearby area. Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication.

GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

Figure 1: GSM Modem

Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS control, data transfer, remote control and logging can be developed easily. The modem can be connected to any microcontroller through MAX232 can be used to send and receive SMS or make/receive voice calls. It can be used in GPRS mode to connect to internet. GSM modem is a highly flexible plug and play quad band SIM900A GSM modem for direct and easy integration to RS232 applications.[1]

B. *SOLENOID VALVE*

A **solenoid valve** is an electromechanically operated valve. Solenoid valves differ in the characteristics of the electric current they use, the strength of the magnetic field they generate, the mechanism they use to regulate the fluid, and the type and characteristics of fluid they control. The mechanism varies from linear action, plunger-type actuators to pivoted-armature actuators and rocker actuators. The valve can use a two-port design to regulate a flow or use a three or more port design to switch flows between ports. Multiple solenoid valves can be placed together on a manifold. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. Figure 2 shows the process of Solenoid valve. [4]

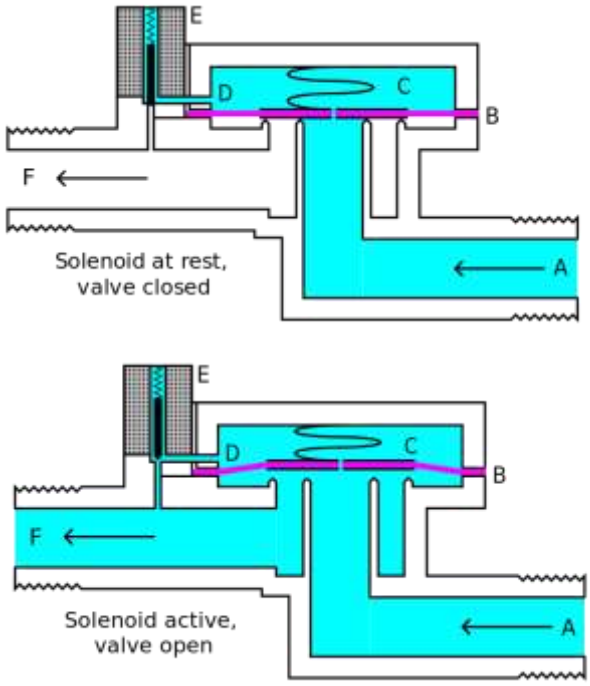

Figure 2: process of Solenoid valve

C. *REMOTE CONTROLLER*

It provides simple wireless controls, automation and telemetry in a wide variety of industrial applications, including automated pump controls, wireless tactical airfield lighting and remote temperature monitoring. Anything that can be switched (eg: ON or OFF) or that can send and receive data can be done so wirelessly.

Remote control Technology is a global leader in a Wireless solutions industry, providing unique, application focused Engineering and Systems integration capabilities. It has designed, manufactured and supplied both custom and off-the-shelf product and services. It can be classified into wired and wireless remote controller. [1]

IV. SOIL MOISTURE SENSOR

Most soil moisture sensors are designed to estimate soil volumetric water content based on the dielectric constant (soil bulk permittivity) of the soil. The dielectric constant can be thought of as the soil's ability to transmit electricity. The dielectric constant of soil increases as the water content of the soil increases. This response is due to the fact that the dielectric constant of water is much larger than the other soil components, including air. Thus, measurement of the dielectric constant gives a predictable estimation of water content. [2]

The next set of volumetric methods is known as *dielectric techniques*. They estimate soil water content by measuring the soil bulk permittivity (or dielectric constant), Kab, that determines the velocity of an electromagnetic wave or pulse through the soil. In a composite material like the soil (i.e., made up of different components like minerals, air and water), the value of the permittivity is made up by the relative contribution of each of the components. Since the dielectric constant of liquid water (Kaw = 81) is much larger than that of the other soil constituents (e.g. Kas = 2–5 for soil minerals and 1 for air), the total permittivity of the soil or bulk permittivity is mainly governed by the presence of liquid water. [3]

A. *Sensor Installation*

"A single sensor can be used to control the irrigation for many zones (where an irrigation zone is defined by a solenoid valve) or multiple sensors can be used to irrigate individual zones. In the case of one sensor for several zones, the zone that is normally the driest, or most in need of irrigation, is selected for placement of the sensor in order to ensure adequate irrigation in all zones.

Some general rules for the burial of the soil moisture sensor are:

- Soil in the area of burial should be representative of the entire irrigated area.
- Sensors should be buried in the root zone of the plants to be irrigated, because this is where plants will extract water. Burial in the root zone will help ensure adequate turf or landscape quality. For turf grass, the sensor should typically be buried at about three inches deep.
- Sensors need to be in good contact with the soil after burial; there should be no air gaps surrounding the sensor. Soil should be packed firmly but not excessively around the sensor.
- If one sensor is used to control the entire irrigation system, it should be buried in the zone that requires

water first, to ensure that all zones get adequate irrigation.

Typically, this will be an area with full sun or the area with the most sun exposure.

- Sensors should be placed at least 5 feet from the home, property line, or an impervious surface (such as a drive-way) and 3 feet from a planted bed area.
- Sensors should also be located at least 5 feet from irrigation heads and toward the centre of an irrigation zone.
- Sensors should not be buried in high traffic areas to prevent excess compaction of the soil around the sensor."[2]

B. *Setting the Sensor Threshold*

"Once the sensor has been buried and the SMS controller has been connected to the irrigation system, the sensor needs to be calibrated and/or the soil water content threshold needs to be selected. Based on the sandy soils in much of Florida, the following steps should be followed to calibrate or select a threshold for the soil moisture sensor controller:

Step 1. Apply water to the area where the sensor is buried. Either set the irrigation zone to apply at least 1 inch of water or use a 5-gallon bucket to apply directly over the buried sensor.

Step 2. Leave the area alone for 24 hours, and do not apply more water. If it rains during the 24 hours, the process should be started over.

Step 3. The water content after 24 hours is now the sensor threshold used to allow or bypass scheduled irrigation events. This threshold may be decreased slightly (~20%) to allow more storage for rainfall; however, the landscape will still need to be carefully monitored to ensure that adequate irrigation is being supplied."[2]

V. PROPOSED SYSTEM

The smart system is implemented towards open forming in the field of agriculture. The system is formed with a water tank to the drip pipes is connected through the smart solenoid valve where the solenoid valve is connected to the control system. The microcontroller/arduino is placed, which is connected with various components such as sensors, GSM module, IOT module, solenoid valve, power supply etc. The soil moisturing sensor is placed in the area of land or a farm. This sensor basically would be placed in soil and it detects moisturing level. The PH sensor is used here for detecting hydrogen levels in the form for effective maintenance.

The GSM module is connected with subscribe identification module for the mobile communication with the user. The LCD display is connected to display the information to the user which helps to understand the progress of system to establish the remote communication. Figure 3 shows the setup of proposed system.

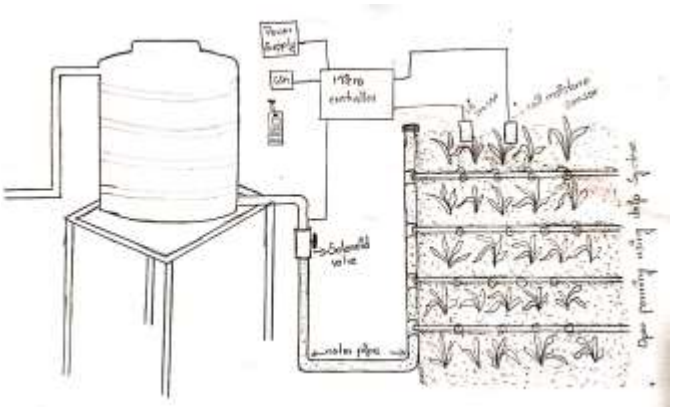

Figure 3: Automated drip irrigation system

The figure 4 demonstrates the architecture of proposed system. The architecture consist with arduino microcontroller connected with main components such as soil moisturing sensor, water level sensor, GSM module, smart solenoid valve etc . This automated system architecture is integrated with the drip irrigation system in the field of agriculture. The IOT module helps to connect the things remotely where user can have an advantage of accessing things remotely. The GSM module is used for the accomplished in the module where it helps to establish the communication between user and the system. The user can control the system through mobile device by sending messages as control signals.

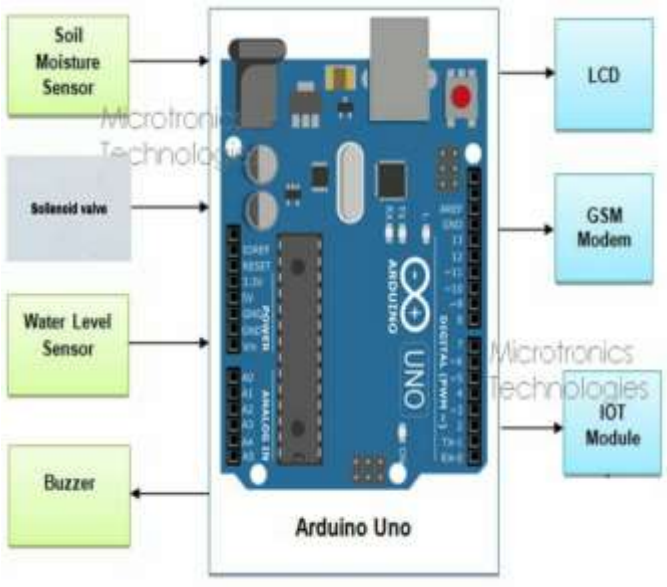

Figure 4: System architecture

the user/farmer through GSM module and passes control to the solenoid valve receives the control from arduino controller, it allows water to flow through the pipes. Then the drip system starts delivering the water to roots of the plants. The drip system delivers the water until the moisturing level is normal.

If the moisturing sensor sense the soil moisture level as normal, then it sends the control signsl to arduino controller tells solenoid valve to stop the flowing of water through drip irrigation pipes. The progress would be displayed through LCD display and also it sends the message of status to the farmer for updating. Alternatively, the farmer can operate the smart drip irrigation system remotely from mobile device through GSM system. The system developed to operate remotely such that if user/farmer sent the message to the control system then it receives as a control signal and starts functioning. For instances, the message 'ON' is to start the system and 'OFF' is to stop the functioning of system. By this way the user/farmer can operate smart drip irrigation system remotely

VI. CONCLUSION

In this paper, we proposed a system to automate the drip irrigation towards open farming in the field of agriculture using IOT (internet of things). The main aim is to introduce the smart agriculture towards villages and educate the farmers towards smart technology. In this system the soil moisturung sensors and GSM technology are used, which helps to operate the drip system automatically and remotely where it reduces the human efforts and helps to avoid difficulties to the user/farmer.

REFERENCES

[1] Naveen N, Lakshmi M A, Gajendra M A, "Monitoring and Controlling of Smart Equipments towards Manufacturing Industries using IoT " IJCST vol. 11, issue 2, April-June 2020.

[2] Michael D. Dukes, Mary Shedd, and Bernard Cardenas-Lailhacar "How Do Soil Moisture Sensor (SMS) Irrigation Controllers Work" http://edis.ifas.ufl.edu/TOPIC_SERIES_Smart_Irrigation_Controllers.

[3] Rafael Muñoz-Carpena "Field Devices For Monitoring Soil Water Content" http://edis.ifas.ufl.edu/TOPIC_SERIES_Smart_Irrigation_Controllers.

[4] Wikipedia "Solenoid valve" https://en.wikipedia.org/wiki/Solenoid_valve.

Soil moisturing sensor detects the r

Authors Profile

Mr. Naveen N - received his B.E degree in Computer Science & Engineering from Vishweshwaraiah Technological University, Belagavi, and Karnataka, India in 2016 and received M.Tech degree in Computer Science & Engineering from Dr.Ambedkar Institute of Technology affiliated to Vishweshwaraiah Technological University in the year 2018. He is a teaching assistance, lecturer. He is working as lecturer, department of computer science & Engineering in Government Polytechnic, Chintamani, and Karnataka, India from the year 2018. He is interested on latest technologies such as Internet of Things, Cloud Computing, Wireless Sensor Networks, Android Technology and Artificial Intelligence etc.

Ms. Deepashree R K- a student of Government Polytechnic, Chintamani pursuing her B.E in department of Computer Science & Engineering at PES University, Bangalore, Karnataka, India. She has received her Diploma in Computer Science & Engineering Certificate from Government Polytechnic, Chintamani, and Affiliated to Directorate of Technical Education, Bangalore, and Karnataka, India in the year 2019. She is interested on latest technologies such as Internet of Things, Cloud Computing, Wireless Sensor Networks, Green Computing, Network Security etc.

Ms. Hemaashree K- a student of Government Polytechnic, Chintamani pursuing her B.E in department of Information Science & Engineering at UVCE, Bangalore, Karnataka, India. She has received her Diploma in Computer Science & Engineering Certificate from Government Polytechnic, Chintamani, and Affiliated to Directorate of Technical Education, Bangalore, and Karnataka, India in the year 2019. She is interested on latest technologies such as Internet of Things, Cloud Computing, Wireless Sensor Networks, Web technologies, Artificial Intelligence, Green Computing, and Network Security etc.

Ms. Sirisha V- a student of Government Polytechnic, Chintamani pursuing her B.E in department of Computer Science & Engineering at UVCE, Bangalore, Karnataka, India. She has received her Diploma in Computer Science & Engineering Certificate from Government Polytechnic, Chintamani, and Affiliated to Directorate of Technical Education, Bangalore, and Karnataka, India in the year 2019. She is interested on latest technologies such as Internet of Things, Cloud Computing, Wireless Sensor Networks, Green Computing, Network Security, Virtual reality etc.

Mr. Kiran Kumar R- a student of Government Polytechnic, Chintamani pursuing his B.E in department of Computer Science & Engineering at Don Bosco Institute of Technology, Bangalore affiliated to VTU, Belgaum, Karnataka, India. He has received his Diploma in Computer Science & Engineering Certificate from Government Polytechnic, Chintamani, and Affiliated to Directorate of Technical Education, Bangalore, and Karnataka, India in the year 2019. He is interested on latest technologies such as Internet of Things, Android Technology, Wireless Sensor Networks, Network Security, Developing Games etc.

Mr. Shiva Reddy M V- a student of Government Polytechnic, Chintamani pursuing his B.E in department of Computer Science & Engineering at SJB Institute of Technology, Bangalore affiliated to VTU, Belgaum, Karnataka, India. He has received his Diploma in Computer Science & Engineering Certificate from Government Polytechnic, Chintamani, and Affiliated to Directorate of Technical Education, Bangalore, and Karnataka, India in the year 2019. He is interested on latest technologies such as Internet of Things, Wireless Sensor Networks, and Network Security etc.