IoT Based Smart Agriculture with Automated Irrigation and Crop Suggestions.

[1]Palak Brijpuria, [2]Manvitha Akula, [3]Nisha Biradar, [4]Kuldeep Padaliya, [5]Prof. Swati Narkhede
[#1234]Department of Information Technology
Dhole Patil College of Engineering, Wagholi, Pune.

Abstract: The project presents the correct use of the soil moisture sensors which helps to ease out the pain to monitor and keep records about the changes in the soil moisture starting from the cultivation to the harvesting period of the crops. Using the ESP controller with hygrometer moisture sensor, humidity is measured and analysed. The hygrometer is a sensor which when placed in the soil for a certain duration, provides information related to the moisture status of the soil. The ESP8266 will collect and process the data received from the hygrometer. When a threshold moisture level of the soil is reached, the water will be supplied accordingly. This is essential because water must be provided to the plant at a specific time for a good yield. User can access this from any remote location to keep a track of his crops or plants. This system efficiently manages both, water and energy, it also analyses the collected data by sensors and gives specific suggestions about suitable crop to grow based on the properties of that land. This system ensures the healthy growth of the plant without the presence of the user.

Keywords: ESP8266, Moisture Sensor, IoT, Crop Suggestion

I. INTRODUCTON

In the present era, one of the greatest problems faced by the world is water shortage and agriculture being an important occupation consumes lots of water. Therefore, something is required that uses water judiciously. Automatic irrigation systems estimate and measure the level of existing field's moisture in order to operate and control an irrigation system, restoring water as needed while minimizing the use of water.

The soil moisture-based irrigation control [1] uses Unique techniques, which are relatively simple, but these quantities are related to the soil water characteristics that is specific to the type of the soil available. Also, sensors used require routine maintenance for proper performance. Intelligent automatic plant irrigation system [2] concentrates on watering the plants regularly without the human monitoring using a moisture sensor. The circuit is built around a comparator Op-amp which drives a relay to switch on motor. The system uses hardware component, which is subjected to variation in the environmental conditions. An Android application is used for monitoring the soil moisture, activating the motor and scheduling the irrigation process. Prototyped with the real-time, smart sensor array is used for measuring the soil moisture and the soil temperature. This system is not specific for a field and hence its usage is not limited. Proper scheduling of irrigation is important for efficient water utilization in the crop production, particularly under conditions of water shortage. The effects of the applied amount of irrigation water, irrigation frequency and the water usage are particularly important. To improve the water utilization there must be a proper irrigation method scheduling the strategy. So, our project devices a simple system, using a microcontroller to automate the irrigation and to use minimum water according to the requirements.

II. LITERATURE SURVEY

Smart Farm Monitoring Using Raspberry Pi and Arduino 2015 Siwakorn Jin-darat, Pong-pisitt Wuttidit-tachotti[1]. The findings of this study found that the system could monitor surrounding weather conditions including humidity, temperature, climate quality in the farm.

Sustainable Agriculture using Eco-friendly and Energy Efficient Sensor Tech-nology 2016 Srisruthi.S, N.Swarna, G.M.Susmitha Ros, Edna Elizabeth[2] which supports careful management and cultivation of crops involving less use of fertilizers, pesticides, calculated use of precious natural resources like energy, water through controlled irrigation and fertilization practices with the help of green sensor technology and electronic control systems.

Soil In infiltration Rate as a Parameter for Soil Moisture and Temperature Based Irrigation System 2016 Analyn N. Yu-mang, Arnold C. Paglinawan, Lariz Ann A. Perez, John Francis F. Fidelino and Joseph Benedict C. Santos[3] an Irrigation System Automated by using sensors and automated valve is designed so that there is a control in irrigation, which also reduce the system's power consumption. The moisture sensor is used to determine the moisture of the soil and when to trigger the irrigation.

Research on water-saving irrigation automatic control system based on Internet of things 2011 Zhang Feng [4], to improve irrigation of water, use efficiency, reduce cost of irrigation water, this paper discussed the design of wireless sensor network and Internet technology of farm-land by automatic irrigation control method. Emphasis on an analysis of the routing protocol of sensor network nodes to achieve the system hardware, software design, middleware, and applications.

Automated Irrigation System Using a Wire-less Sensor Network and GPRS Module 2013 Joaqun Gutir-rez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel ngel Porta-Gndara[5] . The system has a distributed wireless network of soil-moisture sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to an android application.

III. SYSTEM OVERVIEW

This prototype monitors the amount of soil moisture and water level. A predefined range of soil moisture is set and that varies with soil type. When the moisture of the soil deviates from the specified range, the system is turned on/off. In case of dry soil and high-water level, controller will activate the irrigation system, pumping water for watering the plants.

The block diagram of smart irrigation system is represented in Fig1. It consists of ESP8266 Wi-Fi controller which is the brain of the system. The moisture sensor is connected to the input pins of the controller. The water pump is coupled with the output pins. If the sensor value deviates from the predefined range, the controller turns on the pump. The servo motor is used to control the angular position of the pipe, which ensures equal distribution of water to the soil. Also, an Android application is used for monitoring the sensor data and predicting crops based on that data.

This system can be implemented on large scale for farming purposes, which can further prove to be more advantageous. Owing to prevailing conditions and water shortages, the optimum irrigation schedules should be determined especially in farms to conserve the water.

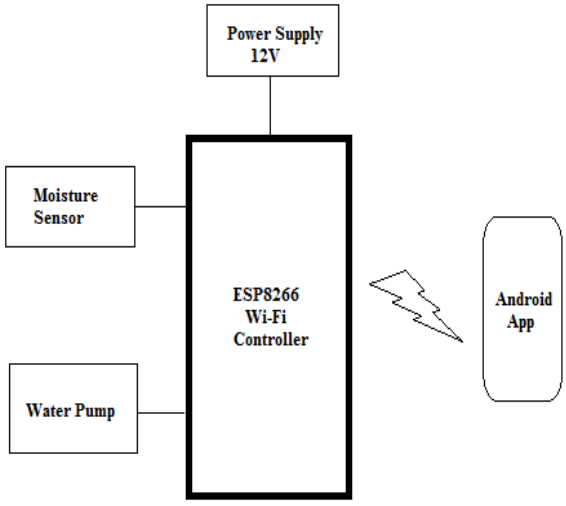

Fig 1. Block diagram

Software Design:

In this prototype, the controller is programmed in Arduino software. It provides a number of libraries to make programming simple. The program in Arduino designates a pre-set range of resistance value in digital format (ranging from 0 to 1023) for both the moisture. Any aberration from the set range switches on/off the pump, to water the plants. Also, an Android application is used for controlling and monitoring ESP8266.

IV. HARDWARE DESCRIPTION

WI-FI MODULE: -

The ESP8266 Wi-Fi module is a self SOC with integrated TCP/IP protocols that can give any microcontroller access to your Wi-Fi network.

The ESP8266 is capable of hosting an application or offloading all Wi-Fi networking function from another application processor. Each ESP8266 module come programmed with an AT command set Firmware. The ESP8266 module is extremely cost effective.

There is almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support.

Fig 2. ESP8266 Wi-Fi model

WATER PUMP: -

Micro DC 3-6V Micro Submersible Pump Mini water pump for Fountain Garden Mini water circulation System, which can be operated from a 3 ~ 6V power supply. It can take up to 120 litres per hour with very low current consumption of 220mA. Just connect tube pipe to the motor outlet, submerge it in water and power it. Make sure that the water level is always higher than the motor. Dry run may damage the motor due to heating and it will also produce noise.

Fig 3. Water pump

SOIL MOISTURE SENSOR:

This is an easy to use digital soil moisture sensor. Just insert the sensor in the soil and it can measure moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low in the soil.

Specifications: -

- Operating voltage: 3.3V~5V
- Dual output mode, analog output which is considered as more accurate
- A fixed bolt hole for easy installation
- With power indicator (red) and digital switching output indicator (green)
- Having LM393 comparator chip, stable
- Panel PCB Dimension: Approx.3cm x 1.5cm
- Soil Probe Dimension: Approx. 6cm x 3cm
- Cable Length: Approx.21cm
- VCC: 3.3V-5V
- GND: GND
- DO: digital output interface (0 and 1)
- AO: analog output interface

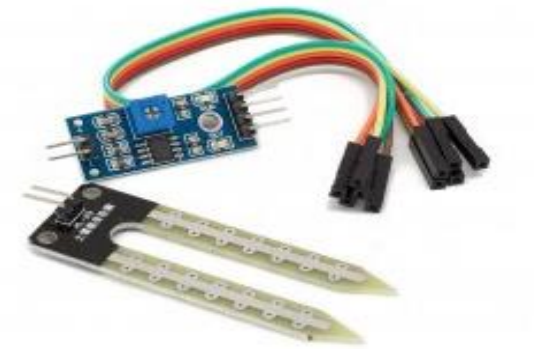

Fig 4. Soil moisture sensor

V. ALGORITHM STEPS

Algorithm Used:

Step 1: Start.
Step 2: Initialize the system on Arduino Software.
Step 3: The moisture sensor constantly checks moisture
Step 4: The soil moisture sensor checks the soil moisture level constantly.
Step 5: The Wi-Fi Model (ESP) send the value continuously to the server for analysis upcoming sensor value.
Step 6: The sensor constantly senses the moisture and humidity of the field and updates the data in the web server.
Step 7: If the water level reduces the permissible level, the relay which is connected to the ESP8266 will turn on the motor.
Step 8: Similarly, if the soil becomes dry, the motor which is connected to the motor driver will be turned on to wet the field.
Step 9: If the step 8 is completed, it will go to the step 4.
Step 10: Similarly, if the step 7 is over, the command will go to the step 3

VI. RESULT

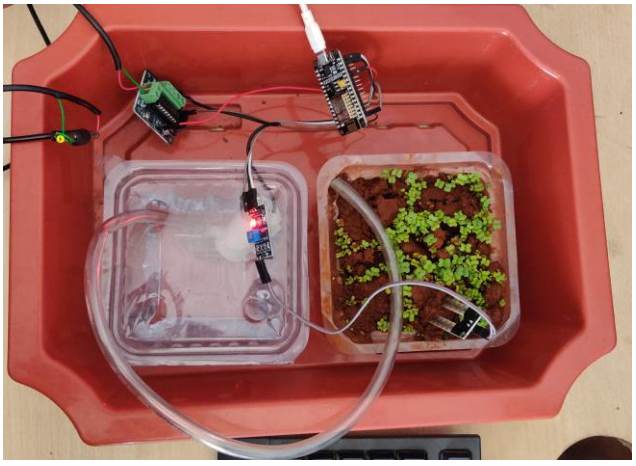

Fig 5. Hardware Model Setup

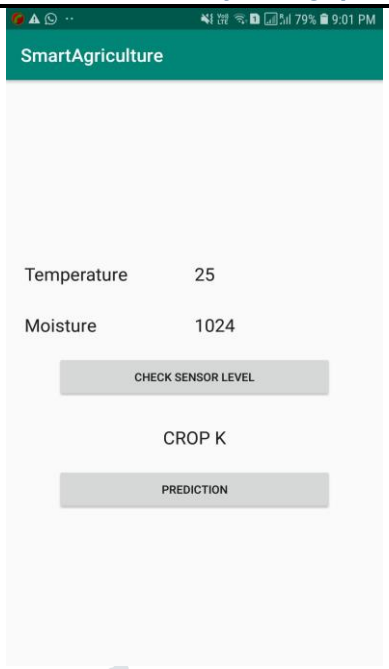

Fig 6. Android Application

VII. ADVANTAGES OF THE SYSTEM

This technology is recommended for efficient automated irrigation systems and it may provide a valuable tool for conserving water planning and irrigation scheduling which is extendable to other similar agricultural crops. Maximum absorption of the water by the plant is ensured by spreading the water uniformly using a water pump. So, there is minimal wastage of water. This system also allows controlling the amount of water delivered to the plants when it is needed based on types of plants by monitoring soil moisture. Also, there is a user-friendly android application to monitor field's data. This project can be used in large agricultural area where human effort needs to be minimized. Many aspects of the system can be customized and fine-tuned through software for a crop requirement.

VIII. CONCLUSION

The proposed system is useful to the farmers. This system is used to sense the moisture by using the sensor which is placed on the field. Moisture can be measured by the Hygrometer. Sensed data will be stored on the server/cloud. ESP8266 is used to make an interface between sensors. The most important thing in this proposed model is that it has Android Interface. The system is provided with an Android Interface which will be user friendly to all of us. Advancements in sensor technology and control systems allow for optimal use of resources. Our aim is to design and develop newer techniques that will allow farm automation to deliver to its full potential. Thus, it can be concluded that the proposed project will be beneficial to the society by adopting the fast-growing Internet of Things and sustainable ways of farming.

IX. FUTURE SCOPE

Our project can be improvised by adding a Web scarper which can predict the weather and water the plants/crops accordingly. If rain is forecasted, less water is let out for the plants. A water meter can be installed to estimate the amount of water used for irrigation and thus giving a cost estimation. Furthermore, Wireless sensors can also be used.

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