PROJECT NAME : NOISE POLLUTION MONITORING

PROJECT DEFINITION:

Noise monitoring refers to the systematic process of measuring, recording, and assessing sound levels in various environments to understand the extent of noise pollution and its potential impact on human health and the surrounding ecosystem. **The sensors interact with microcontroller which processes this data and transmits it over internet. This allows authorities to monitor air pollution in different areas and take action against it**.

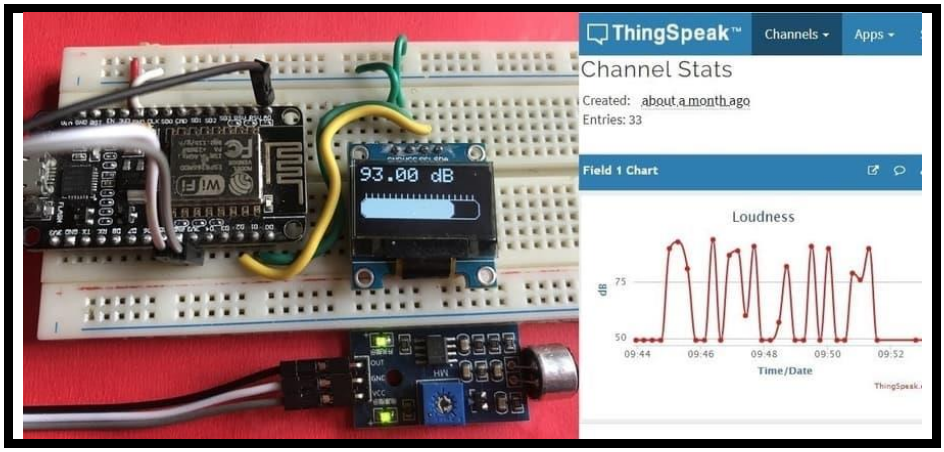
INTRODUTION:

Noise pollution:

Noise pollution is an invisible danger. It cannot be seen, but it is present nonetheless, both on land and under the sea. Noise pollution is considered to be any unwanted or disturbing sound that affects the health and well-being of humans and other organisms. Sound is measured in decibels

.Tehnique to monitor noise pollution:

In this **IoT project**, we will



make **Decibelmeter using ESP8266 & Sound Sensor**. This **DIY project** is very simple and can be made at home for monitoring loudenss in
dB. We will use **Nodemcu ESP8266**, **Sound Module** & **Display** either 16×2 LCD Display or OLED Display. The Sound Sensor will detect the sound and convert it into an analog voltage which is read by Nodemcu ESP8266. The Nodemcu connects to wifi and uploads the data **t**hingspeak Se**rver**.

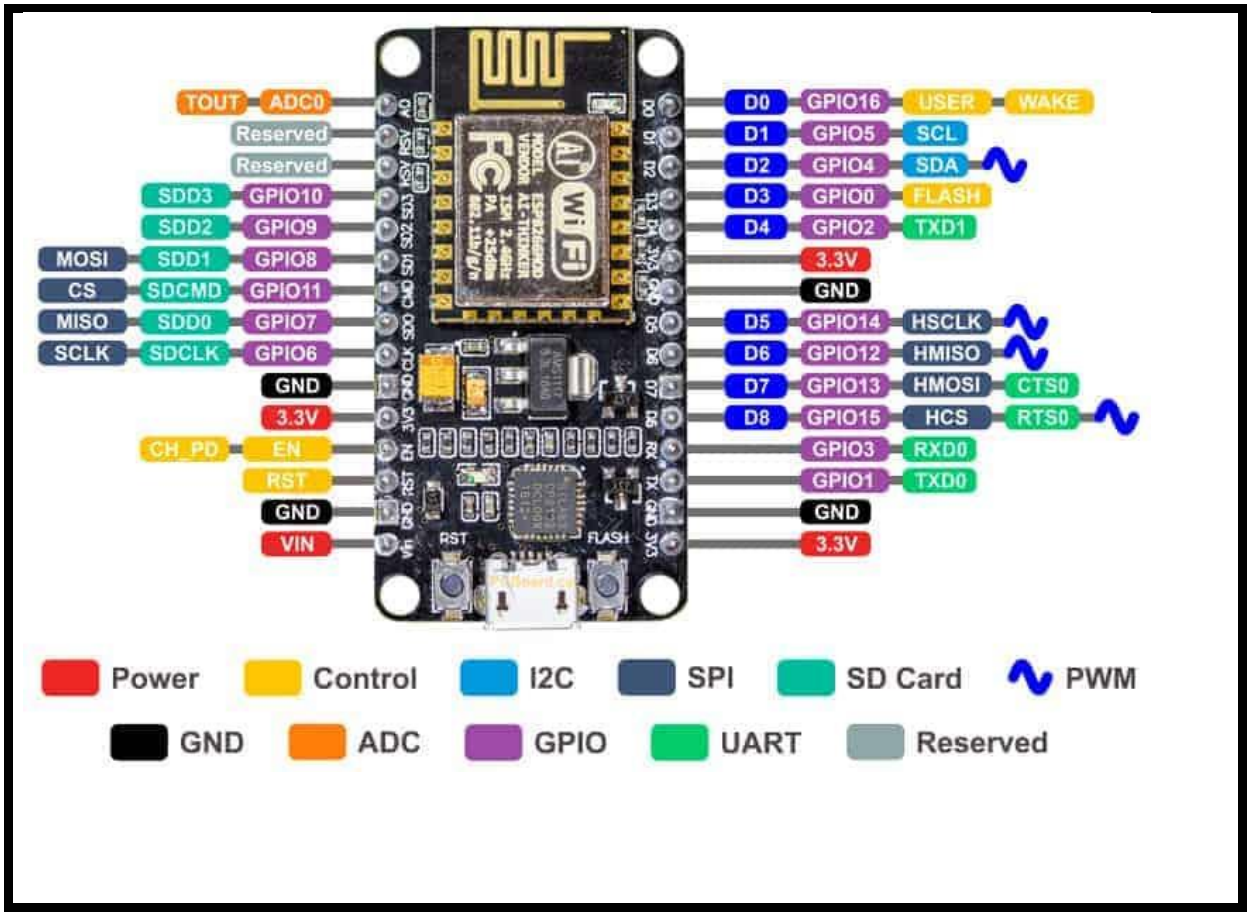
S.N.	Components Name	Quantity
1	NodeMCU ESP8266	1
2	Sound Sensor	1
3	OLED Display	1
4	LCD Display	1
5	Connecting Wires	10
6	Breadboard	1

COMPONENTS:

NodeMCU ESP8266

The NodeMCU (***N***ode ***M***icro***C***ontroller ***U***nit) 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 Pinout and Functions Explained



Power Pins There are four power pins. **VIN** pin and three **3.3V** pins

- **VIN** can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on **VIN** is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the **VIN** pin
- **3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.
- GND are the ground pins of NodeMCU/ESP8266
- I2C Pins are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized

programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

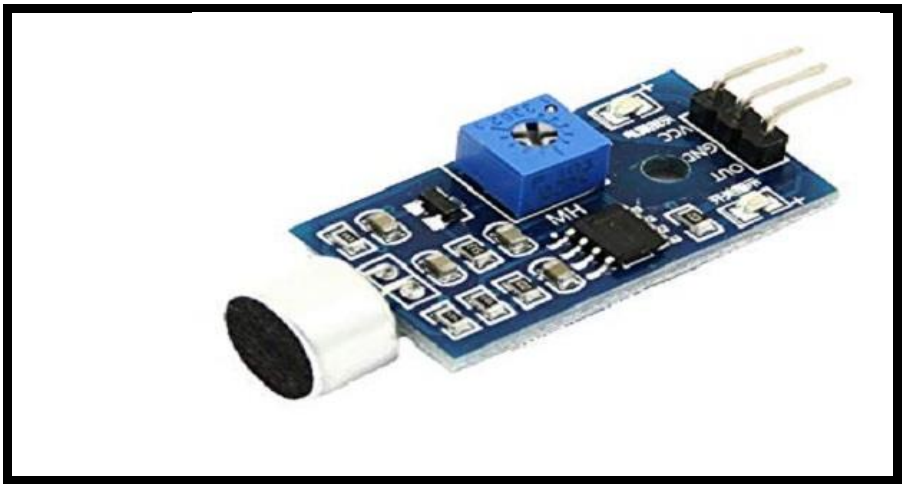
- GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts.
- ADC Channel The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.
- UART Pins NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log
- SPI Pins NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:

- 4 timing modes of the SPI format transfer
- Up to 80 MHz and the divided clocks of 80 MHz
- Up to 64-Byte FIFO
- SDIO Pins NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.
- PWM Pins The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 µs to 10000 µs (100 Hz and 1 kHz).
- Control Pins are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.

- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep-sleep
-  Control Pins are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.

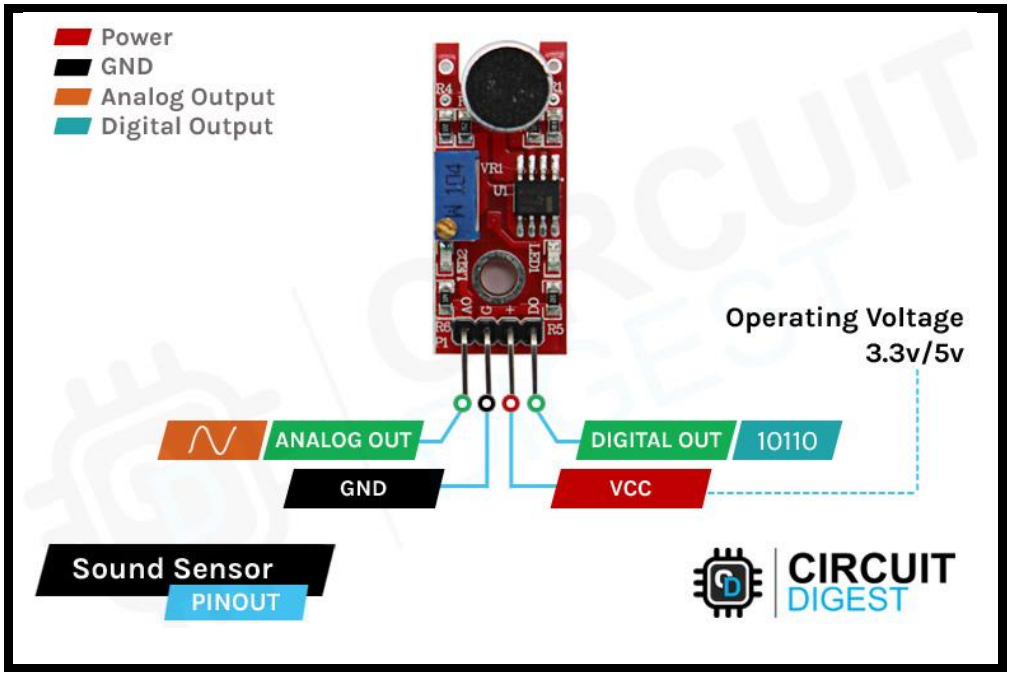
- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep-sleep.

Sound Sensor:



The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage.

Sound Sensor Pinout



VCCis the power supply pin of the Sound Sensor that can be connected to 3.3V or 5V of the supply. But note that the analog output will vary depending upon the provided supply voltage.

GNDis the ground pin of the Sound Sensor module and it should be connected to the ground pin of the Arduino.

DOUTis the Digital output pin of the board, low output indicates that no sound is detected by the sensor, and high indicates that the sensor has detected sound.

AOUTis the Analog output pin of the board that will give us an analog reading directly from the Sound sensor.

LCD (Liquid Crystal Display)

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

organic light-emitting diode (OLED)

An **organic light-emitting diode** (**OLED**), also known as **organic electroluminescent** (**organic EL**) **diode**,[1][2] is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current. This organic layer is situated between two electrodes;

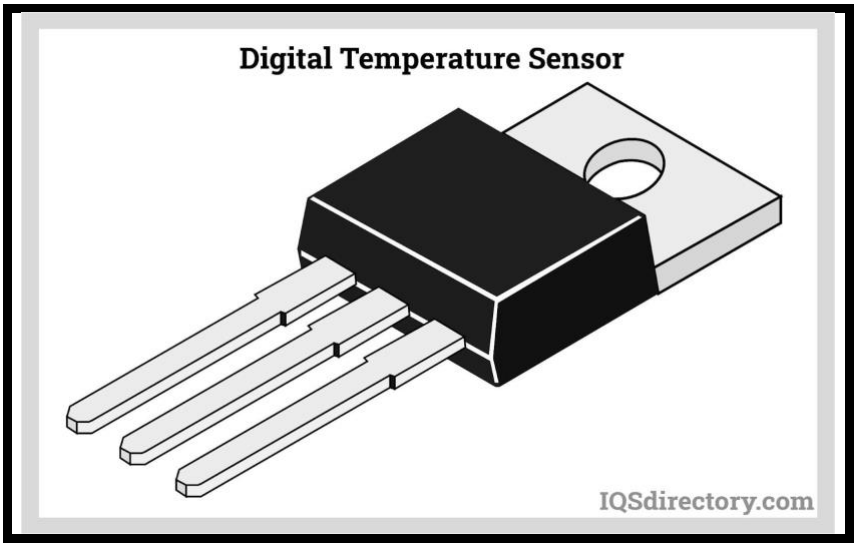
typically, at least one of these electrodes is transparent. OLEDs are used to create digital displays in devices such as television screens, computer monitors, and portable systems such as smartphones and handheld game consoles. A major area of research is the development of white OLED devices for use in solid-state lighting applications.

GAS SENSOR

A gas sensor is a device that can detect the presence and quantify the concentration of a specific gas in the atmosphere, such as water vapor (humidity), organic vapors, and hazardous gases.

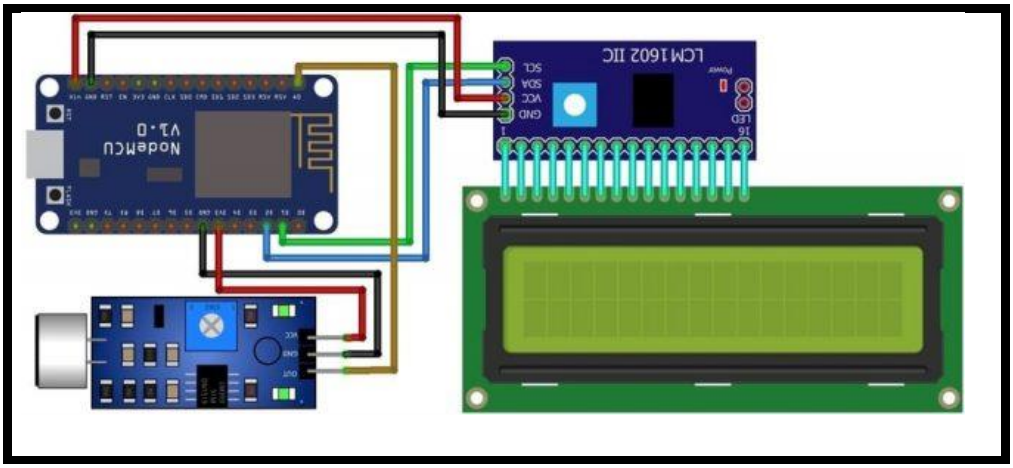
Temperature Sensors

Temperature sensors are devices that detect and measure coldness and heat and convert it into an electrical signal. Temperature sensors are utilized in our daily lives, be it in the form of domestic water heaters, thermometers, refrigerators, or microwaves. There is a wide range of applications of temperature sensors, including the geotechnical monitoring field.



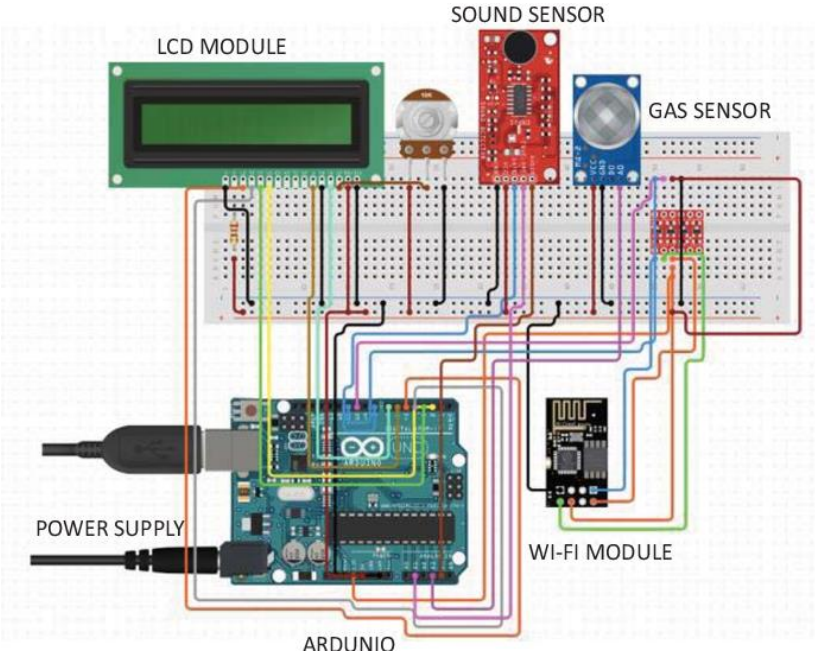
IoT Decibelmeter with ESP8266 & 16×2 I2C LCD Display

Connect the Analog output pin of Sound Sensor to ESP8266. Similarly connect the I2C Pins (SDA, SCL) of LCD Display to D2 & D1 of ESP8266. Supply the LCD Display with 5V through Vin Pin. Similarly, supply the Sound Sensor with 3.3V supply through 3.3V Pin. You can also add 3 LED of a different color to Nodemcu D3, D4 & D5 Pins. This LED glows on the basis of different sound intensity.



[Smart Embedded Framework using Arduino and IoT for Real-Time Noise Pollution Monitoring and Alert system]

The connections are pretty simple, we just have to connect the sound sensor to one of the Analog pin and the LCD to the I2C pins. In the above diagram, we have connected the power pins of the sound sensor and LCD display to 3v3 and GND pin



BENEFITS OF NOISE MONITORING SYSTEM:

Increase safety

The goal of noise management is to maintain low noise exposures, such that human health and well-being are protected.

Noise monitoring safeguards employees' hearing from any excessive noise in the workplace that leads to hearing problems, insomnia, hypertension, heart disease, ear injuries, and the ringing and buzzing in the ear called tinnitus.

Also authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue.

Better communication

Work environments with regulated sound levels allow employees to communicate clearly, follow verbal instructions correctly, focus, and absorb written information easily knowing that the place is hushed and no loud distractions are present.

Beats stress

One of the most common effects of noise pollution that many of us are aware of is that it can lead to hearing loss, but did you know that sound level management is also necessary to fight stress? Any undesired sound triggers a stress response in the amygdala, a region of the brainstem. The amygdala learns, over time, what sounds

signal potential danger. When one is detected, the amygdala prompts the release of cortisol, a stress hormone.

Monitor sound levels with uHoo Aura

Aside from measuring temperature, humidity, carbon dioxide, carbon monoxide, formaldehyde, particulate matter, light, total volatile organic compounds, air pressure, uHoo Aura also provides real-time and accurate information on the presence and severity of noise present within a built environment. By having the right data on the factors affecting your workplace’s indoor environmental quality, you will be able to make adjustments and devise strategies that are guaranteed to improve the health, safety, and the productivity of your employees.