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Sustainable Irrigation for Enhancing the Water usability in Agriculture using IOT

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Abstract - India is land of agriculture and most of the people here depend on agriculture for their livelihood. India can be among top 5 exporters of agro-commodities by shifting its focus on the agriculture and effective hand holding of the farmers. These days, one of the big challenges countered by formers is the scarcity of water. Another major dispute encountered by Indian agriculture sector is the increase in rate of formers suicide because of informal debt. According to the survey conducted in India there are 768 farmers committed suicide in 2014 and 766 in 2020 this is because of lack of fresh water for irrigation purpose, and with industrialization farmers are selling their property and they are moving towards the urban areas the only reason for this is scarcity of fresh water, with effective watering and skilled agriculture can lead to the very good yield in the farm land. So, innovations and implementations in agriculture using the available and reliable technology would reduce the cost of farming and increase the yield from agriculture and thereby we can see the prosperity in agricultural field.

***Key Words*:** soil moisture sensor, Ph-sensor, solenoid valve, relay, flowrate meter, ESP32, ESP8266MOD, Power junction, Generic.

1.INTRODUCTION

Agriculture is the only source of food and more than 45% of world population were depends on the agriculture and in India 75% of Indian population is depends on the agriculture and one third of the nation's capital comes from farming agriculture is the primary source of livelihood Agriculture can help to reduce the poverty and raise the income and improve the food security by 80%. With effective agriculture poor people in rural areas can become the rich people can produce the employment in the rural areas.

The idea of smart irrigation to the farm lands proposes the design of a generic IoT framework for improving agriculture yield by effectively scheduling irrigation on the crop's current requirements, environmental conditions and weather forecasts. This idea gives the design of an affordable irrigation system. This idea reduces the amount of water required and thus reduces the cost and improves the soil health. The generic framework has been validated using a case study for Horticulture crops. In India due to lack of proper knowledge in agriculture farmers sometimes uses excessive amount of fertilizer like urea, nitrogen, phosphorus etc. which slowly alters the soil quality and lowers the productivity of crop cultivation by time. At the same time farmers doesn't know the correct amount of water that is needed by different crops to grow, so they either use excessive water or less water for irrigation. Various geographical land areas require various amount of water according to their moisture content and moisture holding capacity. Due to excessive watering of fields many hazards can arise like water logging near roots, bacterial growth etc. So, this idea helps to solve these problems.

Image of the farmer in agriculture fieldshown below

2. COMPONENTS USED

1. **ESP32:** ESP32 is a single 2.4 GHz WiFi-and-Bluetooth combo chip designed with the TSMC ultra-low- power 40 nm technology. It is designed to achieve the best power and RF performance, showing robustness, versatility and reliability in a wide variety of applications and power scenario.
2. **WATER FLOW RATE CONTROL:** Water flow sensor consists of a plastic valve from which water can pass. A water rotor along with a hall effect sensor is present the sense and measure the water flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the hall effect sensor. Thus, the rate of flow of water can be measured.
3. **SOLENOID VALVE:** A solenoid valve is an electrically controlled valve. The valve features a solenoid, which is an electric coil with a movable ferromagnetic core (plunger) in its center. In the rest position, the plunger closes off a small orifice. An electric current through the coil creates a magnetic field. The magnetic field exerts an upwards force on the plunger opening the orifice. This is the basic principle that is used to open and close solenoid valves.
4. **SOIL-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 garden.
5. **NODE MCU- ESP 8266 NodeMCU:** It is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoC from Expressive Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the development kits. The firmware uses the LUA scripting language.
6. **RELAY CONTROLLER:** 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. It consists of many channels like 1, 2, 4, 8…etc.
7. **JUMPER WIRES:** Jumper wires are simply wires that have connector pins at each end, allowing them to be used to connect two points to each other without soldering.
8. **PH-SENSOR OR METER:** PH meter, electric device used to measure hydrogenion activity (acidity or alkalinity) in solution. Fundamentally, a pH meter consists of a voltmeter attached to a pHresponsive electrode and a reference (unvarying) electrode. The pH-responsive electrode is usually glass, and the reference is usually a mercury–mercurous chloride (calomel) electrode, although a silver– silver chloride electrode is sometimes used. When the two electrodes are immersed in a solution, they act as a battery. The glass electrode develops an electric potential (charge) that is directly related to the hydrogen-ion activity in the solution (59.2 millivolts per pH unit at 25 °C [77 °F]), and the voltmeter measures the potential difference between the glass and reference electrodes.

3. LITERATURE SURVEY

The main objective is to design a device which will control the usage of water in farming. In this scenario, research has been done to develop an effective automated IOT system by using sensors, ESP 32 Microcontroller. As a reference, we can take the following research papers.

Pavan Kumar Naik et al.,[1] developed automatic irrigation system thereby saving time money power of the farmers. The system consists of soil sensors, which is used to measure the water content in the soil. Moisture in the soil is an important component in the atmospheric water cycle. Sensor module outputs a high level of resistance when the soil moisture is low. This system has both analog and digital outputs. Once the sensor information is collected, this automated system gives signals to actuators and transmits the data to farmers through SMS. A FUZZY based algorithm is developed with set values of temperature and soil moisture and the level of water is programmed into a microcontroller-based controller system to control the water flow. The microcontroller is connected to soil moisture sensor, relay and motor. These sensors sense the various parameter of the soil, motor is used to provide water to the land. And relay is used control the motor. Here a GSM modem is used to transmit the information about the crop from sensors.

Prachi Patil et al.,[2] worked on automating the agricultural environment in the real time using IOT. The irrigation and controlled use of water for the social welfare of the Indian agriculture system. The system is used to check the moisture level in the soil of the farm. It also controls the soil moisture by controlling the soil

moisture level by moisture content in the soil and accordingly switching the motor ON/OFF for the purpose of irrigation. In this system soil moisture sensors, are used for monitoring the moisture level in the soil. Once the moisture level has reached the particular level, the system takes appropriate action to stop the water flow. This system also monitors the water in the water source so that if the water level becomes very low, it switches off the motor to prevent the damage. This system also consists of a GSM modem through which the farmer can easily be notified about the critical conditions in the farming.

Rajeshwari madly et al., [3] "Intelligent Irrigation Control System Using Wireless Sensors and Android Application". This System is based on increasing the yield of a crop by using intelligent Irrigation Control System Using Wireless Sensors. Here they are using sensors like PH sensors and soil moisture sensors for monitoring the primary parameters like temperature and humidity. Decision is taken based on the type of the crop being grown and sensed data. In this system the farmers are given with a mobile application in which they can monitor and control the irrigation system.

Srishti Rawal in [4] developed the system to use appropriate quantity of water to irrigate crops based on soil moisture measurements. The system is combination of the Hardware and the Software components, the hardware part comprises of moisture sensors, this proposed system uses IOT for sprinkler control and to keep farmers to updated. Water sprinkler control was achieved by setting a threshold value at which irrigation should begin. When the sensor detects the moisture content before the threshold, the sprinklers are switched on until the soil gets moist completely. The readings of each sensor can be presented as graphs as well at another page using things-peak channel and the lines explains the level of soil moisture.

Advantages:
Increase in productivity. Reduced water consumption and fertilizers. No man Power Required. Require smaller water sources.
Disadvantage:
The topology structure of the proposed system is not efficient and can bring down the performance of the entire system.

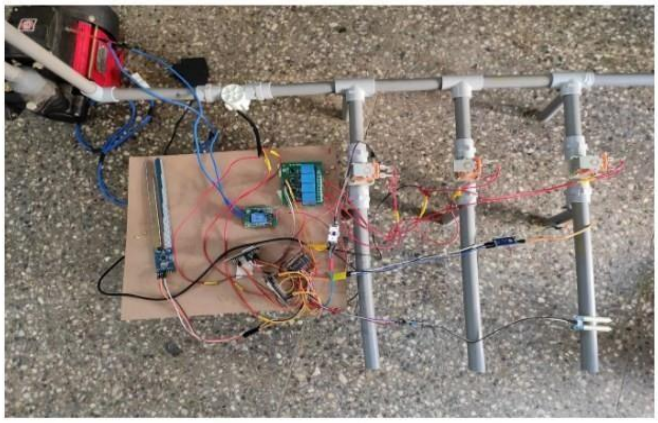
4. WORKING

Initially the power connection to be given to all components. At first the soil moisture sensor reads the moisture content from soil and passes that information to ESP32 microcontroller, to ensure the quality of the signal sent to microcontroller we use amplifier in between soil moisture sensor and ESP32 to strengthen the signal passed from soil moisture sensor to ESP32. After receiving the readings from soil moisture sensor, the ESP32 microcontroller checks the value received from soil moisture sensor against the standard value defined in embedded C language in ESP32 microcontroller. If the value received from soil moisture sensor is less than the standard value the ESP32 passes the instruction to 4 channel relays to turn on the solenoid valve. The solenoid valve is an electromechanically operated valve. As soon as the solenoid valve turns on the water starts flowing through pipe and then to the surrounding area. If the soil moisture sensors return value to ESP32 after sometime if the value of soil moisture is greater than standard value set in source code then ESP32 gives instruction to relay to turn off the solenoid valve to stop the flow of water. If the soil moisture value is less than the standard value the water continues to flow till the threshold value of the soil moisture.

There are few scenarios where some part of land is wet and some are dry. In that case the ESP32 checks for the less soil moisture from soil moisture sensor readings. Then ESP32 gives instruction to 4 channel relays to turn on the specific solenoid valve which connected to soil moisture sensor which has less soil moisture value, the specific solenoid valve turns on to allow the flow of water. The remaining solenoid valves are turned off. By this way the water is effectively used in irrigation.

This can also be used for passing fertilizer to the crops. Instead of water the fertilizer can be passed through pipes. This can be controlled in Blynk Application where user can turn off the motor after desired period of time and condition.

Implementable model of the proposed system



5. RESULTS

System which reduces work to farmer. A single farmer can control acres of land's irrigation using this

IoT device. The methodology of the advanced irrigation techniques which initially the user has to install the device and also mobile application was interfaced with the respected device to get the real time data of the field and crops.

Readings of the soil moisture sensors will be displayed on the Blynk app

The farmers should install this device in their agricultural fields and get proper data of soil and as well as water requirements for their respected crops in fields, Farmer will get all the related data about crops and climatic conditions of land to the mobile application. Hence it can be used for both convenience and without bearing any effect on the system or the data contained in it.

6. CONCLUSIONS

The main goal of this idea is to provide an effective solution for over usage of water. This idea will give huge range of solutions. To say in simple words the idea is useful for farmers who cultivate small levels of irrigation and farming. Aim of the idea is to reduce the problems for Farmers and reduce their workload.

The main goal is to find the moisture and other factors to detect the need of water. By implementing this idea, we can improve or rather decrease the loss rate due to over irrigation of water and the adequate amount of water is provided to the crop. The system will have latest technology and optimized operations with moderate cost. The proposed idea is more efficient than existing system. And it also gives greater performance at lower cost. This idea can be easily implemented and installed in the farm.

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