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IoT Based Automatic Plant Watering System Through Soil Moisture Sensing—A Technique to Support Farmer's Cultivation in Rural India

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Abstract : Agriculture and Cultivation of paddy, wheat and vegetables basically takes place in Rural areas where technology isn't available to that extend where this kind of huge production of grains and vegetables can be automated to help farmers. Farmers spend most of their time in the Agriculture field for watering the crop by leaving other works. Hence to help farmers from staying on the field whole day, we came up with a project which senses soil moisture and based on the data this system automatically turns ON the water pump into the field, and when the soil reaches enough moisture level, then water pump automatically gets turned OFF. Hence this concept may provide a long term solution to the farmers for a maintenance free agriculture where farmers don't have to stay on the field breathing toxic chemicalsand spoiling their health. The proposed project also have other features like sensing the Ambient temperature and humidity in the Agricultural field, sensing daylight intensity and rainfall detection on the field. Hence this inexpensive project can provide a solution for many agricultural and health related problems. To implement this project in a ease of access and updated way, we have incorporated IoT platform where the farmer can monitor all these field parameters over internet on their smart phone application. Therefore this could be a milestone in rebuilding the future.

Keywords Nodemcu · DHT11 · IoT · Blynk · Soil moisture · Relay Module

1 .Introduction

The Internet of Things (IoT) has transformed the way we live in this world
. Now we have Smart connected homes, cars, more integrated industries, smart cities, smart villages all these because of IoT systems.
A plant watering system, also known as an automated irrigation system, represents a technological advancement designed to streamline the process of providing water to plants. This innovative solution caters to the diverse needs of plants by automating the irrigation process based on predetermined schedules or real-time environmental conditions. Integrating sensors, such as soil moisture sensors, enables these systems to assess the hydration levels of the soil, ensuring plants receive water precisely when needed. Plant watering systems range from simple setups controlled by timers to sophisticated smart systems that can be remotely monitored and adjusted through web interfaces or mobile applications. With a focus on efficiency and water conservation, these systems contribute to sustainable and resource-conscious gardening practices, promoting healthier plant growth while minimizing water waste.

Our Earth will reach a population of 9.2 billion by 2048. Hence to feed this huge population, the old agricultural practices needs to be combine with IoT [3]. The dramatic change in climate and weather has left a environmental impact on farming, hence smart farming through the use of IoT will help farmers to reduce waste and increase productivity [4–6].

IoT application help farmers to collect data regarding health and condition of their crop [7]. By using internet of things (IoT) and sensors network technology we can control water wastage by adapting green farming methods in irrigation [8].

Every second, the field conditions like soil moisture, rainfall, humidity, temperature and light intensity are sensed and this data is sent to IoT cloud server and will get updated on smart phone of the farmer, so that the farmer can monitor the field without being present on the field [9].

This IoT system will be very helpful in solving a wide range of human related problems in upcoming days [10].

2 System Design

The designed system consists of microcontroller (nodemcu) which has both WiFi and microcontroller capabilities and is a best suit for IoT application projects. The representation of such a system is shown in Fig. 1

The system further consists of bunch of sensors like soil moisture sensor to sense the moisture level in soil, DHT11 sensor for temperature and humidity monitoring, LDR sensor for light intensity and finally a raindrop sensor for rainfall detection. Depending upon the moisture content in soil, AC water pump is switched ON/OFFby a relay which is inturn controlled by NodeMCU. A logic level converter is added because NodeMCU (microcontroller) is a 3.3 V device which cannot drive or receive

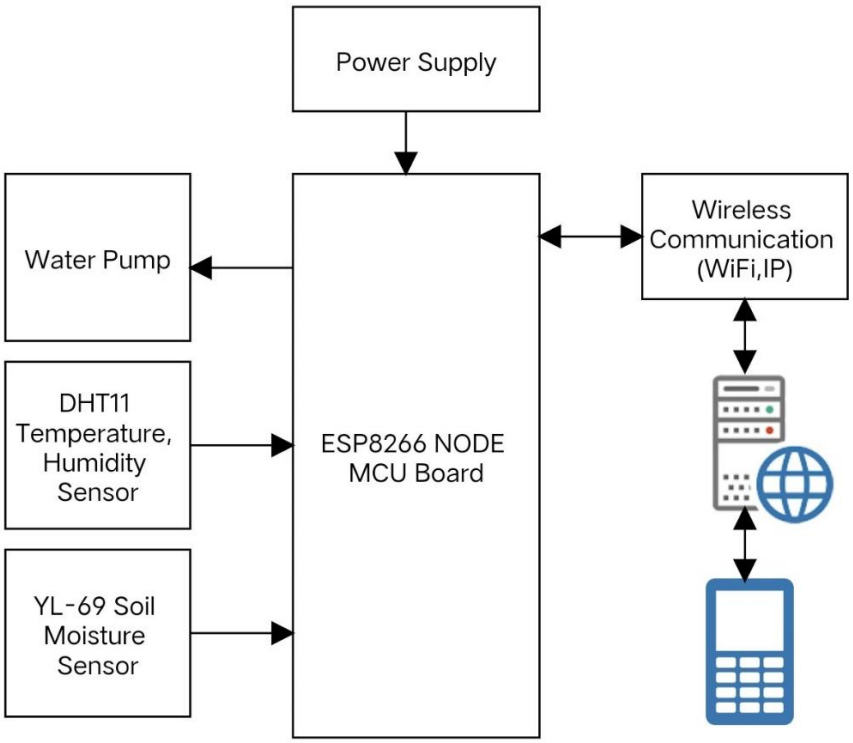

Fig. 1 Block diagram or system design.

3 Hardware Requirements in Implementation of Module

1. **NodeMCU**
2. **Soil Moisture Sensor**
3. **DHT11 Sensor**
4. **Water Pump**
5. **Relay Module**
6. **KA7805 Voltage Regulator**

4. Software Requirements in Implementation

The software used for monitoring sensors data over IoT is based on Blynk IoT Plat- form. It is nothing but an IoT platform with customizable mobile Apps, private cloud, rules engine, and device management analytics dashboard. The Blynk displayed onApp for various conditions of soil moisture, humidity, temperature, rainfall and light intensity are shown in Fig.

Fig. 10 Blynk App display

5. Result

The complete Test set up for Automatic Plant Watering System Through Soil Moisture Sensing is shown in Fig. 11.

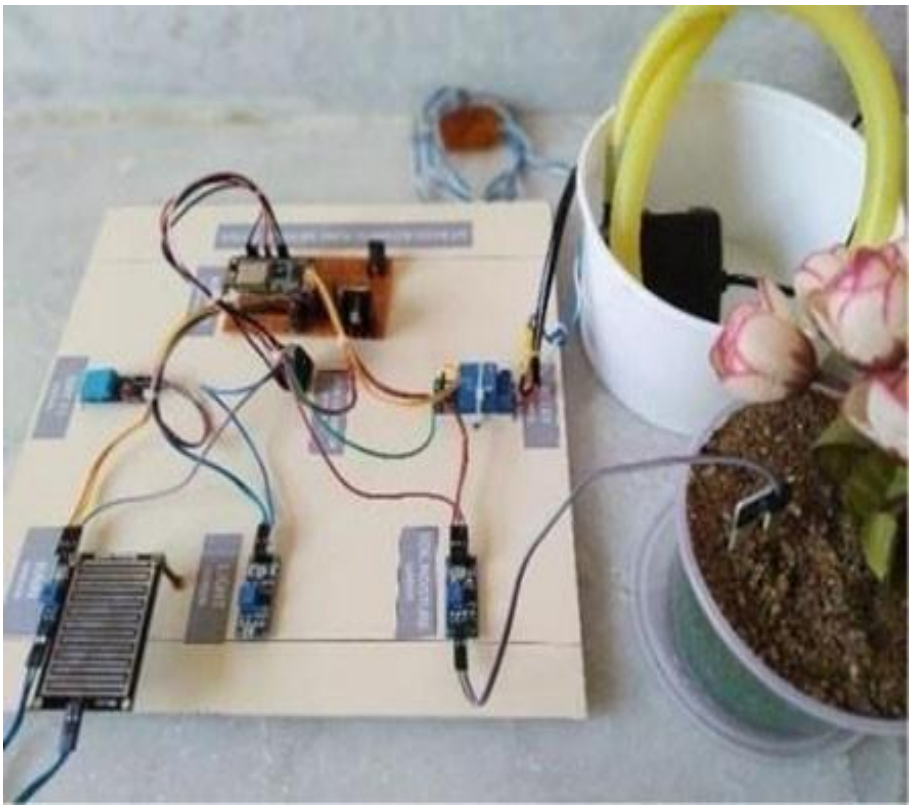

Fig. 11 Setup of the system

. For the project to function over IoT, Nodemcu should be provided with WiFi cre-dentials like SSID and Password to access the cloud server. After powering every- thing, Nodemcu collects data from all sensors. Soil moisture sensor is an active low device which gives a low signal if the soil is wet and a high signal if the soil is dry.We also have a 1 channel relay module interfaced with Nodemcu, which is also an active low device. When the soil in the field gets dried, the soil moisture sensor sends a high signal to Nodemcu, then according to the program. nodemcu gives a low signal to relay which turns it ON. Hence water pump starts pumping water to the fiind . Now when the soil gets enough wet the soil moisture sensor sends a low signal to nodemcu which intern sends a high signal to relay which turns it OFF. Hence water pumping to the field is stopped.All the data from sensors and the status of water pump is sent to the BLYNK cloud server, so that the farmer can monitor it from the Android Application.

4 Conclusions

Thus, IoT based automatic plant watering system has been implemented. NodeMCU collects data from all sensors and uploads to Blynk IoT server. The soil moisture sensor senses the moisture content present in the soil. If the soil is dry it sends a high signal to nodemcu which intern switches ON the water pump via the relay. If the soil gets enough wet then the sensor sends a low signal to Nodemcu, hence the water pump gets turned OFF automatically. Thus the complete system is tested. It is more efficient with affordable cost for implementation in small home gardens and can be extended for large scale cultivation of farmers.

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