REVOLUTIONIZING AGRICULTURE WITH SMART WATER MANAGEMENT

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Abstract— Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The objective is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this project is integrated with Arduino Technology. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds.
The objective of this paper is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done.

***Index Terms*— IOT , WSN,** Arduino , ESP32

1. INTRODUCTION

Internet of things IOT consists of two words Internet and Things. The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing, actuating and live monitoring of certain sort of data. IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly, or collected data from other devices and process the data and send the data to various servers. The other term internet is define as Global communication Network connecting Trillions of computers across the planets enabling sharing of information .Thus the IOT can be define as:"A dynamic Global Network Infrastructure with self-configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things have identities, physical attributes ,and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network ,often communicate data associated with user and their environment." An ideal IOT device consists of various interfaces for making connectivity to other devices which can either be wired or wireless. Any IOT based device consists of following components:

I/O interface for Sensors.

- Interface for connecting to Internet.
- Interface for Memory and Storage. Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and Search Engines. Wireless Sensor Network (WSN): It consists of various sensors/nodes which are integrated together to monitor various sorts of data. They form the backbone of IOT systems to enable connectivity and coupling to applications and these protocols facilitate exchange of data over the network as these protocols enable data exchange formats, data encoding and addressing. Embedded Systems: It is a sort of computer system which consists of both hardware and software to perform specific tasks. It includes microprocessor/microcontroller, RAM/ROM, networking components, I/O units and storage devices.

2. RELATED WORKS

Irrigation is most important for high yield of the farm. Today, by using WSN technology it is possible to monitor and control the environmental conditions as soil moisture, temperature, wind speed, wind pressure, salinity, turbidity, humidity etc for irrigation. Automated irrigation performed by using solenoid valve and pump. Solenoid valve is an electromechanical valve used with liquid controller to control an electronic current through solenoid which is a coil of wire that uses to control the state of the valve according to need of irrigation.

M.Nesa Sudha et al., 2020 proposed a TDMA based MAC protocol used for collect data such as soil moisture and temperature for optimum irrigation to save energy. MAC protocol plays an important role to reduce energy consumption. Two methods used for energy efficiency as Direct Communication method and aggregation method. Direct Communication method provides collision free transmission of data, because all the sensor nodes send data directly to the base station without the need of header node. This method is better where the base station is near but it is not optimum where the base station is far because sensor nodes consume more energy during transmission of data and if there is much data to the sensor node, sensor nodes quickly damaged.

The simulation result show that aggregation method provides better performance rather than direct communication method. It provides 10% increase in residual energy and 13% increase in throughput. Sensor nodes consume more energy while transmitting data.

AnujNayak et al., 2017 describe that sensor nodes batteries are charged by using harnessing wind energy. A routing algorithm named DEHAR is proposed to extend overall batteries power. The proposed method is efficient where the amount of sensor nodes very low because of latency experienced due to synchronous sleep scheduling. However, the main problem using harnessing wind energy is the unreliability as the power of the wind is not permanent.

Man Zhang et al., 2019 analysis the temporal and spatial variability of soil moisture for the realization of variable irrigation and for improve yield in the farm. Temporal variability adopts the changes of soil moisture at the place where the sensor nodes installed and analyze soil moisture variation at different times according to season. Spatial variability analyses calculate all parameter of soil moisture as average, maximum, minimum in whole area.

Joaquin Gutierrez et al., 2018 proposed an irrigation system that uses photovoltaic solar panel to power system because electric power supply would be expensive. For water saving purpose, an algorithm developed with threshold value of temperature and soil moisture programmed into a micro controller gateway. The system has a full duplex communication links based on internet cellular interface using GPRS based on mobile data for graphically display and stored in a database server. The automation irrigation system consists of two components were WSU and WIU. Sherine M.AbdEl-kader et al., 2018 proposed APTEEN (Periodic Threshold old sensitive Energy- Efficient sensor Network) protocol. APTEEN is a Hierarchical based routing protocol in which nodes have grouped into clusters. Each cluster has a head node and head node is responsible for broadcast data to the base station. APTEEN broadcast parameters attribute, which is a set of physical parameters, in which the user is interested to obtain info, Thresholds value as Hard Threshold and Soft Threshold, Schedule as TDMA schedule uses to assign slots to save energy, which provide collision free transmission. It controls the energy consumption by changing threshold values and count time. The performance of proposed protocol is better than LEACH on average 79% and by LEACH-C on average 112%.

B. Balaji Bhan et al., 2019 proposed a system to develop WSN based soil moisture controllers that determine the water requirement by comparing soil moisture with predefined threshold value. An intelligent remote system consists of wireless sensor nodes and computer system in which data is transmitted to a server system from where the data accessed by individuals for decision making for automated control of irrigation for the yield productivity. Sbrine Khriji et al., 2020 describe different type of sensor nodes for real monitoring and control of irrigation system. Each node consists of B mote and actuator. TelosB mote is an ultralow power wireless module for monitoring applications. Soil nodes used to measure the soil moisture weather nodes used to measure environmental parameter and

actuator used for controlling the opening of valves for irrigation. The system has cost efficient and reduce the power consumption The experimental result shows that the plants are well irrigate and if there is any change in threshold value the system alert to farmer about the problem to take decisions.

Yunseop Kim et al., 2018 represents real time monitoring and control of variable rate irrigation controller. The sensor nodes measure environmental parameter and transmit data to base station where base station process data through a user-friendly decision making program and all data commands send to irrigation control station. The Irrigation control station sends machine location using GPS to the base G455 station, send control signal back to irrigation control.

Fiona Regan et al., 2019develop heterogeneous real time water monitoring network system to monitor water quality parameter such as pH, temperature, turbidity and conductivity. The implementation of intelligent sensors incorporating TEDS (Transducer Electronic Data Sheet) which is a machine readable specification of the sensor characteristics, enable sensors to interfaced with the system in a plug and play fashion. PSOC system used to create generic sensor interface. The plug and play capabilities enabled by the developed WSN platform allow for integration of any commercially available water quality sensors. PSOC plug and play system capable of transmitted data to the sensor that processed data for transmission to the web.

Joaquin Gutierrez et al., 2018 represents that the sensors use Smartphone to capture and process images of soils. Images can be capture to estimate the water content of the soil. The router node is used to forward collected values to the gateway that provide automatically pump the water to the crop in a field. An Android app used for connectivity such as Wi-Fi. Android app wakes up the Smartphone by using given parameters. In-built camera takes an RGB picture of the soil through an anti-reflective glass window to take estimation of wet and dry area. The mobile app enables the Wi-Fi connection of Smartphone to transmit the estimation value to the gateway via a router node for control an irrigation water.

3. EXISTING SYSTEM

During day to day activities many people often forget to water their plants and thus it becomes challenging for them to keep their plants healthy and alive. Also it is a challenge for farmers to maintain their fields and manage watering of plants during shortage of water. Based on the above background, we thought that it is necessary to implement the automated system which will take care of plants. In the existing system we can't automatically water the plants and we need to be there at every situation in order to detect the moisture of soil which is burden to us and time taking process.

4.PROPOSED SYSTEM

Automatic watering of plants is based on Internet Of Things (IOT). In this proposed system we use Arduino unto software and hardware, Soil moisture sensor, Raindrop sensor, DHT11 Sensor, Relay Module, Dc motor. The sensors automatically checks the soil moisture and based on some threshold value if soil is dry then it waters the plant and if soil is wet which is more than threshold value then is stops watering the plants.

4.1. MATERIALS AND METHODS

The ESP32 Dev Kit is a development board based on the ESP32 system-on-chip (SoC) manufactured by Espress if Systems. The ESP32 is a popular microcontroller that offers both Wi-Fi and Bluetooth connectivity, making it suitable for a wide range of IoT (Internet of Things) and embedded projects.

4.2 SOIL MOISTURE SENSOR

Fig :4.2 Soilmoisture sensor

Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighing of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of

the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

4.3 DC MOTORPUMP

Fig:4.3 DC motor pump

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque.

4.2 RELAYMODULE

Fig : 4.4 RELAY MODULE

A relay is an electrically operated switch. It consists of a set of input terminals for a single or multiple control signals, and a set of operating contact terminals. The switch may have any number of contacts in multiple contact forms, such as make contacts, break contacts, or combinations thereof.

4.3 RAINDROP SENSOR

Fig:4.3 Raindrop Sensor

A raindrop sensor, also known as a rain sensor or rain detector, is a device designed to detect rainfall or measure its intensity. It consists of various components working together to provide accurate readings. At its core, the raindrop sensor typically contains a conductive surface or sensor pad that interacts with water droplets. When rain falls onto the sensor surface, it causes a change in conductivity, which is then measured by the sensor circuitry

A LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

Pin Diagram:

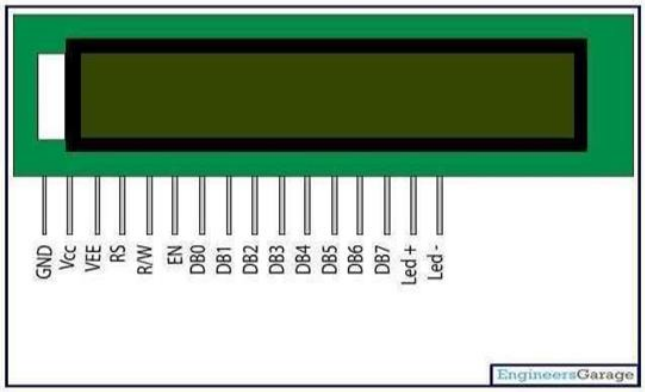

Fig:5.1sspin diagram

5.PERFORMANCEANALYSIS

Whenever me and my family go for vacations, we used to get worried about my plants because they need water on regular basis. gone through several options to solve this problem as plants need water according to the moisture level of soil. So I have made Smart Irrigation System Using ESP32.

In this system, soil moisture sensor senses the moisture level of the soil. If soil will get dry then sensor senses low moisture level, Rain sensor, Humidity and temperature sensor it automatically switches on the water pump to supply water to the plant. As plant get sufficient water and soil get wet then sensor senses enough moisture in soil and the rain. After which the water pump will automatically get stopped. I have used a self-made water pump in this system using 12 volt DC motor. I could use 12 volt water pump in the system but to operate this, it will require a relay module. So, to reduce all these hardware complexity, I made DC motor based water pump using diode, transistor registers combined circuit which operates DC motor according to the Arduino code. yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than99% accurate results.

6. CONCLUSION AND FUTURE SCOPE

Smart irrigation system using Arduino is designed in this project. The prototype of the model worked properly when tested on different soils. The components that we use in the system are readily available and easy to operate. Thus, this system acts as an effectual method of irrigation. It is far better than the manual irrigation process which requires a lot of manpower and time. By using the app, the farmer can operate the system from distant places. The farmer can utilize this time in other significant activities. Also, the major issue of water scarcity is dealt with. No amount of water is wasted in the process of irrigation.

Thus, this system can be very useful in areas where water is in short supply. As the required amount of water is provided to the crop, the crop growth is better. Farmers can thus benefit from the enhanced crop yields. The project is tested for different types of soils and it works properly. The future work of the system can include the addition of temperature sensors and a more powerful motor to pump water to the fields. Thus, the large-scale implementation of the project can also be done.

7. REFERENCES

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