Farmers Assistant Innovation and Resolution: Web Server based plant monitoring for smart Irrigation

Pushan Kr. Dutta, Akshay Vinayak, Simran Kumari

Abstract: ***In this study, we propose a simple and efficient, low-cost power controlled embedded system for smart agriculture implementing portable user-driven models for Internet of Things tools and sensors that provides agriculturists ecologically suitable means to use viable resources like pesticides and water in a regulated manner in the farming land. Our recommended work incorporates collection of sensor tools for soil moisture analysis to detect the soil conditions. A water pump is linked to switch on and off automatically based on humidity sensor values. The suggested Farmers Assistant Innovation and Resolution scheme observes environmental features such as soil temperature, humidity, level of light exposed to soil , pH using the Internet of Things and then formulates the respective resolution techniques for soil health measurement and plant growth innovation techniques. This system is more competent as an automatic irrigation system playing its role in irrigation of field. The system is also capable of removing pests if and when necessary with the aid of image processing technique. At the same time, using GSM, the Node MCU forwards message on farmers mobile about pump status. The microcontroller accepts the pump status, soil moisture and relative humidity in the air or enclosed region and provides this information through some kind of data acquisition device. The scheme can be used in a variety of areas by restricting the appropriate voltage including mobile phone charging, access drip irrigation and tracking and irrigation centres for traffic updates.***

***Index Terms*:** Internet of Things (IoT), agriculture, moisture, automatic irrigation, moisture sensor, temperature sensor, PH sensor, light intensity sensor.

I. INTRODUCTION

In India, in view of most of it, agriculture assumes an imperative role in advancing the country as our economy. India ranks second in cultivating output globally. However, with population expansion in urban and semi-urban townships, owing to mismanagement in rainwater harvesting and planning, most groundwater resources have been depleted. Since most of the fresh water supply is to be delivered to families, it is difficult to handle sufficient water supply that will be the critical factor for farming. Because rural households require water, carrying this much water from rivers and water shortage, the government must apply fast-track agro-based automation for irrigation water supply, which would be essential to vindicate the need. With the expansion of rainwater conservation social schemes focused on water conservation and drainage, it has turned out to be vital to manage the use of water using electronic equipment in places where water could not be generated using electrical energy resources. Smart agricultural operation and tools are used to provide control to solve this problemSoil moisture sensor base irrigation system guarantees appropriate soil nutrient level [1] for plant life all through the season. Sensor senses the soil's moisture content in this structure and switches the pump unit on or off accordingly. Sensor of soil moisture is used to locate the soil condition whether the soil is dry or moistIf the soil is dry, the pump motor flushes the water until after the field is wet and the microcontroller repeatedly screens it. The main advantage of the soil humidity sensor is to ensure precise measurements and agriculturalists are not required to visit the farm to operate the pump. In reference to [2], [3], WSN is made possible with the help of built-in ESP8266-NODE MCU microcontroller. This board is used here for its greater cache memory and storage capacity. The board is capable of detection, transmission, and receiving signals and establishing a connection between all the other modules. The former modules are sued for detecting the correct readings by making the use of sensing circuits that are built for this purpose. The circuits that are used here for different purposes are a capacitive temperature sensor (water resistant) for the detection of soil temperature, Light intensity sensor for the number of light plants are exposed to, a Moisture sensor for sensing the amount of moisture content of the soil, and pH sensor [4], [5], for maintaining the pH of soil. In reference to [6], the circuit readings and the pattern of plant growth are recorded with the help of image processing technique and the plant growth is then monitored. The readings and the plant growth are processed [7] and is sent to the receiver module which is capable of displaying it to the interface that makes it easier for the user to know about their plants growth. Phase three then comes to underplay, in reference to [8], the programming is done such that it detects the amount of moisture and checks whether the moisture threshold exceeds the certain pre-defined threshold or not. In reference to [9], [10], on detecting the change in readings, the pump is automatically switched ON by the system and the respective field is irrigated for a certain amount of time and then shut down immediately. It ensures that the amount of time the pump is switched on soil is completely wet and the threshold of moisture goes up. This is the most crucial part of the project where the growth of the plant [4], [11] along with pest control is being monitored and data is analyzed accordingly. Here plants images are clicked from day 1 when the plant was sown. We have used Photometric Image Analysis Method and Lagrange's Mean Interpolation algorithm for the relative growth of the plant. The logbook for images of the plants was used here for analyzing the growth of the plants. This job is a university project application development. We first

Revised Manuscript Received on May 22, 2019.

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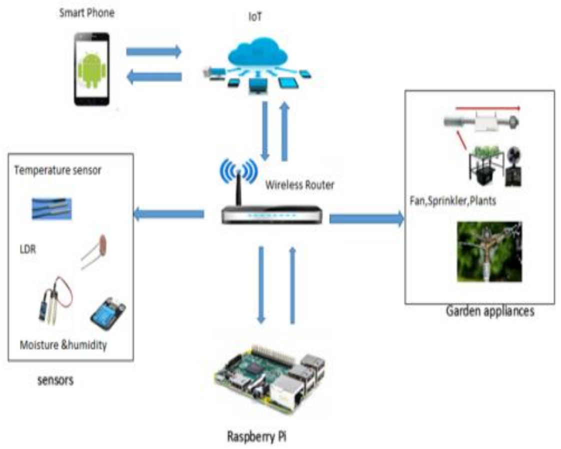
collected all the necessary parts in the recommended job and then used a solar panel to drive a charging battery. Although we showed using electrical efficiency in the intended test, the light-dependent resistors were not connected. After this job, we connected the DWT11 sensor for evaluation in moisture and humidity and the Voice and data relay interfaced with the soil moisture sensor to calculate the output. The Raspberi pi unit was also linked to the arduino in order to achieve serial port data for soil and soil moisture and moisture mapping as shown in fig1.



1.

Fig 1: Schematic Diagram of different parts of the Circuit

The made system keeps the track of plants growth also making it easier for the planters to automatically irrigate the field and also detect the pests if and when necessary. The primary objective of the present project is to provide a novel means of the plantation and help planters reduce their workload. The following functions should be carried out by the smart system: 1. Monitor the amount of soil water available to plants on a continuous basis (this is usually done using a sensing system).

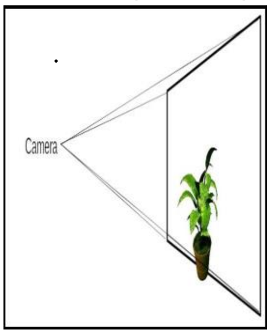


Fig. 2.A. Image of the plant in front of white paper

2.B. Converting into Grayscale image

Figures 2A and 2B tell about the steps taken for image processing, first, the images are snapped with a help of a camera keeping a white background and then the image is converted to a grayscale format then further implementing Photometric Image Analysis the Adaptive Mean Thresholding is taken out and finally, Adaptive Gaussian Thresholding is taken out. After completing these steps, the polarized image is augmented into array format and Lagrange's Mean Interpolation algorithm is applied to the image to find out the growth of the plant. In the same way when all the plants' images are taken and daily analysis is done the non-familiar structural orientation of plants such as eaten leaves, irregular growth etc. are dealt with pest detection and control.

II Related Work

A similar research work was done in a tomato greenhouse on the south of Italy by Mancuso et all [12]. The air temperature, relative humidity and soil temperature are measured using Sensicast devise with wireless sensor network. Web-based application for crop monitoring was also developed. The user of the Greenhouse can read the measurements on the Internet. If some measurable variable rapidly changes, SMS or GPRS will submit an alarm to the owner's mobile phone. In one minute interval, the bridge node gathers data from other sensor nodes to transmit the measurements of temperature and relative humidity. Smart plant monitoring, research was done by Teemu Ahonen et al [13] for a smart farming system (AgriSys) that can analyze and interfere with an environment to maintain its adequacy[14]. The scheme has an inferential rules bank that can be easily upgraded to regulate the agricultural environment. AgriSys primarily focuses on inputs such as temperature, humidity, and pH. The process also addresses habitat-specific problems such as dust, infertile sandy soil, and persistent wind. Bluetooth communication is used to relay sensor records to a adjacent mobile phone[15].

The sensors when operated the output or the data set that we received was uploaded over the server. This was done so that the data related to the growth of the plants can be analyzed from any corner of the world and certain suggestion can be delivered looking into the kind of data we receive for a bunch of plants such that the growth does not alter or modify due to the environmental conditions as shown in figure 3.

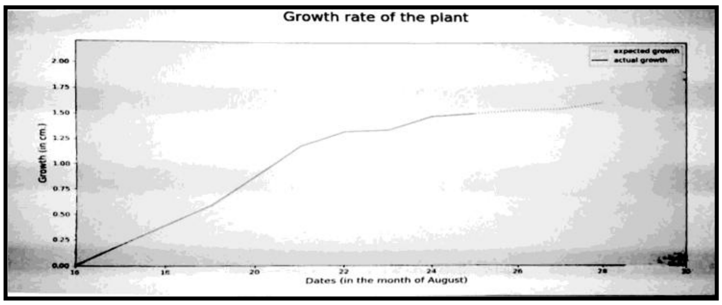


Fig. 4a. A. Before retrieving and receiving the data

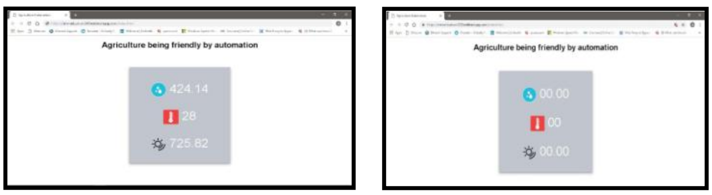


Fig 3: Graph showing the growth of the plant based on dryness

The BT Terminal mobile application was used at the end of the mobile phone to receive device data. A USB power supply is used to power the microcontroller board in the graphic displayed. However, a DC supply consisting of two AAA cells was used during actual field testing. A standby mode built onto STM32 firmware has been used to improve the equipment's power efficiency [16]. In this structure, ground pH, moisture and temperature measurement was presented with Internet of things-based system. Senor designs for pH, moisture and temperature were successfully implemented and also tested for proper functioning. Bluetooth is used to communicate with the

Fig. 4b. A. after retrieving and receiving the data

TM32 the whole system was grated for further precedence in networking. A website is created to upload sensor data into the cloud as shown in figure 4A and figure 4B.

III. IoT based Smart Agriculture Monitoring System

The proposed system makes use of NODE MCU 1.0 (Fig. 5.) which is the microcontroller for this project. For increasing its analog pin outs 16x multiplexer is also added so that more numbers of sensors can be connected on board. The microcontroller is coded that way that it can handle all sensors and will be capable to send data to the server. In addition, for controlling the pump with this microcontroller a relay board is attached to one of the analog pins to obtain the major output of currents so that automatic irrigation is made possible. With that of the help of a Raspberry Pi console, we design plant monitoring and smart gardening system using IoT. With the help of sensors such as humidity sensor, moisture sensor, LDR, temperature sensor interface with the Raspberry Pi board, all parameters of the garden such as temperature, humidity, moisture, light intensity are controlled. We simply attach this system water valve to a hose, making it the simplest watering system ever. It allows switching on or off based on the sensor reading and gives the plant an accurate amount of water they need. This system is also designed to display various charts based on the reading of the sensor and the graph is plotted to monitor the growth of the plant.

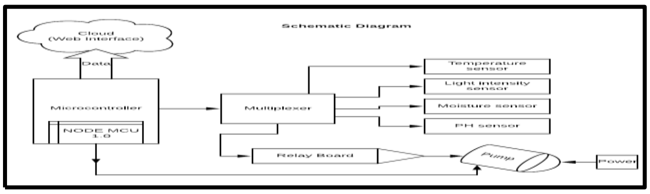


Fig 5: Schematic diagram of the different sensors implemented

Sensor for monitoring soil moisture measures the volumetric current of soil water. Soil moisture sensor indirectly measures the volumetric water content by using some other soil properties, such as electrical resistance, dielectric constant, or neutron interaction, as a proxy for the moisture content. The sensor collects all the data and refreshes the value every 2 minutes. All sensor data are stored and sent to the mobile app as well as to the windows application[17]. There is also regular checking of plant watering which can be done manually or automatically. It integrates Android, Windows, Raspberry Pi, Iot to work together to achieve the goals of the system[18].

The system helps save water, the utility bills, and also achieves the plant's water requirement. The user can also use the application to manually control the water valve. Thus the user can water the plants from anywhere and pour on the plants. Connect directly this system water valve[19] to a hose, making it only the simplest watering system ever.

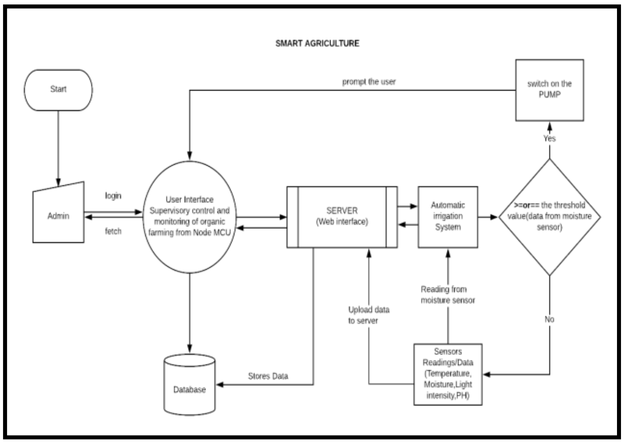


Fig.6:Flowchart of the working of the system.

The sensor collects all the data and every 2 minutes refreshes the value. All sensor data is stored and disseminated to both the mobile app and the windows app. Plant watering is also regularly checked and can be done manually or automatically[20]. It integrates Android, Windows, Raspberry Pi, Iot to collaborate to achieve the system's goals. In future aspects, we can develop a robot with WSN- wireless sensor network, ESP8266 - WIFI shield, NODE MCU- microcontroller with characteristics of Arduino Uno with a greater number of GPIO pins that compares the color of the leaf to an already saved image of the leaf using digital image processing technique to determine if the plant is in good condition or if there is any other nutritional deficiency. This can be further developed by applying Machine learning, and System on chip.

IV. Conclusion

The proposed system helps the user to know about the plant growth, pest organization and detection, automatic irrigation and other environmental factors as well as generate graphs on the data collected from the growth of plants and help improve the growth cycle. Using IoT with the help of the Raspberry Pi controller, plant monitoring and smart gardening will bring more convenience and comfort to the lives of people to take care of their garden. The system is designed with the limitations of low cost. The ESP8266 module employed is considered more efficient and applicable than the Arduino microcontroller because it can be used simultaneously as a Wi-Fi station and access point AP. In this paper, on the justification of the ESP module, three different plant data are multiplexed.

Published By:
Blue Eyes Intelligence Engineering Sciences Publication

On the basis of the Pie webserver, the realized data at three locations are shared and demonstrated in various aspe cts. Due to first-impact automatic and manual control point efforts, the environments of the proposed locations in the worst cases are kept in the desired position.The control action can even be done by the webpag e server's administrator manually. Finally, the cost of design and application based on the ESP8266 Node MCU module is considered to be cheap compared to GSM, that triggers data and SMS messages control efforts.

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