Automatic Irrigation System Using Arduino

Ramu Gangineni[1], Prudvi Binnada[2], Vandavagula Sharan Reddy[3], Ravi Teja B[4]

[1,2,3,4]*Student, Dept. of Electrical and Communication Engineering, Lovely Professional University, Punjab, India*

Abstract

Asia is the world's largest and most populous continent, with a total population of 460 million people. Housing this populat ion poses a various of problems in numerous areas. Where supplying the safe nutritious food to each and every individual is the most difficult task. Unfortunately, due to a variety of production problems, farmers are unable to achieve the desired throughput, which can lead to suicide insome cases. However, storing and distributing these harvests properly is a challenge. Different types of models and automated systems have been implemented and various technological devices have come to work as detecting the soil moisture, humidity of the air but still there is lack of food for living beings. In the proposed operation different related models have been studied and an integral model is presented where the integration of Arduino based system has made with the use of IOT.

Keywords: *Servo motor, Sensor, Arduino .*

1.INTORDUCTION:

Asia is the largest continent and most populated region of the earth with more than 500crore population and with increasing of population is not only a problem but providing them with proper life is also challenging for their governments and organisations. And agriculture is the only thing that can feed all the people. The population in Asia going to spike by several billions by coming 30 to 40 years although there are many types of measures to Add up productivity and harvest recent dramatic increases in food prices in much of the world have caused much concern and have even resulted in some public protests and riots .Many commentators have predicted that food supplies in the Asia Pacific region will become much more limited in the future as the result of population growth. The rapid growth of cities new food demands by growing middle classes causing more using of food "today more than 1 billion people are hungry and 16 million people die of hunger every year 17000 everyday incoming 30 to 40 years the world needs to feed more than 2 billion population and considering the death of hunger behalf many farmers are taking the life by their own due to lack of money, someby debt trap , and many other by natural calamities like tsunami and heavy rains the crop is getting wasted and there are not getting minimum price for the crop Food wasting is a big problem in our country and around the world, with 1.3 billion tonnes of food thrown away each year, enough to feed 3 billion people. Approximately 20% of grain and 42% of vegetables and fruits produced on the Asian continent are wasted each year. When people are starving to death and farmers are committing suicide, this figure skyrockets. According to the Food and Agriculture Organization, halving food waste will save enough food to sustain 870 million people around the world. Farmers would go out to their fields to check the soil moisture level. They start the engine and wait for the water level to rise high enough to water the area.

It is a time-consuming job for the farmer. It can provide excellent control and monitoring over existing structures in the agriculture sector with the support of numerous sensors. The agriculture framework can be upgraded to increase performance with limited effort and without making any improvements to current infrastructure thanks to IoT and a few other technologies including cloud storage, smart GPS, and network integration.

In this paper, we propose an automatic irrigation system based on the Arduino Uno, with a servo motor as a key component. The servo motor rotates in accordance with the requirements. If there are two crops A&B, and crop A has less moisture, the servo motor rotates towards crop A and begins watering, and when crop A is full, it rotates towards crop B. It reduces water waste. Moisture measurement at a single location in a large agricultural field does not make sense because the fields are divided into different areas. To pump water to the specific locations covered by a sensor unit, a distributed number of sensor nodes and scattered pumping units are required. Soil moisture sensors intelligently measure soil moisture and, based on that data, the field is automatically irrigated with minimal human Intervention. Farmers can access complete moisture data from afar using the mobile application.

2.Literature Survey

Automated irrigation system using aurdino and servo motor and its main aim to control the wastage of water for agriculture crops. And two more important items are soil moisture sensor and temperature sensor these works under wireless sensor network. Sensors are also used to check nutrition percentage of field. Mainly aurdino is used to transfer data from sensor to mobile application. Code used in the aurdino for maintaining the water quantity as per requirements and conditions of the farming field.web application helps the irrigation through continuous monitoring and scheduling . It can be done by mobile phone.

V.R.Balaji and M.Sudha designed the system device to generate power from sunlight using photovoltaic cells. This system is not powered by electricity. They used a PIC microcontroller in this project to turn on and off the motor pump. This system does not support weather forecasting

Sbrine Khriji et al., 2014 [1] implemented various types of sensor nodes for irrigation system control and real-time monitoring. Each junction is made up of an actuator and a TelosB mote. It is a wireless module used to monitor websites. Soil nodes are used to measure soil moisture, temperature nodes are used to measure weather conditions, and actuators are used to keep irrigation valves open. It is cost effective and reduces power consumption. The results of the experiment show that the plants are well irrigated, and if the threshold value changes, the system alerts the farmer to the problem so that the correct decision can be made.

Yunseop Kim et al. proposed a real-time monitoring system and variable rate irrigation controller control in their paper [2]. The sensor nodes collect and transmit data and environmental parameters to the base station, which processes the data with an easy-to-use decision-making programme and sends all data commands to the irrigation control station. The irrigation control station sends the machine's location to the base station via GPS, and the base station responds with a control signal.

According to Macro Mancuso et al. [3], the Rinnovando group (Rgroup) is a collaboration of agriculture specialists who focus on monitoring microclimate in tomato greenhouses. The primary goal of monitoring is to determine when a crop is at risk of developing so that the farmer can treat the field with fertiliser only when necessary.

Hema N. et al., 2014 [4] used an Automated Weather Station to forecast real-time local weather parameters of interpolation. This paper uses a limited WSN with soil and temperature moisture
sensors to provide accuracy and error correction of around 99.48 percent for real-time interpolated data. Using AWS data, this irrigation in the atmosphere such as rainfall and monsoon. Soil moisture and AWS data aid in error correction in irrigation management.

3. COMPONENTS:-

Arduino:-

Arduino is an open and accessible electronics system that offers utilisation simple hardware and software to make it easy to use. Arduino boards take inputs like light from a sensor, a finger on a switch, or a tweet and transform them into outputs like turning on an LED, activating a generator, or publishing something online. You can tell the board's microcontroller what to do by giving it a set of instructions. This is accomplished using the Arduino programming language (based on Wiring) and the Arduino Software (IDE) (based on Processing). Shown in fig(1).

Fig 1: Arduino Microcontroller

Over the years, Arduino has been used in thousands of projects, ranging from basic household objects to sophisticated research instruments. This open-source movement has gathered a global culture of developers - instructors, hobbyists, and professionals - whose efforts have added up to an immense amount of readily accessible knowledge that can be of tremendous help to both novices and experts.

ServoMotor:-

A servomotor is a rotary or linear actuator that has the ability to precisely regulate angular or linear orientation, velocity, and acceleration. First and foremost, It consists of a suitable motor and a location feedback sensor. It also necessitates the use of a sophisticated controller, which is frequently a dedicated servomotor module.

While the term servomotor is often used to describe a motor that can be used in a closed-loop control system, it does not apply to a specific type of motor. Shown in fig(2)

Fig 2: Servo Motor

SENSORS:-

Soil Moisture Sensor:

Two probes are used to feel the water level of the plants in the soil moisture sensor. As current is passed between these two probes in Fig(3), the resistance value of the moisture level is estimated. If there is less water in the soil, the resistance is lower, and vice versa.

Soil moisture sensors are instruments that determine how much water is in a given amount of soil. The removal, drying, and weighing of a sample is needed for direct gravimetric measurement of free soil moisture. Moisture

sensors calculate the volumetric water content indirectly. By using another soil property as a criterion, such as electrical resistance, dielectric constant, or neutron interaction, a proxy for moisture content can be established.

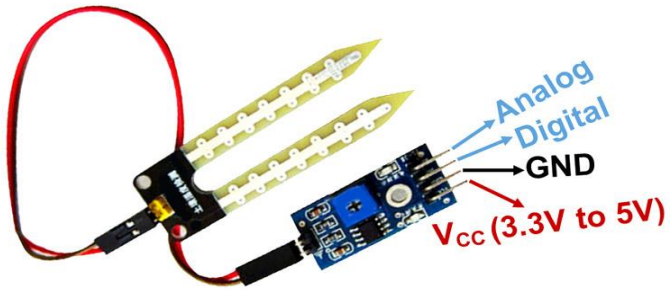

Fig 3: Soil Moisture Sensor

Temperature and Humidity Sensor:-

In the DHT11 Temperature and Humidity Sensor has a calibrated digital signal output with the temperature and humidity sensor complex. Its technology ensures high dependability and stability.

This sensor contains a resistive element as well as a sense of wet NTC temperature measuring devices. It has excellent quality, quick response, anti-interference capability, and high cost-performance advantages. The humidity sensing component, which consists of two electrodes with a moisture holding substrate between them, is used to measure humidity. As a result, as the humidity changes, so does the conductivity of the substrate or the resistance between these electrodes.The resistance change is measured and processed by the integrated chip that prepares it for reading by a microcontroller. A NTC temperature sensor or a thermistor is used in these sensors to measure temperature. A thermistor is a variable resistor that changes resistance as temperature changes. These sensors are created by sintering semi-conductive materials such as ceramics or polymers to provide larger changes in resistance with only minor temperature changes. The abbreviation "NTC" stands for "Negative Temperature Coefficient," which means that resistance decreases as temperature rises.

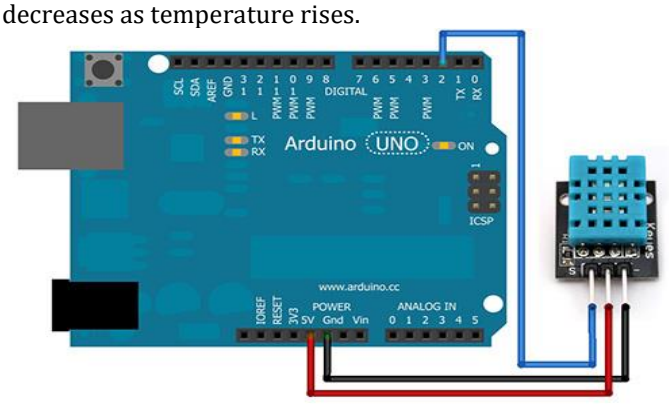

Fig 4: Temperature and Humidity Sensor with Arduino

RelayModule:-

The relay module is also an electronically controlled switch that helps to turn on or off a circuit with far higher voltage and/or current levels than a Microcontroller can manage, as shown in Fig (5). The low voltage circuit and the high power circuit of the microcontroller have no relation. The relay protects each circuit from the other. The letters NC, COM, and NO signify three connections on each channel in the module. The jumper limit may be set to high level effective mode. which 'closes' the usually open (NO) switch at high level input or low level effective mode. It works the same as high level input but at low level depending on the input signal trigger mode.

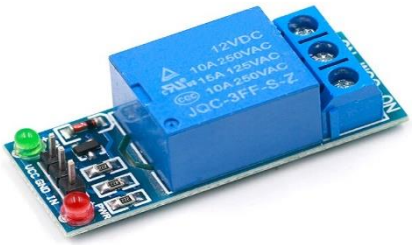

Fig 5: Relay Module

Wi-Fi Module ESP8266:

The Wi-Fi Module ESP8266 is a low cost module, Used to interface the microprocessors. It has 96KB of data RAM as well as 64KB of instruction RAM.

Fig 6: ESP8266 Wi-Fi module

Working of Automatic Irrigation System:-

The Smart Irrigation System has a broad scope for automating the entire irrigation system. Here, we're constructing an IoT-based irrigation system with an ESP8266 NodeMCU Module and a DHT11 Sensor.

It will not only automatically irrigate the soil based on the moisture level, but it will also send data to the Thing Speak Server to keep track of the land condition.

The system will include a water pump that will be used to sprinkle water on the land based on the environmental conditions of the land, such as moisture, temperature, and humidity.

crop that will necessitate 50-55 percent soil moisture

So, when the soil loses moisture to less than 50%, the motor pump will automatically switch on to sprinkle the water, and it will proceed to sprinkle the water till the moisture approaches 55%, at which point the pump will be turned off.

- The sensor data will be sent to the ThingSpeak Server at predetermined intervals, allowing it to be monitored from anywhere in the world.
- ESP8266 NodeMCU Programming for an Automatic Irrigation System
- Only the DHT11 sensor library is used as an external library when programming the ESP8266 NodeMCU module.
- The moisture sensor outputs analogue data, which can be read using analogue pin A0 on the ESP8266 NodeMCU.
- Because the NodeMCU's GPIO cannot provide an output voltage greater than 3.3V, we are using a relay module to drive the 5V motor pump. Additionally, the Moisture sensor and DHT11 sensor are powered by an external 5V power supply.
- This is how an IoT-based smart irrigation system works.

Circuit Diagram:-

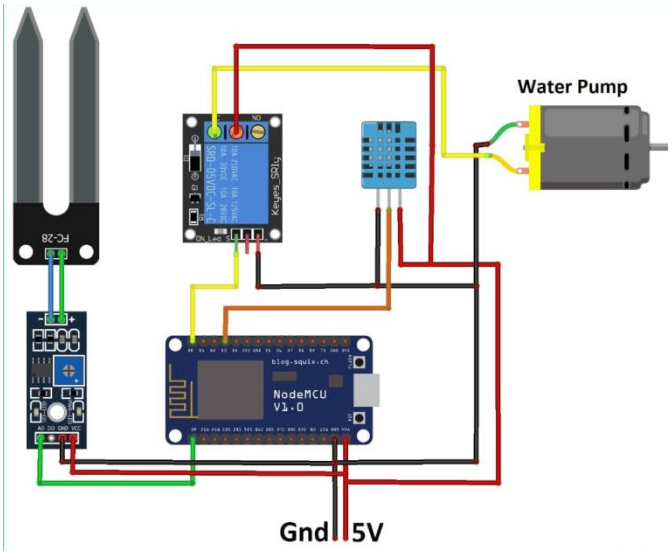

Fig 7: Prototype of Automatic Irrigation System

Methodology:-

The automatic irrigation system is a smart way to monitor crop condition and automatically irrigate crop fields. This proposed system reduces farmer workers by supplying water to plants and monitoring crop condition. This system makes use of various components such as the DHT11 sensor and the Soil moisture sensor, temperature and humidity sensor, and so on, and based on these sensor parameters, farmers are provided an automated method of irrigating their fields With the assistance of the proposed system, we can even obtain the current status of the soil, motor, crop condition, and the status of the various components.
Reading from the two sensors where also transmitted to a THINKSPEAK channel to obtain graph. THINKSPEAK is a open data platform and API from internet of things that enable that you to collect, store, analyze, visualize an act on data from sensor or acutators such as arduino.

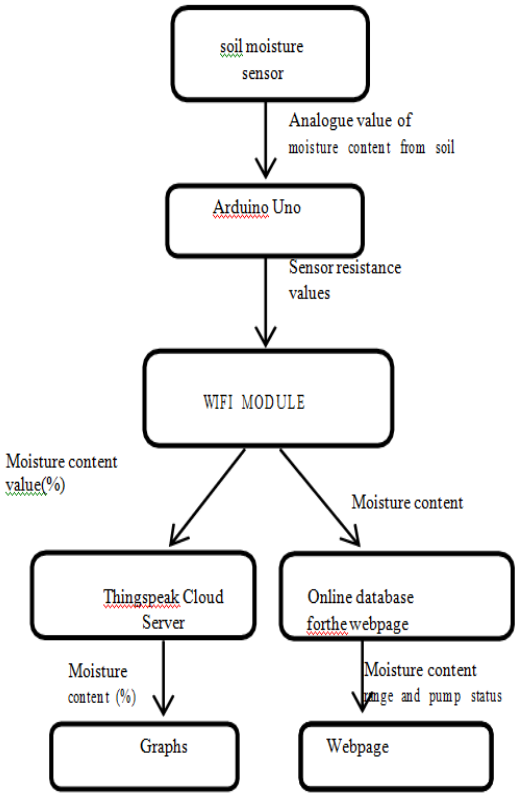

Fig 8: Flow chart of the system

Advantages Of Automatic Irrigation System Using Arduino:

Conventional irrigation methods are ineffective in dealing with
Because of the scarcity of irrigation water, this industry must benefit.
Technological advances in the modern era As a result, the new smart the agricultural irrigation system has the following benefits.

Boost farmland productivity: Farmland productivity is declining.
No need of manpower.
Increase the qualityness of crop.
Decrease the soil erosion and the nutrition level of field.
Lower your water consumption.
There is no need for additional personnel.
Reduce soil erosiveness.

Conclusion and Future Work

The irrigation phase is the most important necessity for human civilization, and it is regarded as the backbone of our country. Water conservation is critical in the current climate. High level of concern this project aims to protect the environment. By continuously monitoring the soil's condition, Controlling the flow of water and thus reducing waste this system has the potential to significantly benefit farmers. Would lower labour costs and boost efficiency in

farming. We obtain better results by modernising farming techniques. High yields and improve farmers' living standards it will be extremely beneficial in arid and semi-arid areas.

In the coming days, we will be able to have a system that monitors the farm as well as a fully automated irrigation system that will recognise which crop is in the field and will automatically preserve the moisture level that is appropriate for that crop.

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