# A MAJOR PROJECT ON IOT based smart agriculture system

A Project Work Submitted in partial fulfilment of

requirement For the award of degree of

**BACHELOR OF TECHNOLOGY**

**IN**

**ELECTRICAL ENGINEERING**


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# SELF DECLARATION

We hereby declare that the work is being presented in the minor project entitled "**IOT BASED SMART AGRICULTRE SYSTEM**", submitted in the **Department of Electrical Engineering ,Faculty of Engineering and Technology , Gurukula Kangri vishwavidalya, Haridwar** is an authentic record of my own work carried out during the period of minor under the guidance of **Mr. Gajendra singh Rawat ,Department of Electrical Engineering** in Partial fulfillment of the requirement of degree of **Bachelor of technology , Faculty of Engineering and Technology , Gurukula Kangri vishwavidalya, Haridwar.**

The matter presented in this discussion has not been submitted by me in anyway for the award of any degree or to any other institute .

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## CERTIFICATE

This is to certify that the minor project report entitled "**IOT BASED SMART AGRICULTRE SYSTEM**", **"** submitted by **Akash meena, Ashish meena** , **Vikash Bachelor of Technology** in **Electrical Engineering**, **Faculty of Engineering and Technology, Gurukula Kangri Vishwavidalaya Haridwar** is an original work carried out under the guidance of **Mr. Gajendra Singh Rawat.** The matter embodied in this minor project report has not been submitted elsewhere.

**Under the guidance of**

**Mr. Gajendra Singh Rawat**

Head of Department Electrical Engineering

## ACKNOWLEDGMENT

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**Akash meena**

**Ashish Meena**

**Vikash**


## Abstract


Internet of Things (IoT) technology has brought revolution to each and every field of common man's life by making everything smart and intelligent. IoT refers to a network of things which make a self-configuring network. The development of Intelligent Smart Farming IoT based devices is day by day turning the face of agriculture production by not only enhancing it but also making it cost-effective and reducing wastage. The aim / objective of this report is to propose IoT based Smart Farming System assisting farmers in getting Live Data (Temperature, Soil Moisture) for efficient environment monitoring which will enable them to increase their overall yield and quality of products. The IoT based Smart Farming System being proposed via this report is integrated with Arduino Technology mixed with different Sensors and a Wi-Fi module producing live data feed that can be obtained online from Thingsspeak.com. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98% in data feeds.


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# . CHAPTER I: INTRODUCTION

## 1.1 OVERVIEW

The objectives of this report is to proposed IoT based Smart Farming System which will enable farmers to have live data of soil moisture environment temperature at very low cost so that live monitoring can be done.

The structure of the report is as follows: chapter I will cover over of overview of IoT Technology and agriculture-concepts and definition, IOT enabling technologies, IOT application in agriculture, benefits of IOT in agriculture and IOT and agriculture current scenario and future forecasts. Chapter II will cover definition of IOT based smart farming system , the components and modules used in it and working principal of it. Chapter III will cover algorithm and flowchart of the overall process carried out in the system and its final graphical output .chapter IV consist of conclusion, future scope and references.

## 1.2 IOT TECHNOLOGY AND AGRICULTURE

### 1.2.1 IOT: CONCEPT AND DEFINITION

Internet of things IOT consists of two words Internet and Things .The term things in IOT refers to various IOT devices having unique identities and have capabilities to perform remote sensing , actuating and live monitoring of certain sort of data.IOT devices are also enable to have live exchange of data with other connected devices and application either directly or indirectly , or collected data from other devices and process the data and send the data to various servers. The other term internet is define as Global communication Network connecting Trillions of computers across the planets enabling sharing of information .Thus the IOT can be define as :"A dynamic Global Network Infrastructure with self configuring capabilities based on standard and inter operable communication to protocol where physical and virtual things have identities, physical attributes ,and virtual personalities and use intelligent interfaces and are seamlessly integrated into the information network ,often communicate data associated with user and their environment."

An ideal IoT device consists of various interfaces for making connectivity to other devices which can either be wired or wireless.

Any IoT based device consists of following components:

1. I/O interface for sensors
2. Interface for connecting to internet.
3. Interface for memory and storage
4. Interface for audio/video

IoT devices can be of various forms like wearable sensors, smart watches, IoT smart home monitoring, IoT intelligent transport systems, IoT smart health devices etc.

### 1.2.2 IOT ENABLING TECHNOLOGIES

Internet of Things has a strong backbone of various enabling technologies- Wireless Sensor Networks, Cloud Computing, Big Data, Embedded Systems, Security Protocols and Architectures, Protocols enabling communication, web services, Internet and Search Engines.

**Wireless Sensor Network (WSN):** It consists of various sensors/nodes which are integrated together to monitor various sorts of data.

**Cloud Computing :** Cloud Computing also known as on-demand computing is a type of Internet based computing which provides shared processing resources and data to computers and other devices on demand. It can be in various forms like IaaS, PaaS, SaaS, DaaS etc.

Big Data Analytics: Big data analytics is the process of examining large data sets containing various forms of data types—i.e. Big Data – to uncover hidden patterns, unknown correlations, market trends, customer preferences and other useful business information.

**Communication Protocols**: They form the backbone of IoT systems to enable connectivity and coupling to applications and these protocols facilitate exchange of data over the network as these protocols enable data exchange formats, data encoding and addressing.

**Embedded Systems:** It is a sort of computer system which consists of both hardware and software to perform specific tasks. It includes microprocessor/microcontroller, RAM/ROM, networking components, I/O units and storage devices.

### 1.2.3 IOT APPLICATIONS IN AGRICULTURE

With the adoption of IoT in various areas like Industry, Homes and even Cities, huge potential is seen to make everything Intelligent and Smart. Even the Agricultural sector is also adopting IoT technology these days and this in turn has led to the development of "*AGRICULTURAL Internet of Things (IoT)"*
**Table 1.1** Various projects and applications are integrated in Agricultural fields leading to efficient management and controlling of various activities.

| Application Name | Description |
|---|---|

| | |
|---|---|
| Crop Water Management | In order to perform agriculture activities in inefficient manner, adequate water is essential. Agriculture IoT is integrated with Web Map Service (WMS) and Sensor Observation Service (SOS) to ensure proper water management for irrigation and in turn reduces water wastage. |
| Precision Agriculture | High accuracy is required is required in terms of weather information which reduces the chances of crop damage.<br>Agriculture IoT ensures timely delivery of real time data in terms of weather forecasting, quality of soil, cost of labour and much more to farmer. |
| Integraratted Pest Management or Control (IPM/C) | Agriculture IoT systems assures farmers with accurate environmental data via proper live data monitoring of temperature , moisture, plant growth and level of pests so that proper care can be taken during production |
| Food Production & Safety | Agriculture IoT system accurately monitors various parameters like warehouse temperature, shipping transportation management system and also integrates cloud based recording systems. |
| Other Projects Implemented Till Date | 1. The Phenonet Project by Open IoT.<br>2. CLASS Equipment<br>3. Precisionhalk's UAV Sensor Platform<br>4. Cleangrow's Carbon Nanotube Probe<br>5. Temputech's Wireless Sensor Monitoring . |

## 1. 2. 4. BENEFITS OF IOT IN AGRICULTURE

The following are the benefits of IoT in Agriculture:

1. IoT enables easy collection and management of tons of data collected from sensors and with integration of cloud computing services like Agriculture fields maps, cloud storage etc., data can be accessed live from anywhere and everywhere enabling live monitoring and end to end connectivity among all the parties concerned.

2. IoT is regarded as key component for Smart Farming as with accurate sensors and smart equipment's, farmers can increase the food production by 70% till year 2050 as depicted by experts.

3. With IoT productions costs can be reduced to a remarkable level which will in turn increase profitability and sustainability.
4. With IoT, efficiency level would be increased in terms of usage of Soil, Water, Fertilizers, Pesticides etc.

5. With IoT, various factors would also lead to the protection of environment.

### 1.2.5 IOT AND AGRICULTURE CURRENT SCENARIO AND FUTURE FORECASTS

**Table 1.2**. Shows the growth of IoT based adoption in Agriculture sector from Year 2000-2016 and Forecasts of year 2035-2050.

| Year | Data Analysis |
|---|---|
| **2000** | **525 Million Farms connected to IoT** |
| **2016** | **540 Million Farms till Date are connected to IoT** |
| **2035** | **780 Million Farms would be connected to IoT** |
| **2050** | **2 Billion Farms are likely to be connected to IoT** |

# CHAPTER II: OVERVIEW OF THE PROJECT

## 2.1 DEFINITION IOT BASED SMART FARMING SYSTEM

**IoT based SMART FARMING SYSTEM** 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. The system provides the concept of "Plug & Sense" in which farmers can directly implement smart farming by as such putting the System 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. The system also enables analysis of various sorts of data via Big Data Analytics from time to time.

## 2.2 COMPONENTS AND MODULES

In this section, various components and Modules being used for **IoT based SMART FARMING SYSTEM** development is discussed:

### 2.2.1 ARDUINO UNO

The Arduino Uno is a microcontroller board based on the ATmega328(datasheet).It has 14 digital input/output pins(of which 6 can be used as PWM outputs),6 analog inputs, a 16 MHz crystal oscillator, a USB connection ,a power jack, an ICSP header , and a reset button**.**

**Figure 2.1 ARDUINO UNO**

### 2.2.2 WIFI MODULE-ESP 8266

ESP8266 Wi-Fi Module is SOC with TCP/IP protocol stack integrated which facilitates any microcontroller to access Wi-Fi network. ESP8266 module is cost effective module and supports APSD for VOIP Applications and Bluetooth co-existence interfaces. Technical Specifications: 802.11b/g/n; Wi-Fi Direct, 1MB Flash Memory, SDIO 1.1/2.0, SPI, UART, Standby Power Consumption of <1.0mW.


**Figure 2.2 WIFI MODULE-ESP 8266**

### 2.2.3. SENSORS

#### 2.2.3.1. TEMPERATURE SENSOR-DS18B20

The DS18B20 temperature sensor provides 9-bit to 12-bit Celsius temperature measurements and has alarm function with non-volatile user-programmable upper and lower trigger points. The DS18B20 has 64-bit serial code which allows multiple DS18B20s to function on same 1-wire bus.
Technical Specifications: Unique 1-Wire Interface; Measures Temperature from -55$^{o}$C TO +125$^{o}$C; Coverts temperature to 12-bit digital word in 750ms.

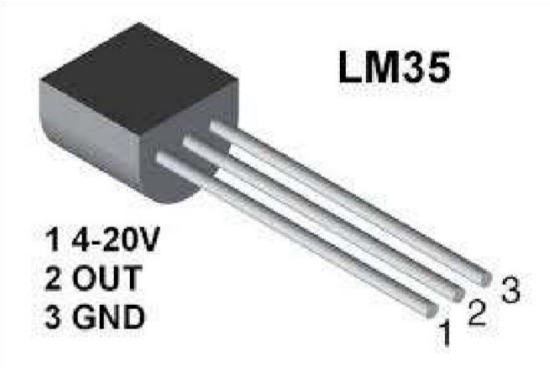


**Figure 2.3 TEMPERATURE SENSOR-DS18B20**

### 2.2.3.2 SOIL MOISTURE SENSOR-FC 28

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.

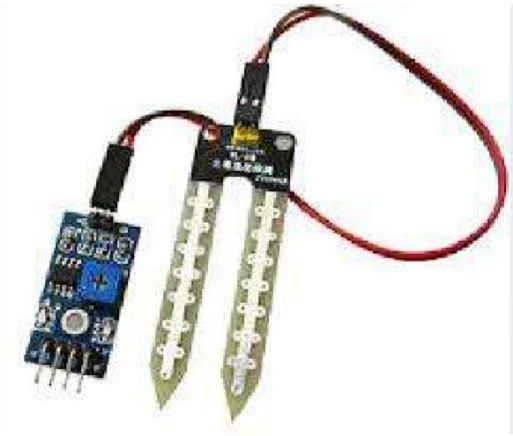

**Figure 2.4 SOIL MOISTURE SENSOR-FC28**

### 2.2.3.3 PASSIVE INFRARRED SENSORS

All objects with a temperature above absolute zero emit heat energy in the form of radiation. It is invisible to the human eye since it radiates infrared wavelengths. PIR sensors don't detect or measure heat, instead they detect the infrared radiation emitted or reflected from an object. It is used to detect the movement of people, animals or other objects. They are commonly used in burglar alarms and automatically activated

lighting systems. When a human passes in the field, the temperature at that point will rise from room temperature. The sensor converts the resulting change into a change in the output voltage and this triggers the detection.


**Figure 2.5 PIR SENSOR**

### 2.2.4 POWER SUPPLY

#### 2.2.4.1. RECHARGEABLE BATTERY

The sealed lead-acid (SLA) 12V, 9Ah rechargeable battery is rated at a 5-hour (0.2) and 20-hour (0.05C) discharge. Longer discharge times produce higher capacity readings because of lower losses. The lead-acid performs well on high load currents. This battery act as an internal power supply for the whole circuit.

**Figure 2.5 Rechargeable Battery**

### 2.2.4.2 BATTERY CHARGING CIRCUIT WITH TRANSFORMER

The circuit acts as a 12 volt battery charger for Lead Acid battery. It gives 12 volt and 5 Amps current for quick charging of the battery. If the battery is partially discharged, full charge will be attained in one hour. The circuit is connected with a 0-14 volt 5 Ampere Step down transformer to convert AC to DC. Since pulsed DC is good for Lead Acid battery, a low value smoothing capacitor is used in the circuit .In the circuit, LED act as the Charger on status.

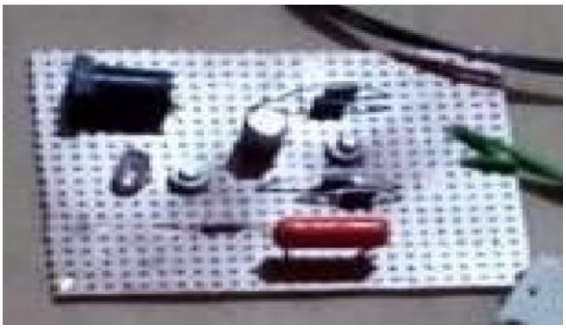

**Figure 2.6 Battery charging circuit**

**Figure 2.7 Transformer**

### 2.2.4.3 EXTERNAL AC ADAPTER

A 12V AC adapter can also be considered as a component in the circuit for external power supply for the circuit which enabled the circuit to be switched ‘ON’ in case if the battery power is very low for use.

The adapter can directly act as an AC/DC convertor to provide pure DC current externally to the circuit.


**Figure 2.8 External AC Adapter**

## 2.3 CIRCUIT DESCRIPTION & WORKING PRINCIPAL

In this circuit there is a programmed ARDUINO which is connected with sensors(soil moisture and temperature)and a wifi module .The working principal of the model based on storing data from the sensors with the help of ARDUINO and passing it to wifi module .The wifi module gives the updates of data in a device through cloud computing. In the device the real time data comes through wifi to the channel named SMART FARMING which we can access through the URL :https//:thingspeaks.com/channels/625454.In the channel the graph is plotted through mat lab technology .There is a chargeable battery which connected with the power supply of ARDUINO so that the circuit start working. There is also charging circuit with AC/DC converter for charging battery .In the case if the battery is not charged there further an adaptor which can explicitly gives power to ARDUINO circuits.

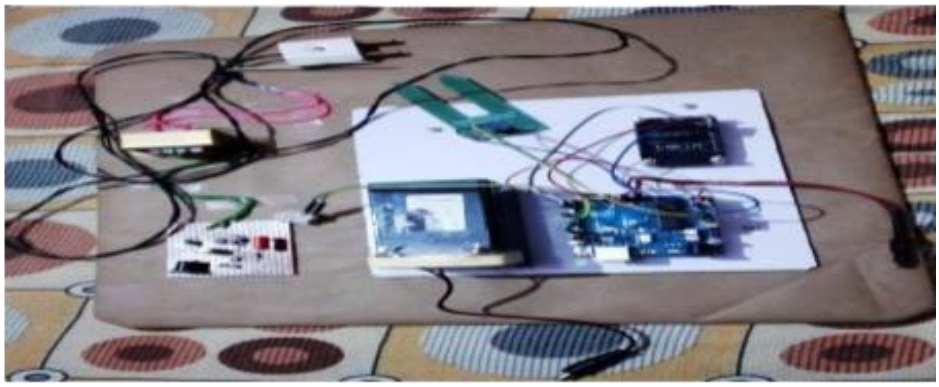

Figure 2.9 Overall circuit design

# 3. CHAPTER-III: ALGORITHMS & FLOWCHART & OUTPUT GRAPHS

## 3.1 ALOGORITHM

THE ALGORITHM OF OVERALL PROCESS**:-**

STEP 1: START THE PROCESS

STEP 2: CONNECTED TO WIFI

STEP 3: READ TEMERATURE AND HUMIDITY

STEP 4: GET TEMPERATURE AND HUMIDITY VALUE S FROM ANOLOG PINS

STEP 5: SEND DATA TO THINGSPEAK API

STEP 6: DELAY TO 10 SECONDS

STEP 7: REPEAT STEP 4, 5 & 6 UNTIL THE PROCESS END

STEP 8: END

### 3.2 FLOW CHART :

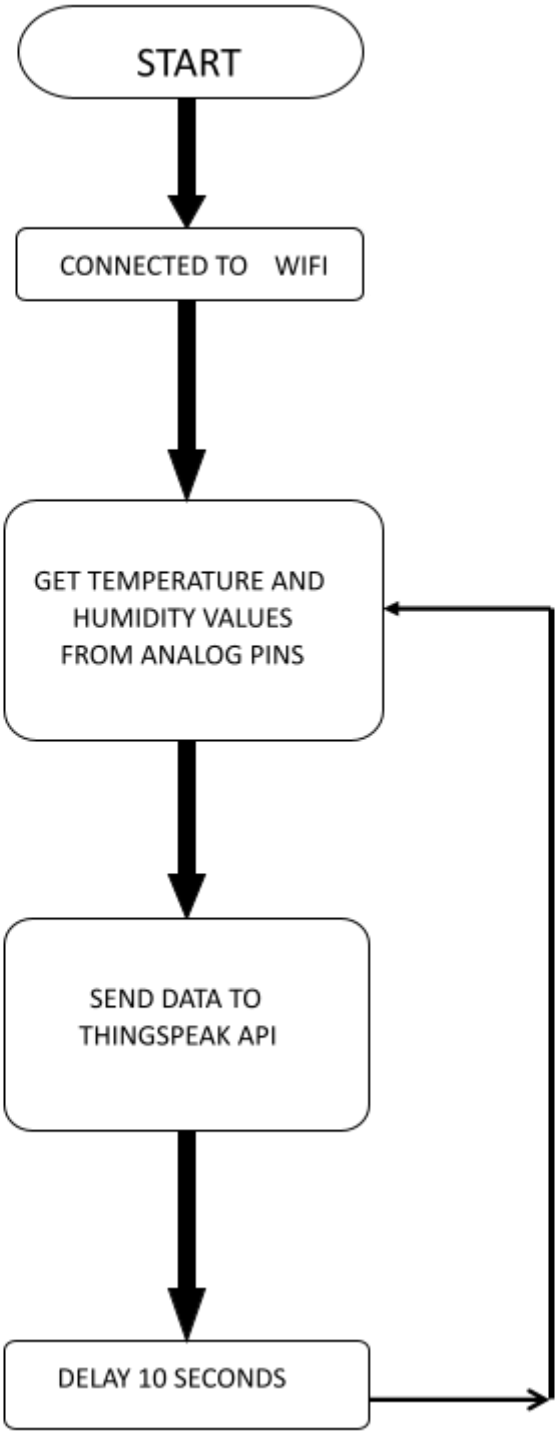


**Figure 3.1 FLOWCHART OF OVERALL PROCESS**

### 3.3 OUTPUT GRAPHS


**Figure 3.2 Live Data of Temperature with Date and Time from Thingspeak.com**


**Figure 3.3 Live Data of Soil Moisture with Date and Time from Thingspeak.com**

# 4. CHAPTER-IV: CONCLUSION & FUTURE SCOPE

## 4.1 CONCLUSION

IoT based SMART FARMING SYSTEM for Live Monitoring of Temperature and Soil Moisture has been proposed using Arduino and Cloud Computing . The System has high efficiency and accuracy in fetching the live data of temperature and soil moisture. The IoT based smart farming System being proposed via this report will assist farmers in increasing

the agriculture yield and take efficient care of food production as the System will always provide helping hand to farmers for getting accurate live feed of environmental temperature and soil moisture with more than 99% accurate results.

### 4.2 FUTURE SCOPE

Future work would be focused more on increasing sensors on this system to fetch more data especially with regard to Pest Control and by also integrating GPS module in this system to enhance this Agriculture IoT Technology to full-fledged Agriculture Precision ready product.

## 5. CHAPTER V: REFERENCES AND SOURCES


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