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SMART IRRIGATION SYSTEM: INTEGRATING DRIP IRRIGATION WITH ADVANCED MONITORING TECHNOLOGIES

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Abstract— The paper emphasizes the critical role of water in agricultural irrigation and proposes the implementation of an externally hosted cloud computing platform to effectively manage irrigation data across the country. This system utilizes information and communication technologies to enable users to analyze data collected from various sensors. These sensors, including humidity, temperature, moisture, and light sensors, transmit signals to a microcontroller, which then communicates this data to an isolated server via serial communication. Upon receiving the sensor data, the isolated server processes it and stores it in a database. This database facilitates the visualization of sensor data through graphs on both PC and smartphone interfaces. Users can interact with these graphs to make informed decisions, such as toggling drip devices on or off based on the sensor readings. Threshold values are set for each sensor to trigger actions accordingly. Overall, the proposed system aims to revolutionize farming practices by leveraging technology to address water scarcity issues and enhance agricultural productivity. By utilizing advanced sensor technology and cloud computing, the system offers a flexible and efficient solution for managing irrigation processes and improving agricultural systems nationwide.

Keywords—Cloud, Embedded, Android, Remote Monitoring, Wireless Sensor Network

I. INTRODUCTION

Agriculture has been the spine of the Indian economy and itwill continue to remain for the long time. Over 70 per cent ofthe rural households depend on agriculture. One-third of our National in come comes from agriculture. The economic improved, started off in the country during the early 1990s, have put the economy on a higher growth rate trajectory. Annual growth rate in gross domestic product(GDP) has accelerated about 25%. Indian agriculture has registered impressive growth over last few decades. The growth in agricultural production has been still for the past several years. The significance of agriculture is:

1) Contribution to National Income,

2) Main source of Food,

3) Agriculture and Industrial development,

4) Sources of Revenue,

5) Source of Foreign trade.

6) Transport,

7) Source of saving,

8) Capital formation,

9) International importance,

10) Way of life,

11) Effect on prices,

12) Source of labor supply,

13) Economic development.

Our land was losing its fertility being put to cultivation continuously for years together. So we have read all the existing system and their working and we have found out that there is no system that uses the micro-controller, cloud, data mining and smart phone all together. So we are combining all the existing system to get the hybrid system. Sensor-Based irrigation system has been studied in much application. These sensors send real time values to microcontroller and micro controller send these values to PC via serial communication [1].

The system suggests an economical and easy-to-use Arduino-based automated irrigation system that utilizes the Android smart phone for remote control. The data received by the Android smart phonefrom the Arduino is displayed on the User Interface [2].

Thevolumetric data of water utilized and crop yield were collectedand the results showed that the water consumption is reducedin the automated field as compared to the manually irrigatedfield[3].

II. LITERATURE REVIEW

In this paper drip irrigation control using mobile phone. Theyuse different sensors like humidity, temperature, light etc. for detection purpose. The sensors ends real time value to microcontroller send topic via serial communication. In this system central monitoring is computer and remote monitoringis mobile phone and mobile send command via network andandroid application to PC. Then PC will ON or OFF device. They use Hardware like ADC0808, IC89C51IC Microcontroller, MAX232 for serial communication. Objective of this paper is

1)Android application and implement hardware of drip irrigation control using internetthat is suitable for real life implementation.

2) Control drips remotely as well as automatically that reduce overhead of farmer and it also reduce manpower that farmer needs to supply water to plants.

3) Is very beneficial for increasingcrops production. This system can be used in area where water resources are less. This type of application we can use for large area farms [1]. This paper makes use of the Arduinobased automated irrigation system that uses the android smartphone for remote control. The system is designed using a soil and moisture sensor that provides a voltage signal that is proportional to the moisture content in the soil and then compared with the predetermined threshold value obtained bysampling of various soils for specific crops. The outcome of the comparison is that the appropriate data is fed to the Arduino processor. The Arduino is linked wirelessly via HC-05 to the android smart phone. The data received by the android smart phone using Arduino is

displayed on the userinterface (UI). The UI in the android smart phone allows theuser to use easy remote control for the irrigation system thatinvolves switching on and off of the driver motor through the Arduino wire which is linked to its controller commands fromthe android smart phone. This type of studies are conducted ona laboratory prototype suggests that this design is valuable andcan be easily implemented on real time applications [2]. In this proposed system the moisture andfertility measured sensors are used and also used Zigbee for android mobiles to sending the SMS and also used drip irrigation automation for soil moisture measurement [7].

In this system we will be including data mining concept for the prediction of future outcomes. Data mining concept examine the large pre-existing data in order to produce the new information. We will be including the cloud computing concept for the communication between the pc and mobile. Cloud computing is a technique in which a large number of computers connected through a real-time communication network

III. PROPOSED SYSTEM

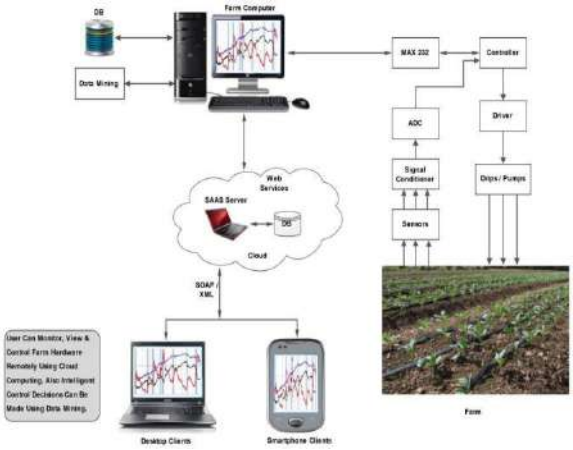


Fig.1.ProposedSystem

Water management system is microcontroller based and web application using the concept of cloud and data mining isusedto monitor and control the water management system from remote location. Whole system is in WSN infrastructure. Water management is done through sensor reading from farm Web application provide easy monitor and control mechanismtofarmer. Graph generated in web application make easy analysis. Cloud computing is a technique in which a large number of computers connected through a real-time communication network Whole system is in WSN infrastructure. Water management is done through sensor reading from farm.Web application provide easy monitor and control mechanism to farmer. Graph generated in web application make easy analysis. Cloud computing is a technique in which a large number of computers connected through a real-time communication network. In this system sensor senses the data and sends the reading to the micro-controller Then micro-controller sends those reading to the farm pc through serial communication Then these readings get stored in

the database that is connected to farm pc in which we use data mining concept. These readingswillbedisplayedontheandroidphoneandpc.

Hardware:

1) Sensors: We use sensors like humidity, temperature, Light, Moisture.

2) Microcontroller: It is heart of system, means it control all operation of system.

3) MAX 232: It converts signals from an RS-232 serial port to signal suitable for use in TTL compatible digital logic circuit

4) Base station: It is master unit to control valve and take data from all sensor node which are at the end.

5) Server: It collects data from all WSN network and take decision if threshold cross of any sensor unit.

6) Web application: It provides graphical interface to userand graph of sensor data value is generated so it is easy to understand for user to analyze and take decision.

Software:

1. Windows7system

1 gigahertz (GHz) or faster 32-bit (x86) or 64-bit (x64) processor Linux system requirements

700MHzprocessor,512MBRAM,5GBofhard-drivespace

2. AndroidOS

AndroidisaLinux-basedoperatingsystemdesignedprimarilyfortouchscreenmobiledevicessuchassmartphonesand tablet computers

In drip irrigation systems, pump and valves may be manually or automatically operated by a controller. Most large drip irrigation systems employ some type of filter to prevent clogging of the small emitter flow path by small waterborne particles. New technologies are now being offered that minimize clogging.

Drip and subsurface drip irrigation is used almost exclusively when using recycled municipal wastewater. Regulations typically do not permit spraying water through the air that has not been fully treated to potable water standards. Because of the way the water is applied in a drip system, traditional surface applications of timed-release fertilizer are sometimes ineffective, so drip systems often mix liquid fertilizer with the irrigation water. An emitting pipe is a type of drip irrigation tubing with emitters pre-installed at the factory with specific distance and flow per hour as per crop distance. An emitter restricts water flow passage through it, thus creating head loss required (to the extent of atmospheric pressure) in order to emit water in the form of droplets. This head loss is achieved by friction/turbulence within the emitter.

The soil moisture sensors are placed at every few feet with the probes in the ground. The soil moisture sensor is set to a particular level based on the type of soil and the crops being grown. The soil moisture is checked through the sensor. The sensors value is then sent to the NodeMCU or the Wi-Fi module. Since this acts like an arduino but can be connected to the Wi-Fi, the sensor reading are checked and matched to the set value of reading. If the value of the

soil moisture sensor is equal to the set value, then a command is sent to the relay to switch OFF the motor. A message is then sent to the client's mobile which is connected to the Node. I f the moisture of the soil is less, then the Node MCU sends a command to the relay to turn ON the motor.

When the water is opened, the drip irrigation system starts to drip the water at the roots. It allows water for half an hour and after half an hour; the moisture level is again checked and sent to the Node MCU. A message is sent to the client device saying that the plants have been watered at that particular time. The process then repeats all over. The intention of this project is to provide the user far away from the fields, a chance to keep an eye on their plants.

Sensor Implementation The system involves three layers of operations, namely, sensor layer, transport layer, application layer. Their functions are as follows:

- Sensor/Information Collection Layer: The main task of this layer is to achieve automatic and real-time transformation of the

Physical figures of real-world agricultural production into digital information or data that can be processed in virtual world through various means.

The main task of Information collection layer is to mark the various kinds of information, and collect the marked information and the physical information in the real world by sensing techniques, and then transform them to digital information for processing. Information collection layer involves these techniques: two-dimension code labels and readers, RFID tags and readers, cameras, GPS sensors, terminals, cable networks, sensor networks and wireless networks

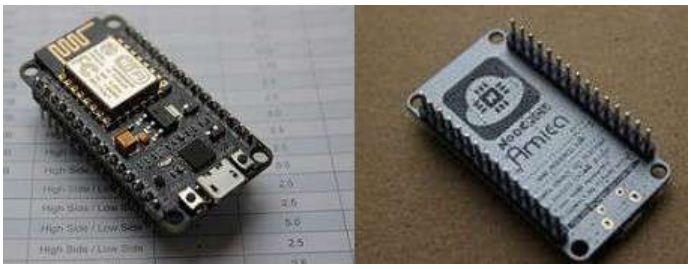
●Transport/Network Layer: The main task of this layer is to collect and summarize the agricultural information acquired through Sensor Layer for processing. Transport Layer is the nerve centre and cerebra of Internet of Things for Agriculture, transmitting and processing data. The network layer includes the integration of the Internet network and telecommunication, network management centre, information centre and intelligent processing centres.

This project has been designed for surveillance of irrigation systems in farms without the need of manual checking of irrigation systems. For example, if you are staying in Bangalore, and have your farm in Andhra Pradesh or elsewhere and it is not possible for you to go to the farms every time to keep a tab on the plants. Instead, this project allows you to check up on your plants using a simple IoT system. The positive part of this project is that, the node used to connect the system to your smart device, also controls the flow of water from the pump and also the timing intervals in between the irrigation cycles. In this paper we will be discussing all about the project as to how it is constructed and how it works.

These are the main components used in this project:

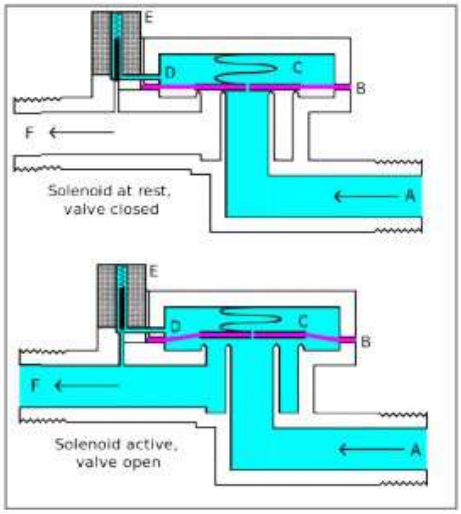
Node MCU (ESP8266) Wifi Module: NodeMCU is an advanced API for hardware input/output device which can

be dramatically reduces the work for configuring manipulative hardware. It uses a code like Arduino but rather is an interactive script called Lua. It is an open source IoT platform. It runs on a firmware of ESP8266 WiFi Soc produced by Espressif systems. NodeMCU has 16 input/output pins and hence 16 nodes can be connected to a single node. The ESP8266 is Wi-Fi Soc which is integrated with a Tensilica Xtensa LX106 core which is widely used in IoT applications.” NodeMCU” refers in default to the firmware rather than the development kits. ESP8266 is an inbuilt WiFi module which can also be used as an individual module as a Wifi module.

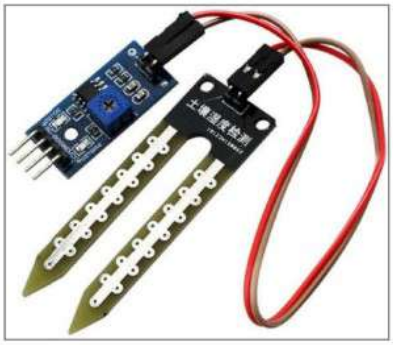


Solenoid Valve: A solenoid valve is an electromechanical a magnetic field and thereby operate a mechanism the characteristics of the current they use, the strength of the magnet field they generate, the mechanism they use to regula fluid and the characteristics of the fluid they control. The mechanisms vary armature actuators and rocker actuators. The valve can use a two to switch flows between ports. Multiple solenoid valves can be placed t frequently used control elements in fluidics. Thei many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibili the materials used, low control power and compact design.

Operation: Ordinary valves can have many ports and fluid paths. A 2 then the two ports are connected and fluid may flow between the ports; if the valve is open when the solenoid is not energized, then the valve is termed solenoid is not energized, then the valve is termed valve has 3 ports; it connects one port to either of the two other ports (typically a supply port and an exhaust port).Soleno are also characterized by how they operate. A small solenoid can generate a limited force. If that force is sufficient to open and close the valve, then a direct acting solenoid valve is possible.



Soil Moisture sensor: Soil moisture sensors measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical res interaction with neutrons, as a proxy for the moisture content. be calibrated and may vary depending on environmental factors such as Reflected microwave radiation is affected by the soil moisture and is used for Portable probe instruments can be used by farmers or gardeners. volumetric water content. Another class of sensors measure another property of moisture in soils called sensors are usually referred to as soil water potential sensors and tensiometers and gypsum blocks.



Drip irrigation system: Drip irrigation is a type of micro-irrigation system that has the potential to save water and nutrients by allowing water to drip slowly to the roots of plants, either from above the soil surface or buried below the surface. The goal is to place water directly into the root zone and minimize evaporation. Drip irrigation systems distribute water through a network of valves, pipes, tubing, and emitters. Depending on how well designed, installed, maintained, and operated it is, a drip irrigation system can be more efficient than other types of irrigation systems, such as surface irrigation or sprinkler irrigation.

Components used in drip irrigation (listed in order from water source) include:

•Pump or pressurized water source

- Water filter(s) or filtration systems: sand separator, Fertigation systems (Venturi injector) and chemigation equipment

- (optional) Backwash controller (Backflow prevention device)
- Pressure Control Valve (pressure regulator)
- Distribution lines (main larger diameter pipe, maybe secondary smaller, pipe fittings)
- Hand-operated, electronic, or hydraulic control valves and safety valves• Smaller diameter polyethylene tube (often called "laterals")
- Poly fittings and accessories (to make connections)
- Emitting devices at plants (emitter or dripper, micro spray head, inline dripper or inline drip tube)

IV. CONCLUSION

Aremotecontrolfordripirrigationisthemostbeneficialapproachforthefarmers.Thissystemreducestheextramanpower of the farmer for his farm like supplying water toplants.Thissystemusesdifferentsensorsliketemperature, light,humidityandmoistureandaccordingtothissensor parameters farmer can control drip due to internet connectivity between client and servers, farmer can control drip component from anywhereThis system remove drawback of previoussystemslikedistanceproblem,rangeproblem.Theproposed system uses an externally hosted cloud computingplatformtomanagethedatabase,androidandtheisolatedserver by the users across the country .This approach is verybeneficial for the farmer for increasing crop production. Thissystem can be usedin area wherewaterresourcesareless.Thissystemcanbe usedfor largearea farms.

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