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Smart Agriculture and Automated Irrigation System

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Abstract
Agriculture plays a paramount role in development of a country especially in developing nations like India.In India two-third of the country's population rely on agriculture as the source of income and one third of country's national capital comes from agriculture only.Due to large diversity in topographical features of the country , the resources and the factors that contribute towards the agriculture are not even.Apart from this the latest trend in over utilization and contamination of these contributing factors has resulted to deeply ponder on the solution.The solution to this situation what we call as "agriculture crisis" ,revolves around changing the traditional methodologies and employing technology to provide data driven insights.Hence the project aims at making agriculture smart using the Internet of Things and automation.The project can be divided into two parts : A) Soil Moisture Sensor and irrigation actuator B)Temperature sensor and temperature actuator. All the devices can be controlled via any smart device or a computer connected with the node MCU over wifi, the above mentioned components are employed in a greenhouse that enables controlled monitoring of the physical factors.

Introduction

Agriculture plays an important role in a country's development.In India agriculture contributes to 25% of the GDP and is the largest provider of employment in rural India. Even after majorly contributing towards the economy ,the agriculture in India is still primarily dependent on monsoons and the production growth of agriculture is stagnant from the past several years. In order to increase the crop yield and minimize human effort, replacing traditional methods with technologically sounded methods is critical. Most of the papers signify the use of wireless technologies for monitoring the agriculture fields , but monitoring alone does not help in improving the crop yield[1]. This project involves monitoring the physical factors such as soil moisture and temperature in a greenhouse and then controlling these using actuators.This method of sensor based irrigation has recently been employed by the State Government of Goa, India using riverbank filtration technology that is observed to prevent water wastage. The project was implemented by The Energy and Resource Institute in collaboration with NIT,Goa. Thus this project aims to provide appropriate conditions to the crop in a greenhouse by taking necessary measures by ensuring the temperature and soil moisture does not fall or rise above the threshold values by employing IOT and automation[2].

Purpose

The smart agriculture and automated irrigation system ,shows a well established combination of Node MCU,breadboard,soil moisture sensor ,relay1,submersible water pump ,temperature sensor ,fan ,relay2 and their interconnection. The system has been designed to achieve the following :

1)Increase the crop yield
2)Reduce manpower
3)reduce water wastage
4)To effectively monitor the agriculture field

System Overview:

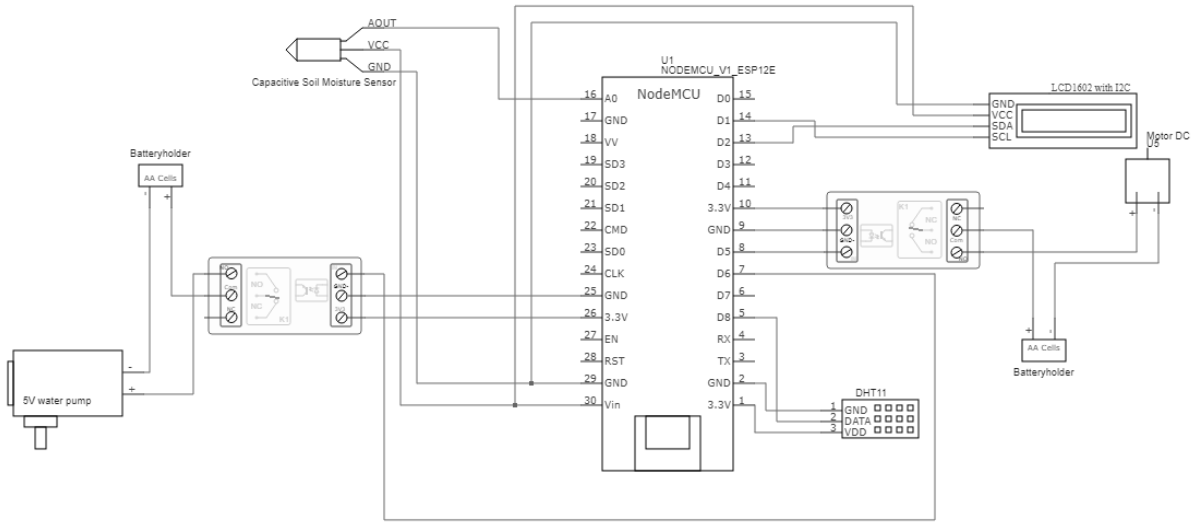

Figure 1: Circuit Diagram

This project consists of 3 Modules namely Module 1-Automated irrigation module, Module 2-Automated Temperature and Humidity control module and Module 3-Led display module[3].
In this system, each node is integrated with the respective sensor that provide a specific functionality to each module. Each sensor senses a parameter and sends it to the NodeMCU. The NodeMCU takes an appropriate action as per the program designed for the purpose. The action consists of sending signals to the actuators/relays to switch ON/OFF the water pump or fan motor for which the threshold values are exceeded.
The system operates in two modes- Automatic Mode and Manual Mode.
In automatic mode,the system takes its own decision depending on the critical values taken.In Manual mode, the user can control the operation under the situation of maintenance.
#Node MCU refer

Working

Module 1: Automated Irrigation Module - consists of NodeMCU, soil moisture sensor, pump relay, pump and Battery[4]

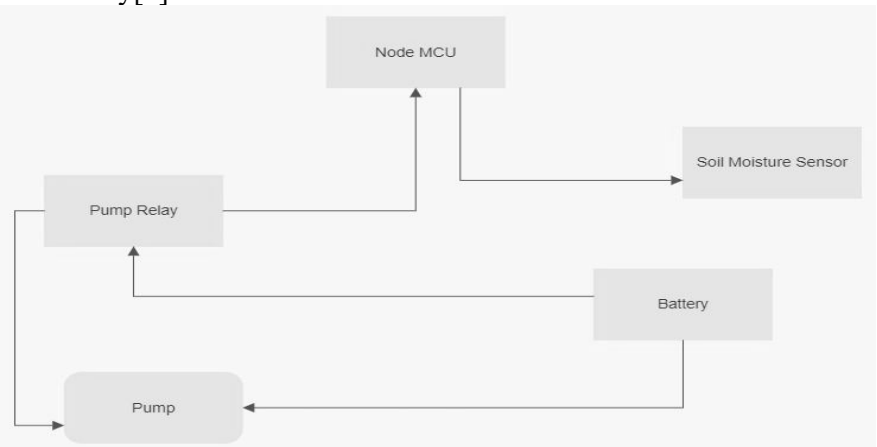

Fig 14:Module 1 Block Diagram

Working- When the soil moisture falls the critical value that is not suitable for the crop, the NodeMCU sends the signals to the pump relay to switch ON the pump and start irrigating the

field.When the optimum level of moisture is attained, the soil moisture sensor send signals to NodeMCU which inturn makes the pump relay to switch OFF the pump.

Module 2: Automated Temperature and Humidity Control module- consists of NodeMCU, DHT sensor, Fan relay, Fan Motor and Battery

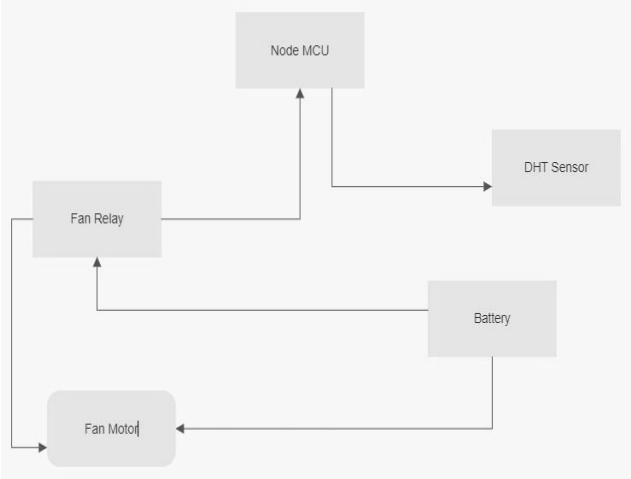

Fig 15:Module 2 Block Diagram

Working- When the Humidity and/or temperature content rises above a critical value inside the Greenhouse, the DHT sensor sends signal to NodeMCU to switch ON the fan Motor.When an optimum level of Humidity and temperature is achieved, the sensor sends the signal to NodeMCU to switch OFF the fan[5].

Module 3: LED Display Module- consists of NodeMCU and LED Display

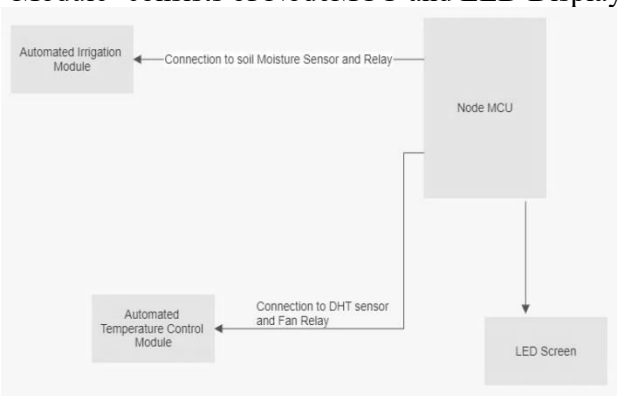

Fig 16:Module 3 Block Diagram

Working: All the inputs from Module 1 and Module 2 are sends to LEC screen/ Computer Application via NodeMCU for continuous monitoring and displaying the consequent temperature and relative humidity(of air and soil both)[6].

Experimentation and result

The system is being tested for brown forest soil under dry and wet conditions. The entire setup has been divided into 2 major areas of focus – Irrigation monitoring and control setup and temperature monitoring and control setup.

Firstly, under irrigation the soil moisture sensor which is capacitive in nature is connected to Node MCU which is placed on breadboard and further connected with DHT sensor. Once the program is started, we receive signals from soil moisture sensors , therefore comparing the values from the moisture sensor with the desired set. In our setup, it consists of a generic model and value set can be altered depending upon the crop being used. If the recorded value lies below the threshold it indicates the relay to turn on the submersible water pump and hence water the soil

and crops. Similarly, if the levels are moving above the desired threshold , the relay stops hence motor remains off and no water is supplied to the crops.
Secondly, when it comes to soil temperature sensor which has a more durable sealed shell structure ensuring that it works even when buried deep underground. In this project thermocouples and thermistors both can be used contact based temperature sensor. When placed in our greenhouse setup, the temperature difference within setup causes a voltage which is henceforth converted into temperature readings and then compared with our threshold set of values. If the temperature falls above our desired values, the relay is activated, completes a circuit , allowing electric current to flow through it and hence the fan connected to it starts rotating thus cooling the entire greenhouse setup. They can be used for recording a temperature ranging from as high as 3000◦ C to as low as -250◦ C.

Conclusion and Future Scope

With the advent of IoT, we added latest technology-based sensors for greater crop production by assembling current real time requirement values of our desired crop and eventually reducing the manual work done by farmers. Temperature and moisture sensors are majorly used here for monitoring and tracking. This could be tracked and regulated by a smart agriculture device based on IoT. Thus, the IoT based smart agriculture and automated irrigation system is very useful in reducing manual work and also giving accurate result by proper utilization of resources. Hence, we conclude, with the usage of sensors high accuracy water supply is provided thus avoiding water from wastage. It can also accurately determine soil moisture and temperature levels to produce good quality crops and improves economic conditions.
As per future perspective, this system can be formulated with extra features like predicting user actions, stating nutrient level of crops, harvesting time etc. All this can be done with the introduction of machine learning algorithms in our project. Hence, it can not only improve yield of crop but also overall production.

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