Environmental Parameter Monitoring and Analysis System

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Abstract: Rise in temperature and humidity is a growing issue these days. It is necessary to monitor environment and keep it under control for a better future and healthy living for all.It can also lead to threats to human life in case global warming occurs Here we propose an environment monitoring system that allows us to monitor and check live environment in particular areas through IOT. System uses temperature and humidity sensors to sense presence of temperature and humidity constantly and transmit this data to microcontroller and reports it to the online server over IOT. The sensors interact with microcontroller which processes this data and transmits it over internet. The level of pollution has increased with times by lot of factors like the increase in population, vehicle use, industrialization and urbanization which results in harmful effects on human wellbeing by directly affecting health of the people. This project is based on the wireless sensor networks for collecting information about Environment.

Keywords: IOT, MICRCONTROLLER, Node Mcu Dht11 SENSOR, OLED, Thingspeak

I. INTRODUCTION

IoT provides a platform that allows us to connect devices and control them with big data technology, which provides us with efficiency in performance, economic benefits and hence minimizes the need for human involvement which in turn saves time and reduces the possibility of errors. This project is IoT based and measures parameters such as the heat index, soil moisture, temperature and humidity. The aim of this project is to provide weather analysis in a better and efficient way. The respective sensors are directly connected to ESP8266 and it calculates all the mentioned parameters. Using IoT techniques, it sends these parameters to the Internet. The process of sending data to the internet is repeated after constant time intervals using ESP8266 Wi-Fi module. The weather statistics can be viewed in our created website. On a web server, the project connects and stores the data. Hence user gets live reporting of weather conditions. Due to increasing need of development in agricultural sector, this project is ideal and compatible for the same.

II. SYSTEM OVERVIEW

unique identifier can be used to retrieve all the staff's records from a centralized database to improve

System consists of Power supply, Node Mcu ESP8266, Dht11 sensor, rechargeable battery, oled, led, switch and connecting wires

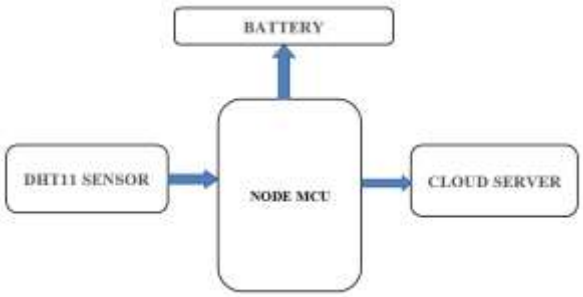


Fig. Block diagram of Transmitter

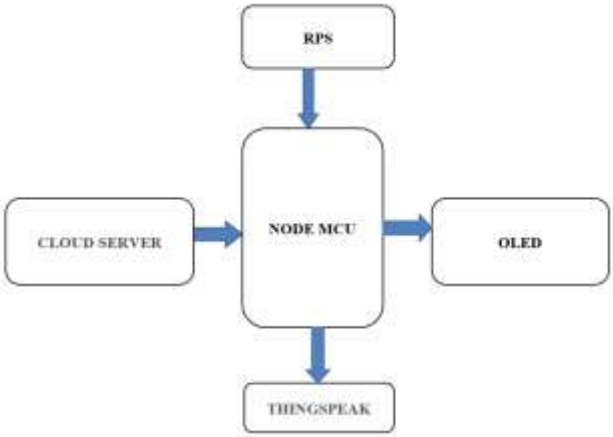


Fig. Block diagram of Receiver

III. COMPONENTS&SPECIFICATION

3.1 Node MCU

The NodeMCU (Node MicroController Unit) is an open-source software and hardware development environment built around an inexpensive System-on-a-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.
NodeMCU is an open-source LUA based firmware developed for the ESP8266 wifi chip. By exploring functionality with the ESP8266 chip, NodeMCU firmware comes with the ESP8266 Development board/kit i.e. NodeMCU Development board.
However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden fr hobbyists, hackers, or students who want to experiment with it in their own IoT projects.

Fig. Node MCU

Espressif systems designed the ESP8266 Wi-Fi module to support both the TCP/IP capability and the microcontroller access to any Wi-Fi network. It provides the solutions to meet the requirements of industries of IoT such as cost, power, performance, and design.
It can work as either a slave or a standalone application. If the ESP8266 Wi-Fi runs as a slave to a microcontroller host, then it can be used as a Wi-Fi adaptor to any type of microcontroller using UART or SPI. If the module is used as a standalone application, then it provides the functions of the microcontroller and Wi-Fi network.

* **Pin Configuration/Pin Diagram**

The **Node MCU Wi-Fi module pin configuration/pin diagram** is shown in the figure below.

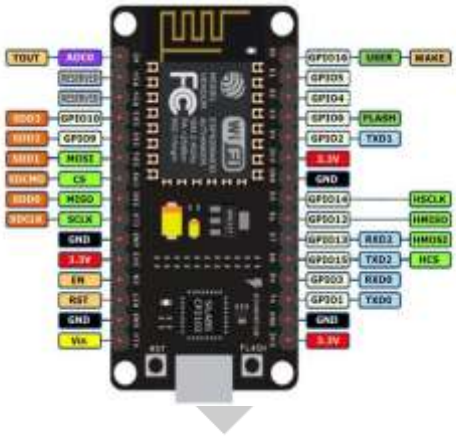


Fig. Pin Configuration of Node MCU

GPIO means General-purpose input/output is a pin on an Integrated Circuit (IC) can be either input pin or output pin, whose behavior can be controlled at the run time. The processor has around 16 GPIO lines and some are used internally to interface with other components of the SoC, like flash memory. GPIO pins allow connecting the board with other peripherals and are capable of generating PWM, I2C, SPI, and UART serial communications. GPIO pin can be used as digital inputs to read a digital voltage or digital outputs to output either 0V (sink current) or 3.3V (source current).

Voltage and current restrictions

Single GPIO pin draws	12mA maximum current.
Power < 3.3 V	Low Power for chip
Power = = 3.3 v	Normal power
Power >3.3 V	kill the chip

Functions

A0	A0 is a function (analogRead()) is used to read external voltage applied on ADC pin of module. ESP.getVcc() This function is used to read NodeMCU module VCC voltage. ADC pin must be kept unconnected.
G	Power Supply ground.
S3	S0 to S3: Data lines (Quad-I/O mode).
S2	S0 to S3: Data lines (Quad-I/O mode).
S1	S0 to S3: Data lines (Quad-I/O mode).
SC	SC: SPI Chip Select.
SK	Serial Clock.
3V	3 volts power supply.
EN	Chip enable pin.
RST	Reset the chip.

GPIO pins

D0	GPIO16	It is a general purpose I/O pin used as GPIO read/write; no special functions are supported on it.
D1	GPIO5	9 general purpose I/O pins
D2	GPIO4	
D3	GPIO0	
D4	GPIO2	
D5	GPIO14	
D6	GPIO12	
D7	GPIO13	
D8	GPIO15	
D9/RX	GPIO1	RX and TX in order to communicate with a host PC from which compiled object code is downloaded.(2 pins)
D10/TX	GPIO1	
D11/SD2	GPIO9	Not mostly used
D12/SD3	GPIO10	It is used to respond for GPIO/PWM/interrupt like functions.

3.2 DHT11 Sensor

The **DHT11** is a commonly used **Temperature and humidity 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 is a low-cost digital sensor for sensing temperature and humidity. This sensor can be easily interfaced with any micro-controller such as Arduino, Raspberry Pi etc… to measure humidity and temperature instantaneously.

DHT11 humidity and temperature sensor is available as a sensor and as a module. The difference between this sensor and module is the pull-up resistor and a power-on LED. DHT11 is a relative humidity sensor. To measure the surrounding air this sensor uses a thermistor and a capacitive humidity sensor.

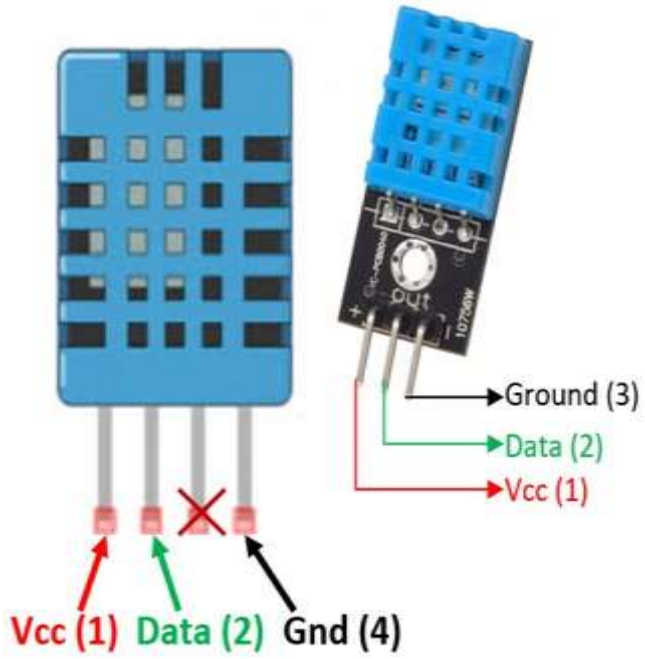


Fig. Pin configuration of DHT11 Sensor

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

- **DHT11 Pinout Configuration**

3.3 Oled Display

OLED (Organic Light Emitting Diodes) is a flat light emitting technology, made by placing a series of organic thin films between two conductors. When electrical current is applied, a bright light is emitted. OLEDs are emissive displays that do not require a backlight and so are thinner and more efficient than LCD displays (which do require a white backlight).

The **OLED displays** are one of the most attractive displays available for a microcontroller. It has a good view angle and pixel density which makes it reliable for displaying small level graphics. Interfacing this IC with MCU can either be done using IIC or using SPI hence helps to save some pins as well.

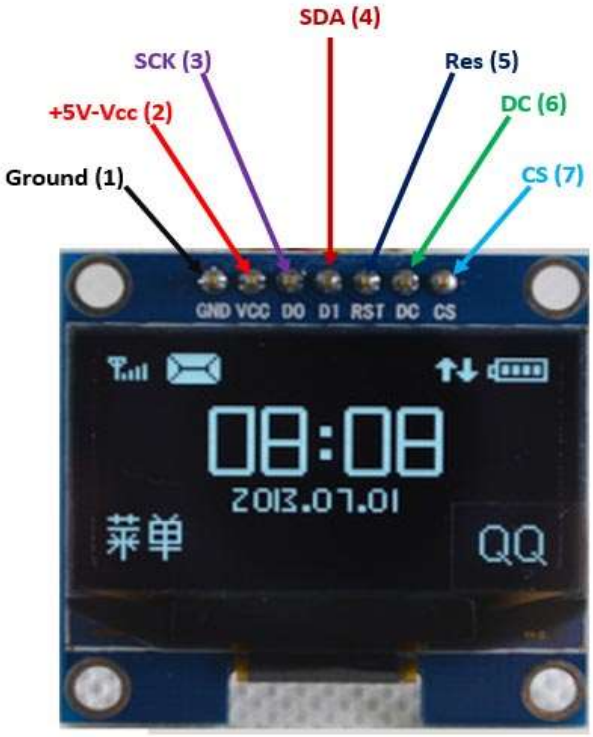


Fig. Pin Configuration of OLED display

- Features of OLED Display:

- Monochrome 7-pin SSD1306 0.96" OLED display.
- 128×64 pixel resolution with 160° viewing angle.
- Supply voltage 3V – 5V (supports both 5V and 3.31v logic devices).
- Uses SSD1306 for interfacing hence can communicate through SPI or IIC.
- Multiple SPI or IIC devices are supported
- Can be easily interfaced with Arduino (Library available).

OLED Pinout Configuration

Pin No:	Pin Name:	Description
1	Ground (Gnd)	Connected to the ground of the circuit
2	Supply (Vdd,Vcc,5V)	Can be powered by either 3.3V or 5V
3	SCK (D0,SCL,CLK)	The display supports both IIC and SPI, for which clock is supplied through this pin
4	SDA (D1,MOSI)	This is the data pin of the both, it can either be used for IIC or for SPI
5	RES(RST,RESET)	When held to ground momentarily this pin resets the module
6	DC (A0)	This is command pin, can either be used for SPI or for IIC
7	Chip Select (CS)	Normally held low, used only when more than one SPI device is connected to MCU

3.4 Rechargeable Battery

A **rechargeable battery**, **storage battery**, or **secondary cell** (formally a type of energy accumulator), is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery,

which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction. Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead–acid, zinc–air, nickel–cadmium (NiCd), nickel–metal hydride (NiMH), lithium-ion (Li-ion), lithium iron phosphate (LiFePO4), and lithium-ion polymer (Li-ion polymer).

Rechargeable batteries typically initially cost more than disposable batteries, but have a much lower total cost of ownership and environmental impact, as they can be recharged inexpensively many times before they need replacing. Some rechargeable battery types are available in the same sizes and voltages as disposable types, and can be used interchangeably with them.

Fig- Rechargeable Battery

I2C display module operates on I2C bus and has the following four pins:

* SDA – Serial data.
* SCL – Serial clock.
* Vcc – 5V.
* GND – ground.

THINGSPEAK

Thingspeak is an open source Internet of Things application and API to store and retrieve data from the sensors using HTTP Protocol over the internet. It is an IoT analytics platform service that allows you to aggregate, visualize and analyze live data streams in the cloud.

The main role of updating data continuously is done by Thingspeak, which has APIs for collecting data produced by sensors and APIs for reading that data from applications. The paper is divided into two parts. One part of the paper is where one has to program a thing to send data. And, the second part is where the other has to see the data. Thingspeak sits in the middle and makes it handy to do both. The paper uses easily accessible hardware to build a proof-of-concept IoT system to monitor air temperature, humidity, soil moisture, soil humidity etc. Further this can be modified with different sensors or actuators for building something for individual purposes. Thus a direct access to all the environmental parameters is given to the user after the above stated procedure is complete

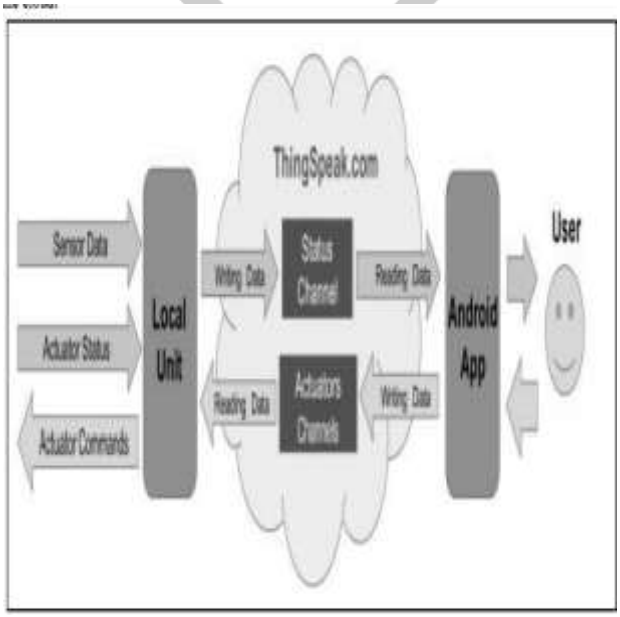


Fig. Working of Thingspeak

IV. WORKING

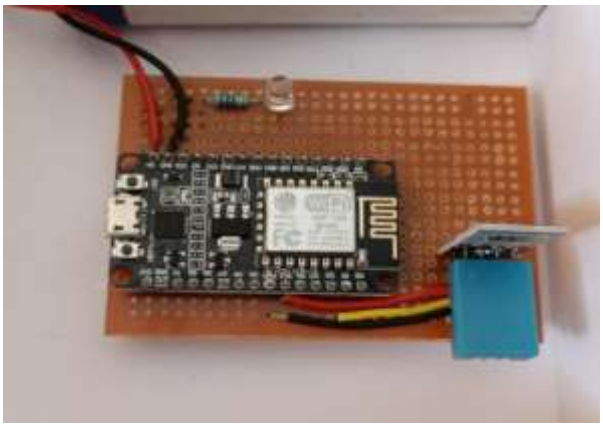
The working of the project mainly happens in two parts. It constitutes a system which is called Environment parameter monitoring and analysis system in which there are two major sub group a transmitter and a receiver.

Transmitter consists of a Dht11 sensor which senses temperature and humidity of nearby surrounding and feeds to Node MCU. The Node MCU then sends data to a cloud server through which recorded data is sent to the receiver.

When the data sent through cloud is received by Node MCU of receiver end. It is displayed on a LCD display in form of temperature and humidity.Later the data gets uploaded on Thingspeak cloud server for analysis purpose. Here visual representation of temperature and humidity is seen to make it easily understandable and also the analysis of data is done calculating average which is also presented in graphical form.

RECIEVER

TRANSMITTER



V. RESULT AND SIMULATIONS

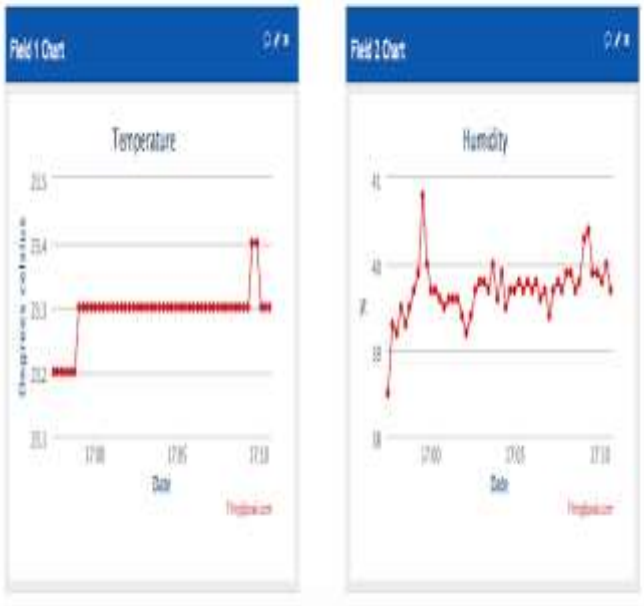


Fig- Simulation on Thingspeak

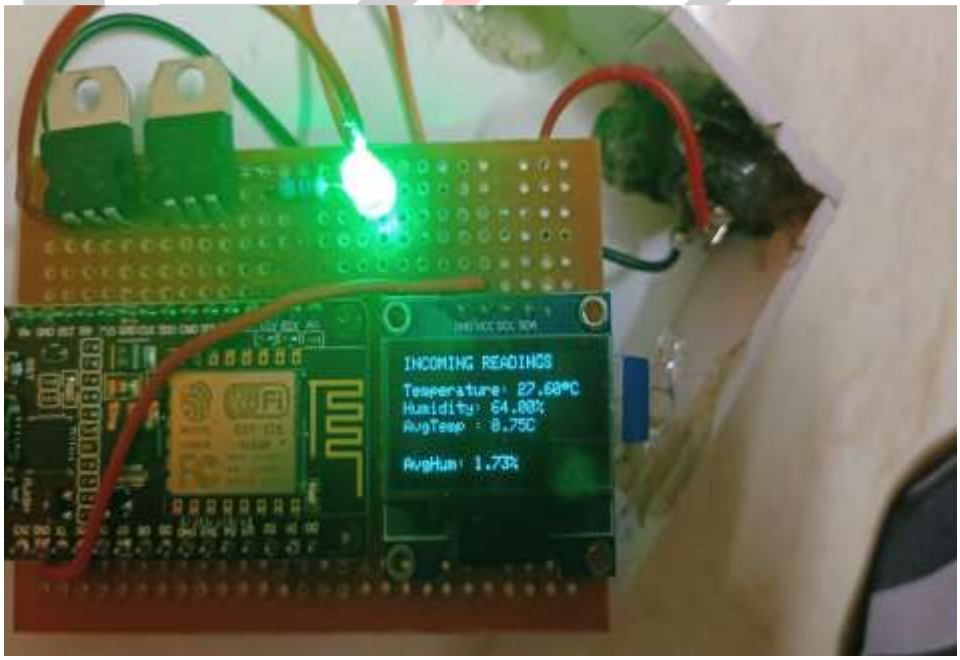


Fig- Result on hardware

VI. CONCLUSION

As IoT is emerging and renewing the idea of technology, it has become an important aspect in development of automation, science and machinery. Similarly, the traditional weather monitoring systems which used to be time intensive, taking hours to visit the location and checking the soil moisture and other factors manually, unknown fluctuations in humidity and temperature causing the growth of pests, have now evolved into a better system with the help of IoT. With the help of IoT, real time analysis of weather parameters such as humidity, temperature, heat index as well as soil moisture is just minutes away.It is an efficient and effortless way to monitor the environment.

It can also be implemented in hospitals or medical institutes for the research & study in "Effect of Weather on Health and Diseases", hence to provide better precaution alerts.
Introducing climate change and global warming variables, in order to forecast more realistic weather parameters

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