SMART AGRICULTURE MONITORING AND CONTROLLING SYSTEM USING IOT

Tamilarasan M

2nd Year M.Tech-CSE, Sri Siddhartha Institute Of Technology ,Tumkur, Karnataka

ABSTRACT

Generally, most of the farmers are facing more issues while cultivating the farming fields. Greenhouses are climate controlled structures with walls and roof specially designed for offseason growing of plants. Most greenhouse systems use manual systems for monitoring the temperature and humidity which can cause discomfort to the worker as they are bound to visit the greenhouse every day and manually control them. Also, a lot of problems can occur as it affects the production rate because the temperature and humidity must be constantly monitored to ensure the good yield of the plants. Internet of Things is one of the latest advances in Information and Communication Technologies, providing global connectivity and management of sensors, devices, users with information. So the combination of IoT and embedded technology has helped in bringing solutions to many of the existing practical problems over the years. The sensors used here are YL69 moisture sensor and DHT11 (Temperature & Humidity sensor). From the data's received, ESP8266 automatically controls Moisture, Temperature, Humidity efficiently inside the greenhouse by actuating an irrigating pipe, cooling fan, and pump respectively according to the required conditions of the crops to achieve maximum growth and yield. The recorded temperature and humidity are stored in a cloud database (Blynk app), and the results are displayed in a webpage, from where the user can view them directly.

1 INTRODUCTION

AGRICULTURE

Agriculture plays a vital role in India's economy**.** 54.6% of the total workforce is engaged in agricultural is engaged in agricultural and allied sector and accounts for the country's Gross value added for the year 2019-2020. Given the importance of the agriculture sector, Government has taken several steps for its development in a sustainable manner. Agriculture is a key source of livelihood. Agriculture provides employment opportunities for village people on large scale in developing country like India. India's agriculture is composed of many crops and according to survey nearly 70% population is depends on agriculture. Agriculture is the most important sector for humankind to survive their existence. It enhances a big concern to manage food for people all over the world. This system allows various devices and sensors to send data over the Internet. It enables farmers to monitor their field remotely from their home by using smartphone or a computer. They used to be present physically on their farm to monitor crops. Use of technology can make this job easier and time efficient. It is very essential to make effective intervention in agriculture and the solution is IOT integration with wireless sensor network. It is more physically things connected to internet, communicate and share data to each other which is smart devices, Today India ranks second in the world in farm output 64% of cultivated land dependent on monsoons. Irrigation accounts for 55-75% of water usage in India. Nearly 60% of the water used in irrigation is wasted. We conserve water by using soil moisture sensors. This growing is trend that will influence everything from business to our daily personal lives.

Fig.No.1 SOURCE OF AGRICULTURE

AFFORD PLAN OF TRADITIONAL AGRICULTURE

Growth in agricultural sector is necessary for the development of economic condition of the country. With rising population, there is a need for increased agricultural production. In order to support greater production in farm, the requirements of the amount of fresh water used in irrigation also. Currently, the agriculture accounts 83% of the total water consumptions in india. Unplanned use of water inadvertently results in wastage of water. Crop growth environment relies mainly farmer's personal experience rather than precise and reliable quantitative data, thus successful experience of planting isnot easy to be summarized and replicated ambition and solution. Rural economy have been the most attractive issues in the world.

OVERVIEW OF THE PROJECT

The IOT has also recently gives a strong impression of the agriculture sector with a wide range of sectors used for various smart agriculture targets. The IOT application are increased exceedingly year by year. It shows the monitoring control of IOT devices for smart agriculture. Different sensors in the agriculture sector play a significant role in Technologies. Connecting multiple interconnected devices, such as several sensors, and smart objects, to mobile devices through use of internet. The sharing of information with intelligent control on decision-making services consists of IOT services due to the many cloud based remote data acquisition. Such capability can provide efficient production to the smart agriculture industry. The conventional approach agriculture is to enhance modernized cultivation with the exploration of the IOT region of interest in the agricultural field development has given heaps of advantages in all sectors over the last decade.

Fig.No. 2 Smart Farming in Agriculture

CHALLENGES IN SMART AGRICULTURE

For Farmers, it is difficult for them to understand technical terms and usage of technology, and also it is a cost effective affair. It is a challenge to balance both. A low budget to hold outcomes because of the dependent on the harvest. Cost optimization can be achieved by minimizing number of people involved in the hierarchy in between farmer and government. Global temperature change is important for management weather and ambient conditions.

OBJECTIVE OF THE PROJECT

The Main Objective of this project is to improve the crop yield and thereby meet the demand. This Project remotely measure monitor water moisture levels in the soil to ensure the crops are getting optimal water resources and automatically trigger sprinkler systems to address low moisture levels in the soil to prevent crop damage or loss and controlling the system. The smart agriculture being proposed via this project is integrated with Arduino technology, mixed with various sensors and wifi module to live data feed can be obtained online from the mobile app.

3 SYSTEM ANALYSIS

EXISTING SYSTEM

The existing system consists of Manual Monitoring of the agricultural field parameters and the use of the GSM technology will take more time to get the required results. So in order to overcome that we have proposed more organized and automated monitoring of the crops by controlling different parameters inside the greenhouse. The Internet of Things is regarded as the third wave of information technology after Internet and mobile communication network, which is characterized by more thorough sense and measure, more comprehensive interoperability and intelligence. In the IOT based smart agriculture system proves to be very helpful farmers, indeed even in the wake of reaping, ranchers additionally face issues away of gathered yield. It creates coordinated framework which deals with all components influencing the profitability in each stage. This system generates irrigation schedule based on the sensed real time data from field and data from whether or not, is there a need for extending the system to send suggestions via in SMS to the farmer directly on his mobile using GSM module instead of mobile app.

DRAWBACKS

- Smart farming continually requires internet connectivity.
- The IOT related equipment allows the farmer to understand the use of technology and to learn. It is the biggest challenge for the large- scale implementation of smart agricultural framing across the continues.
- Given any security measures, the system offers little power and can lead to various kinds of network attacks.

PROPOSED SYSTEM

Our proposed system receives three parameters from the sensors and activates the actuators if the actual values are more than the threshold values and also stores these values in the cloud database enabling them to be accessed from anywhere, anytime. This paper also sheds light on the automatic control over the climatic conditions inside the greenhouse. There are different seasonal crops which can be grown only under certain conditions. Onions, garlic, shallots etc. are the winter crops which require cold conditions for their growth. Cucumbers, melons etc. are the summer crops which require moderate or hot climatic conditions. The prototype we used comprises of moisture sensors, temperature & humidity sensors, Moisture sensors (YL 69) are installed near the roots and temperature & humidity (DHT11) sensor is installed further away to detect the temperature and humidity. These sensors send their

data to the IOT to analyze the results. The IOT will turn the inlet value on, to water the spinach, untilthe soil moisture value becomes greater temperature and humidity values are above the reference value (calculated according to the crop – spinach),to maintain them to be within the threshold levels, sliding door will be opened and fan will be switched ON. At this time when the smart agriculture is IOT based device which is capable of automating the irrigation process by analyzing the moisture of the soil and climatic conditions. The farmers can know get details of farm conditions with the help of remote sensor framework and the systems sitting home or other places.

4 SYSTEM REQUIREMENTS

SOFTWARE REQUIREMENS

BLYNK APPLICATION

Blynk is a platform with IOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where we you can build a graphic interface for your project simply dragging and dropping widgets. Blynk is a new platform that allows you to quickly build interface for monitoring and controlling your ios and Android device. After downloading the blynk app, you can create a project dashboard and arrange buttons, sliders, graphs, and other widgets on to the screen. With blynk you can create smartphone application that allows you to easily interact with microcontroller or even full computers such as the Raspberry Pi.

Fig. No.3 Create interfaces for your Projects

SUPPORTED HARDWARE BLYNK APP

Blynk application can be found from the following links-

- ✓ Android Blynk App
- ✓ IOS Blynk App

After downloading the app, create an account and log in. (If possible than log in with your real mail id for better connectivity later).

You will also need to install the blynk arduino library, which helps generate the firmware running on ESP8266. Download the latest release from blynk-library and follow along with the directions there to install lthe required

libraries.

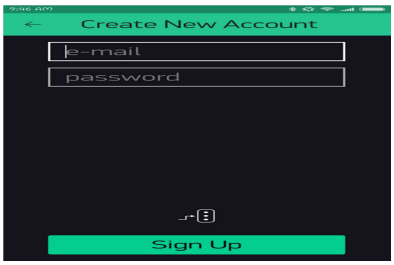


Fig.no 4 Blynk Arduino Library

CREATE A BLYNK PROJECT

- Click the "Create New Project" in the app to create a new Blynk app.Give it any name.
- Blynk works with hundreds of hardware models and connection types. Select the Hardware type. After this, select connection type. In this project we have select WiFi connectivity.
- The Auth Token is very important – you'll need to stick it into your ESP8266's firmware. For now, copy it down or use the "E-mail" button to send it to yourself.

Fig. No. 5 Select the Hardware type

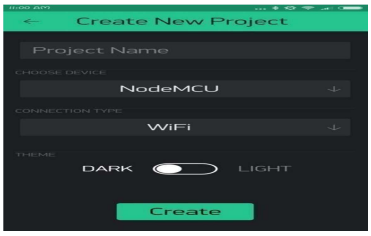


Fig. No. 6Create the project name and device

ADD WIDGETS TO THE PROJECT

- Then you'll be presented with a blank new project. To open the widget box, click in the project window to open.

- We are selecting a button to control Led connected with Node MCU.
- Click on Button.
- Give name to Button say led.
- Under OUTPUT tab- Click pin and select the pin to which led is connected to Node MCU, here it is digital pin 2, hence select digital and under pin D2. And Click continue.
- Under MODE tab- Select whether you want this button as “push button” or “Switch”.
- you have successfully created a GUI for Arduino.

Fig. No. 7 Widget Box

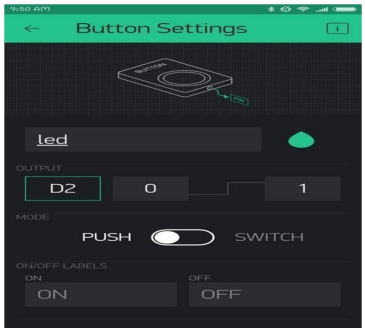


Fig.No. 8 Button Settings

UPLOAD THE FIRMWARE

- Now that your Blynk project is set-up, open Arduini and navigate to the ESP8266_standalone example in the
- File>Examples>Blynk>Boards_WIFI>ESP8266_standalone menu.

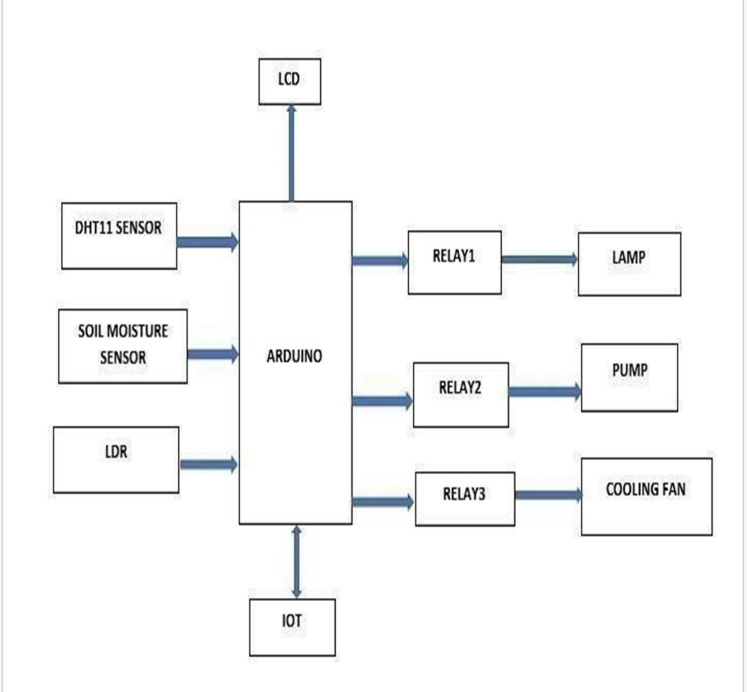
STAND ALONE PROGRAMMING CODE

Before uploading, make sure to paste your authorization token into the auth [] variable. Also make sure to load your Wifi network settings into the Blynk.begin(auth, “ssid”, “pass”) function.

EXECUTION

After the app has uploaded, open the serial monitor, setting the baud rate to 9600. wait for the “ready” message.

HARDWARE REQUIREMENTS
INTERFACING OF SYSTEM



ARDUINO UNO

Arduino Uno is a microcontroller board based on the ATmega3 . It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs,a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connectit to a computer with a USB cable or power it with an AC-to-DC adapter or batteryto get started. You can tinker with your UNO without Worrying too much about doing something wrong. The worst case scenario is that you would have to replace the chip and start again.

Fig. No. 9 Arduino UNO

ARDUINO UNO SPECIFICATIONS

- Microcontroller: ATmega328P
- Operating Voltage: 5V
- Voltage (recommended): 7-12V
- In out Voltage (limit): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- PWM Digital I/O Pins: 6
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC current for 3.3V Pin: 50 Ma
- Flash Memory: 32 KB (ATmega328P)of which 0.5
- KB used by bootloader
- SRAM: 2 KB (ATmega328P)
- EEPROM: 1 KB (ATmega328P)
- Clock Speed: 16 MHz
- LED_BUILTIN: 13
- Length: 68.6 mm
- Width: 58.4 mm
- Weight: 25 g

IOT WiFi Module (ESP8266)

ESP 8266 is one of the low cost WiFi module that belongs to ESP's family which used to control all the electronics projects which are developed by human beings anywhere in the world. The ESP 8266 has anin-built microcontroller and 1MB flash allowing this module to connect toa WiFi. With the help of TCP/IP protocol this module can communicate with WiFi signals. The maximum limit of working voltage of the module is 3.3v, as supply of 5v or more is prohibited as it will damage the module.

Fig.No. 10 Wifi Module

LIQUID CRYSTAL DISPLAY

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segment and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments),

animation and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

PIN DIAGRAM

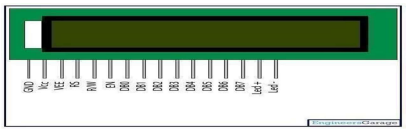


Fig.No.11 Liquid Crystal Display

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

DHT11 SENSOR

The **DHT11** is a commonly used **Temperature sensor that** comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

DHT11 Pinout Identification and Configuration:

No:	Pin Name	Description
For DHT11 Sensor		
	Vcc	Power supply 3.5V to 5.5V
	Data	Outputs both Temperature and Humidity through serial Data
	NC	No Connection and hence not used
	Ground	Connected to the ground of the circuit

DHT11 Specifications:

- Operating Voltage: 3.5V to 5.5V
- Operating current: 0.3mA (measuring) 60uA (standby)Output: Serial data
- Temperature Range: 0°C to 50°CHumidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit
- Accuracy: ±1°C and ±1%

Fig. No. 12 Temperature Sensor

SOIL MOISTURE SENSOR

The Soil Moisture Sensor is used to measure the volumetric water content of soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology. Soil Moisture Sensor probes enable precise low cost monitoring of soil water content. Because our probe measures the dielectric constant of the soil using transmission line techniques, it is insensitive to water salinity, and will not corrode over time as does conductivity based probes. Our probes are small, rugged, and low power.

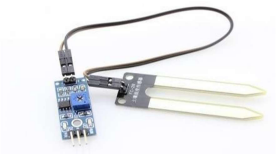


Fig.No. 13 Soil Moisture Sensor

LIGHT DENSITY RESISTOR

This resistor works on the principle of photo conductivity. It is nothing but, when the light falls on its surface, then the material conductivity reduces and also the electrons in the valence band of the device are excited to the conduction band. These photons in the incident light must have energy greater than the band gap of the semiconductor material. This makes the electrons to jump from the valence band to conduction. These devices depend on the light, when light falls on the LDR then the resistance decreases, and increases in the dark. When a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light its resistance will decrease.

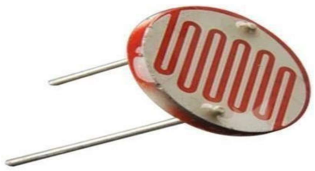


Fig.No. 14 Light Density Resistor

COOLING FAN

Coolers and sliding windows are installed on the side walls of a greenhouse to maintain the temperature and to regulate the airflow within the green house.

Fig.No. 15 Cooling fan

LAMP

The working principle of the Light-emitting diode is based on the quantum theory. The quantum theory says that when the electron comes down from the higher energy level to the lower energy level then, the energy emits from the photon. The photon energy is equal to the energy gap between these twoenergy levels.

Fig.No.16 Lamp

PUMP

A pump is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action, typically converted from electrical energy into hydraulic energy. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps.

Fig.No.17 Pump

RELAY

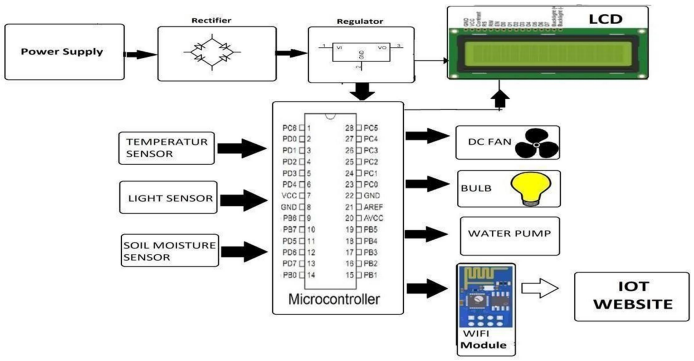
A relay is used as electrically operated switch which is shown the figure. It has a set of input terminals for a single and a set of operating contact terminals.The switch may contain number of contacts in multiple contact forms which make contacts or break contact. Relay is used to turn on the water pump in order to maintain the moisture level of the crop.

Fig.No. 18 Relay

PROJECT DESCRIPTION

EXPERIMENTAL ANALYSIS

For experimental analysis, we changed the desired parameters and monitored the response of the projected system. First, we set the desired temperature degrees on the remote control device. After a few seconds the cooling fan is turning on and the servo motor opens the window. After a short time, the temperature in the green house model dropped to 19 degrees. In case the projected system cannot reach the desired temperature, because it doesn't have an artificial cooling system installed, the projected system will turn off the cooling fan and close the window after reaching the minimum possible optimal temperature and will continue to maintain that temperature. If we set the desired temperature to 25 degrees. The projected system turns off the cooling fan and closes the window, and turns the heater on. When the desired temperature is reached, the heater turns off and the system maintains the given temperature. The usercan also set higher soil humidity in the desired parts of the greenhouse model. In our case, the desired soil humidity is 45% and the current soil humidity is 33%. After setting the desired soil humidity, the projected system opens the electric valve and the soil humidity inside the greenhouse model began to rise slightly. When the soil humidity rises up to 42%, the electric valve turn off. The soil humidity continued to rise slower until soil humidity is 45%. If less soil humidity is desired than the currentsoil humidity, the projected system will not respond. A possible scenario for future work, in this case,is to turn on the heater and the cooling fan to reduce soil humidity.The actual soil humidity and the temperature inside the greenhouse model are sent to the cloud and further to the web site. Other subsystems were also tested and gave satisfactory results.



SCHEMATIC DIAGRAM

IMPLEMENTATION

A green house is where plants such as flowers and vegetables are grown. Greenhouses warm up during the day when sun-rays penetrates through it, which heats the plant, soil and structure. Green houses help to protect crops from many diseases, particularly those that are soil borne and splash onto plants in the rain. Greenhouse effect is a natural phenomenon and beneficial to human being. Numerous farmers fail to get good profits from the greenhouse crops for the reason that they can't manage two essential factors, which determines plant growth as well as productivity. Green house temperature should not go below a certain degree, High humidity can result to crop transpiration, condensation of water vapour on various greenhouse surfaces, and water evaporation from the humid soil. To overcome such challenges, this greenhouse monitoring and control system comes to rescue. This project demonstrates the design and implementation of a various sensors for greenhouse environment monitoring and controlling. This greenhouse control system is powered by Atmega328 microcontroller it consists of temperature sensor, light sensor,

soil moisture sensor, LDR sensor, LCD display module, 12v DC fan, Bulb and pump. Temperature sensor, senses the level of temperature., if it goes high DC fans gets on and when the temperature goes low the fan gets off. Soil moisture sensor, senses the

water level as the level decreases the pumps gets on. In the absence of light, the LDR sensor senses and the bulb starts glowing. By this way it will become easy to monitor and control the system.

RESULT AND DISCUSSIONS
RESULT

The main aim of this project is to implement the modern technology in required fields like agriculture. Using IOT technology in agriculture, this system makes agriculture monitoring easy. The benefits as mentioned like water saving and labour saving are required the maximum in current agricultural state of affairs. Consequently, using the sensor network in fields of agriculture makes clever irrigation. The information from IOT is sent to the client using cloud. Consequently, any changes inside the crop may be identified effortlessly and earl y analysis is achieved as such IOT Based Smart Agriculture Monitoring System and the measured and monitored parameters like temperature, humidity and moisture in soil.

PERFORMANCE

It is easy to maintain and cost is reasonable to purchase. The components which are used are easily available. It has advantage to observe the status on smart phone or laptop using internet. The information is up to date even in absence of farmer. The collected data is updated and the farmer is conscious about the status of the crop. To achieve more effective and accurate details of crop several additional sensors can also be included.

ACKNOWLEDGEMENT

All over the globe researchers are exploring technological solutions to enhance the agriculture productivity in a way that complements existing services by deploying IOT technology. In this article, we have presented a comprehensive survey on the state-of-the-art for IOT in agriculture. To this end, we discuss agricultural network architecture, platform, and topology which help to access to IOT backbone and facilitates farmers to enhance the crop productivity. In addition, this article provides an extensive overview on current and continuing advances in IOT agricultural applications, devices/sensors, communication protocols and many innovative technologies. This research considers various IOT agricultural challenges and security requirements for the better understanding of IOT smart farming security.

CONCLUSION AND FUTURE WORK
CONCLUSION

An arduino based mostly agriculture observance and controlling system is designed. DHT11 sensor, soil moisture sensor, LDR sensor, and Ph sensor is that the main sensors utilized in this project that provide exact value of temperature, humidity, soil and ph severally. This technique intended for controlling and observance environmental parameters in the network. The data can be monitored and controlled in the blynk app. To collect and maintain the data to a central server in real time.

FUTURE WORK

- This system can be expanded in future by adding more sensors to make agriculture system more efficient.
- The sensors like health monitoring of soil and plant.
- To determine soil fertility etc.
- Speech based option can be implemented in the system for the people who are less literate.
- Regional language feature can be implemented to make it easy for the farmers who are aware of only their regional language.

SCREENSHOTS

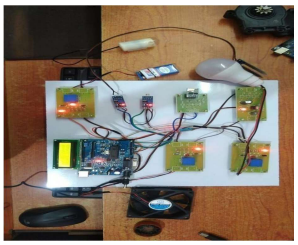


Fig. no 19 Measured and Monitored View

The measured and monitors like temperature, humidity and moisture in soil are shown in figure.

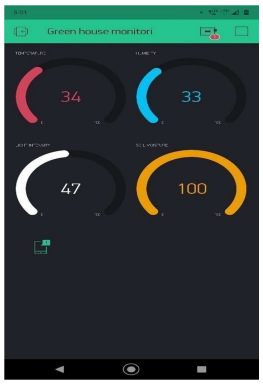


Fig. no 20 Monitoring and Controlling sending the data to web server

IOT based smart system has been developed for remote monitoring and controlling the entire sending data to the web server, storing and displaying data in web page.

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Tamilarasan M. He earned a B.E. in Computer Science and Engineering from Dr NGP Institute of Technology in Coimbatore, Tamil Nadu, through Anna University in Chennai year of 2022. He is currently pursuing a PG in M.Tech Computer Science and Engineering at Sri Siddhartha Institute of Technology in Tumkur, Karnataka, through Sri Siddhartha Academy of Higher Education in Agalakote, Tumkur, Karnataka year of 2024. I published 5 paper in international journals. He can be contacted through email: tamilarasanm072001@gmail.com