RESEARCH PAPER ON SMART FARMING USING IOT

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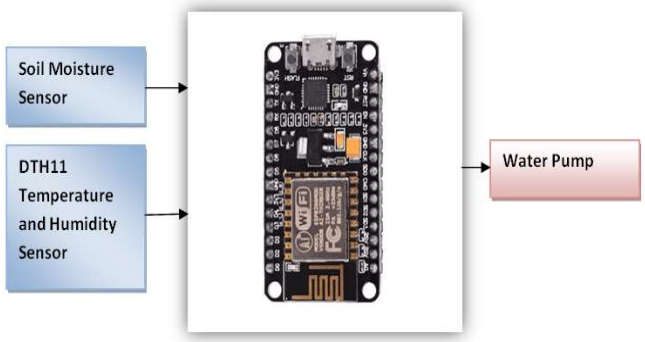
Abstract –

Most of the farmers use large portions of farming land and it becomes very difficult to reach and track each corner of large lands. Sometime there is a possibility of uneven water sprinkles. This result in the bad quality crops which further leads to financial losses. In this scenario the Smart Irrigation System using Latest Iot Technologies helpful and leads to ease of farming.
The **Smart agriculture System** has wide scope to automate the complete irrigation system. Here I am building a **IoT based Irrigation System** using ESP8266 NodeMCU Module and DHT11 Sensor. It will not only automatically irrigate the water based on the moisture level in the soil but also send the Data to ThingSpeak Server to keep track of the land condition. The System will consist a water pump which will be used to sprinkle water on the land depending upon the land environmental condition such as Moisture, Temperature and Humidity.

Key Words: Internet of Things (IOT), NodeMCU, Smart Agriculture using IOT, Arduino, Soil Moisture Sensor, Water level Sensor, Temperature Sensor, Humidity Sensor, Thingspeak.

1. INTRODUCTION –

Smart Agriculture developing model is a real time monitoring system. It monitor the soil properties like temperature, humidity soil moisture PH etc. It is possible to control many operations of the field remotely from anywhere, anytime by IOT. It offers a futuristic way of life in which an individual gets to control his electronic devices using a smart phone, it also offers an efficient use of energy. It applied in all areas of industry, including smart agriculture, smart parking, smart building environmental monitoring, healthcare transportation and many more. The goal of smart agriculture research is to ground a decision making support system for farm management. Smart farming deems it necessary to address the issues of population growth, climate change and labor that has gained a lot of technological attention, from planting and watering of crops to health and harvesting



1.1 Problem Statement –

To provide efficient decision support system using wireless sensor network which

handle different activities of farm and gives useful information related to field to farmer

1.2 Definition-

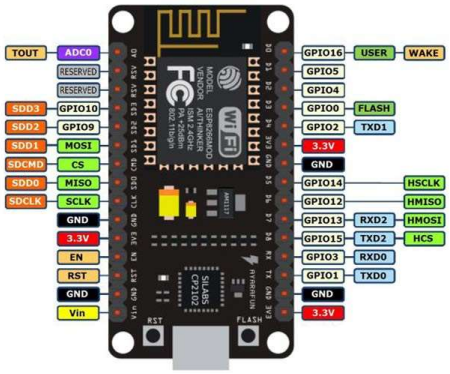
Smart Agriculture IoT
Smart Farming Based Agriculture IoT is regarded as IoT gadget focusing on Live Monitoring of Environmental data in terms of Temperature, Moisture and other types depending on the sensors integrated with it. Agricultural IoT provides the the stick on the field and getting Live Data feeds on various devices like Smart Phones, Tablets etc. and the data generated via sensors can be easily shared and viewed by agriculture consultants anywhere remotely via Cloud Computing technology integration. IoT also enables analysis of various sorts of data via Big Data Analytics from time to time.

2. Components

In this section various components i.e, modules, Sensors used for Smart Farming using IoT are discussed

2.1 NodeMCU :

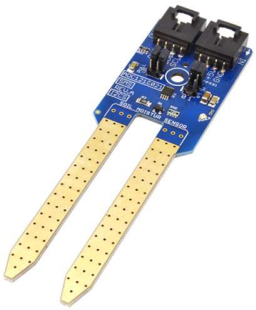
NodeMCU is an open source firmware for which open source prototyping board designs are available. The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).[8] The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kits
NodeMCU is an open-source Lua based firmware and **development board** specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.



2.2 Soil Moisture Sensor Module :

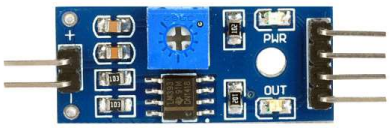
Soil Moisture Sensor is used for measuring the moisture in soil and similar materials. The sensor has two large exposed pads which functions as probes for the sensor, together acting as a variable resistor. The moisture level of the soil is detected by this sensor. When the water level is low in the soil, the analog voltage will be low and this analog voltage keeps increasing as the conductivity between the electrodes in the soil changes. This sensor can be used for watering a flower plant or any other plants requires automation

Soil moisture sensors measure the volumetric water content in soil. A small charge is placed on the electrodes and electrical **resistance** through the sensor is measured. As water is used by plants or as the soil moisture decreases, water is drawn from the sensor and resistance increases. Conversely, as soil moisture increases, resistance decreases.



2.3 LM393 Driver :

The LM393 is a **dual independent accuracy voltage integrated circuit operated with single or else split supply**. These ICs comprises two independent voltage comparators to operate from an only power supply more than a wide variety of voltages. The LM393 series are dual independent precision voltage comparators capable of single or split supply operation. These devices are designed to permit a common mode range-to-ground level with single supply operation. Input offset voltage specifications as low as 2.0 mV make this device an excellent selection for many applications in consumer automotive and industrial electronics.



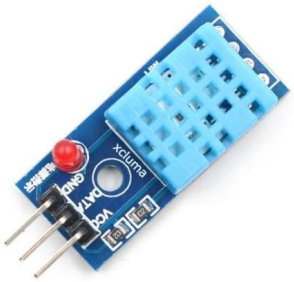
2.4Water Pump Module :

The water pump can be defined as a pump which uses the principles like mechanical as well as hydraulic throughout a piping system and to make sufficient force for its future use. They have been approximately in one structure otherwise another because of early civilization. At present these pumps are utilized within a wide range of housing, farming, municipal, and manufacturing applications. The DC Water pump module is highly used with 12V power supply. It is a fully submersible water pump having lot of applications as water outlet, soda drink outlet, project work and science model applications. The working principle of a water pump mainly depends upon the **positive displacement principle** as well as kinetic energy to push the water. These pumps use AC power otherwise DC power for energizing the motor of the water pump whereas others can be energized other kinds of drivers like gasoline engines otherwise diesel.

2.5DHT11 :

The DHT11 is a **basic, ultra low-cost digital temperature and humidity sensor**. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed).

These sensors are very basic and slow, but are great for hobbyists who want to do some basic data logging. The DHT sensors are made of two parts, a capacitive humidity sensor and a thermistor. There is also a very basic chip inside that does some analog to digital conversion and spits out a digital signal with the temperature and humidity. The digital signal is fairly easy to read using any microcontroller.

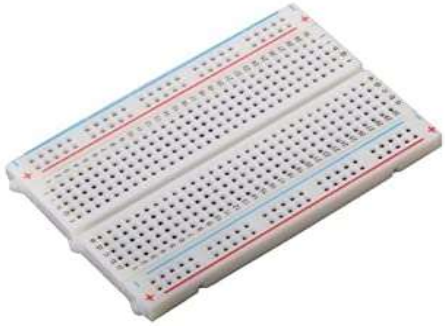


2.6 Relay Module :

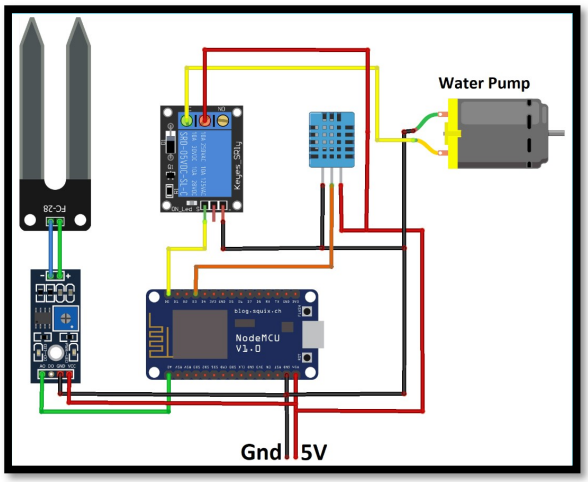
Relays are switches that open and close circuits electromechanically or electronically. Relays **control one electrical circuit by opening and closing contacts in another circuit**. When a relay contact is normally open (NO), there is an open contact when the relay is not energized. A power relay module is an electrical switch that is operated by an electromagnet. The electromagnet is activated by a separate low-power signal from a micro controller. When activated, the electromagnet pulls to either open or close an electrical circuit.
A simple relay consists of wire coil wrapped around a soft iron core, or solenoid, an iron yoke that delivers a low reluctance path for magnetic flux, a movable iron armature and one or more sets of contacts. The movable armature is hinged to the yoke and linked to one or more set of the moving contacts. Held in place by a spring, the armature leaves a gap in the magnetic circuit when the relay is de-energized. While in this position, one of the two sets of contacts is closed while the other set remains open.

2.7 BreadBoard

A **breadboard**, or protoboard, is a construction base
for prototyping of electronics. Originally the word referred to a literal bread board, a polished piece of wood used when slicing bread.In the 1970s the **solderless breadboard** (a.k.a. **plugboard**, a terminal array board) became available and nowadays the term "breadboard" is commonly used to refer to these. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design



3. Circuit Description



IoT based Smart Agriculture incorporates NodeMCU unit that provides base for live monitoring of temperature and humidity and soil moisture level and sends the data to cloud.

Soil Moisture Sensor works on the resistance changing principle. It has two large pads as probes for the Soil Moisture sensing and also acts as a variable resistor. When water level is low in soil, conductivity is less between the pads and resistance is higher. When water level is high in soil, conductivity is high between the pads and resistance is low and provides higher signal out.

The following formula shows to calculate the Temperature:

```
Temperature = ((HighByte <<8) + LowByte) * 0.0625
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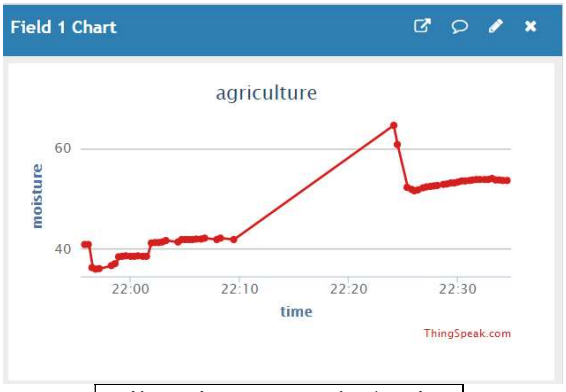
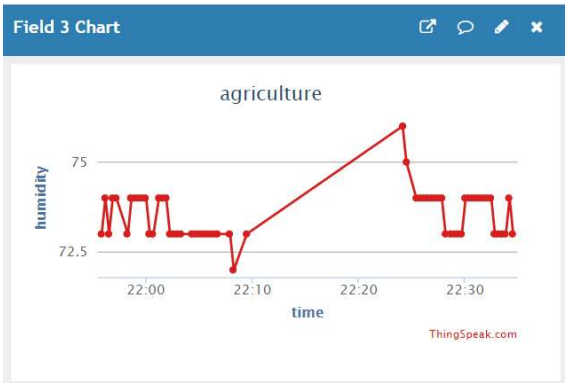
All the data collected from the sensors are stored in Thingspeak website in the form of graphs. I have created three fields in Thingspeak where first field stores Moisture level of soil, second graph stores information of the Temperature wrt time, the third field stores the information of humidity wrt time.



Soil Moisture Level v/s Time

Temperature v/s Time



Humidity v/s Time

3.2 The growth of IoT based adoption in Agriculture sector from Year 2000-2016 and Forecasts of year 2035-2050. (Reference : Smart Farming: IoT Based Smart Sensors Agriculture Stick for Live Temprature and Moisture Monitoring using Arduino, Cloud Computing & Solar Technology by Anand Nayyar)

Year	Data Analysis
2000	525 Million Farms connected to IOT
2016	540 Million Farms till Date are connected to IoT
2035	780 Millions farms would be connected to IoT
2050	2 Billion Farms are likely to be connected to IoT

4. Applications

This technology is an efficient automated irrigation systems and it is a valuable tool for conserving water planning and irrigation scheduling which is extendable to other similar agricultural crops. Moisture level of the soil is measured. So that, we can provide water as per requirement of the soil .It prevents water clogging of soil. Valves are controlled in our system. Therefore labor is not required for valve controlling. The message is sent to users mobile so he can understand the moisture level and user can handle the situation at distant location. All the data is recorded so it would be easy to understand the condition of soil and improve it with respect to that.

4.1 Future Development

Smart Greenhouses A smart greenhouse designed with the help of IoT intelligently monitors as well as controls the climate, eliminating the need for manual intervention.
Intruder Sensor Adding of sensors to the border of the farms can detect the animals entering the farms and with the help of buzzer the farmer are made alert.
Agricultural Drones Agriculture is one of the major verticals to incorporate both ground-based and aerial drones for crop health assessment, irrigation, crop monitoring, crop spraying, planting, soil and field analysis and other spheres.

5. Conclusion

The proposed approach of smart garden monitoring is based upon NodeMCU microcontroller, Data Recording, and the internet of things. It provides real-time statistics of farm environmental factors, so the local users and farmers are able to treat their plants in a well manner. Soil temperature, moisture, and relative humidity are considered environmental factors. The result is stored in the form of graph in Thingspeak website. This approach can remedy the problems of gardening that are faced in urban areas due to lack of farmers.