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Arduino Based Audio Meter

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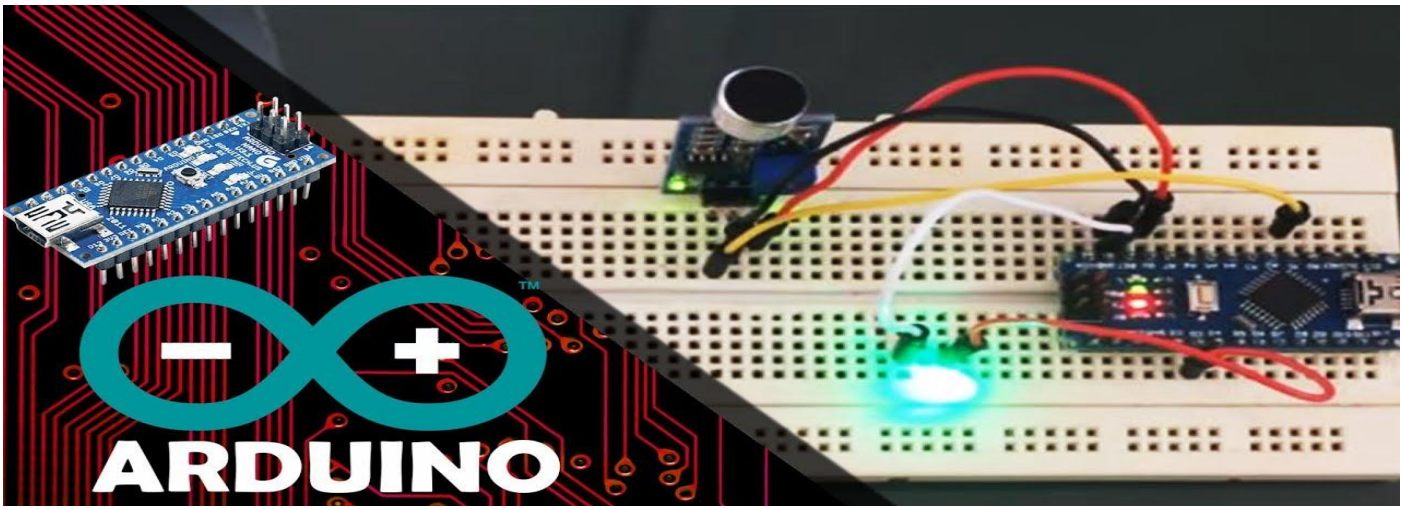

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ABSTRACT

Arduino is a newly developed open source hardware and software system. Yet it has drawn the attention of a large technology community. Its less technical design and affordable cost are basic features that enlarges its large volume of use, where the compatibility with many other electronics and possibility of extension are interesting characteristics that increase the range of its use. Arduino hardware is simply a motherboard which can be used to make interacting objects with suitable computer programming (IDE-Integrated Development Environment).

The idea of this project was to build an Arduino-based embedded device for monitoring intensity of sound at different place. The device was built using the microcontroller Arduino and sensors, which could sense the intensity of sound at any place and provide information in a serial monitor and a liquid crystal display. Out of many clones and different available microcontroller boards, Arduino Uno was used in this project.

This project has two parts-a theoretical part which gives a basic introduction to the materials and equipment used during the project and the second part provides stepwise process for connection and circuitry. The project was successful to meet predetermined goals, implementation was possible with the help of the Arduino book.

CONTENT

1. INTRODUCTION :

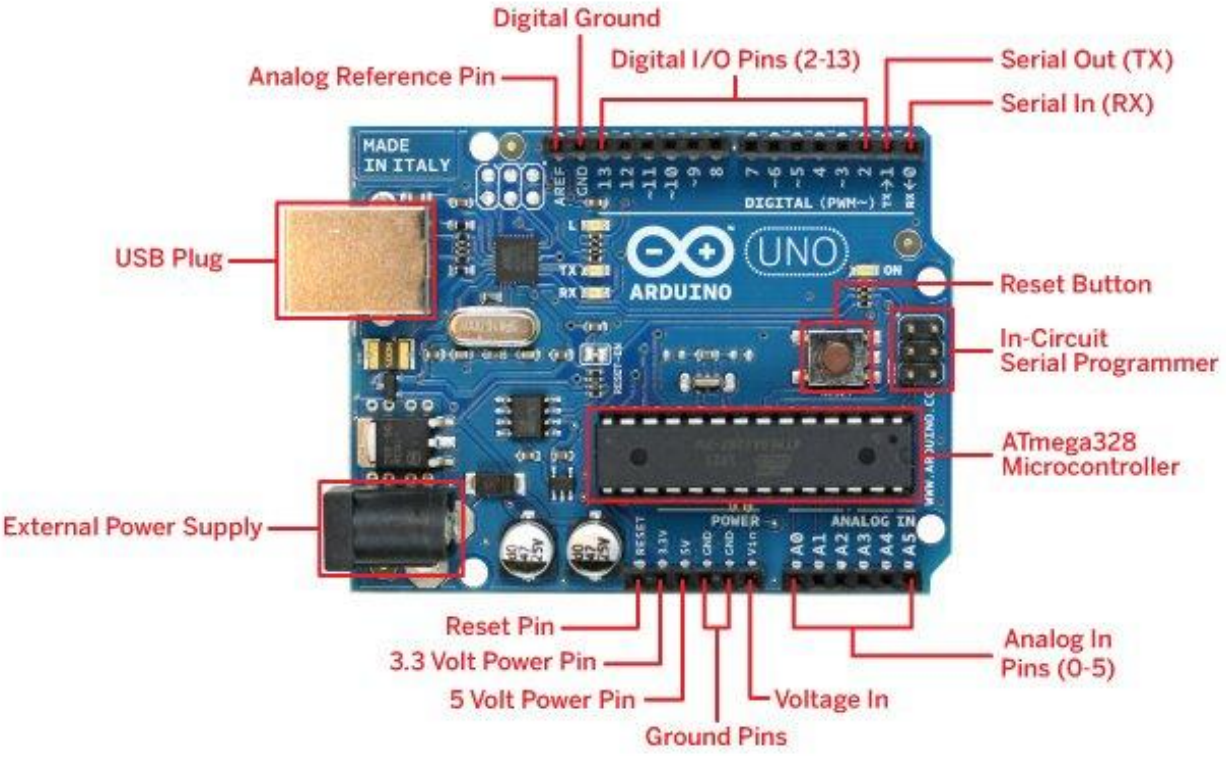
In this Arduino Project we will learn how to use the LM393 sensor for measuring intensity of sound with the Arduino board.

The LM393B sensor is able to measure intensity of sound . A measurement can be done every second. The LM393 sensor senses intensity of sound, and sends the information to digital pin 5 of Arduino UNO From Arduino MCU, intensity of sound values are uploaded to the Cloud at regular intervals of time through ESP8266 WiFi module.

2. MATERIALS AND METHOD :

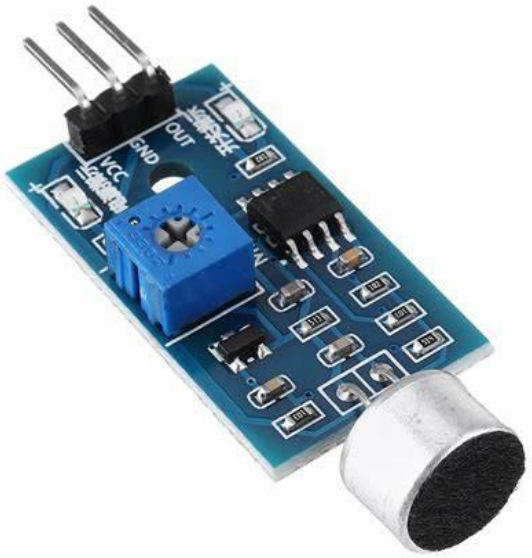
Arduino :

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). 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 connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

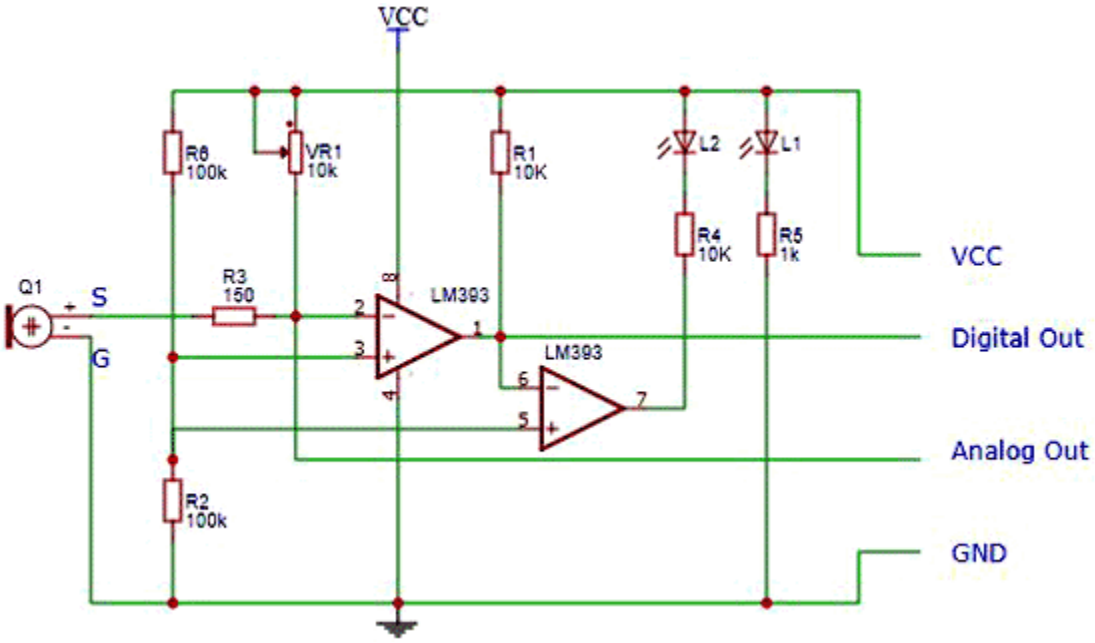


SENSORS :

LM393 Comparator IC is used as a voltage comparator in this Sound Detection Sensor Module. Pin 2 of LM393 is connected to Preset (10KΩ Pot) while pin 3 is connected to Microphone. The comparator IC will compare the threshold voltage set using the preset (pin2) and the Microphone pin (pin3).



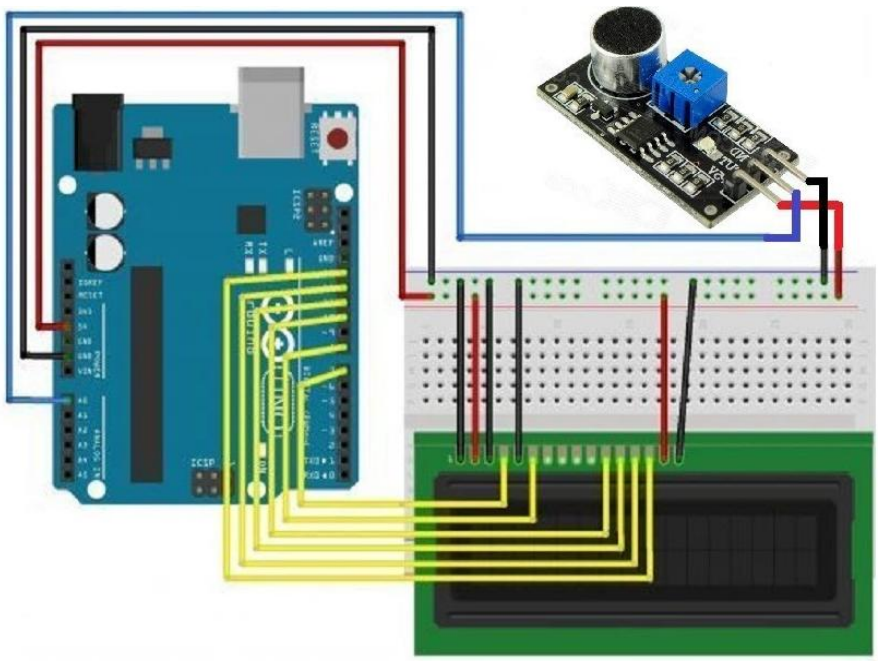
CIRCUIT DIAGRAM OF LM393



IDE :

An **Integrated Development Environment** (IDE) is software that consolidates the basic tools needed for software testing and writing. Without IDE, a developer would have to select and manage all these tools separately, but IDE brings all these tools together as a single framework or service.

SETUP/CONNECTION :



Arduino can be programmed to give the readings (measurement data) in serial monitor and/or in the LCD display. The wiring and connection is one of the most important part of electronics to work it properly.

The required materials for the project are listed below:

- an Arduino board (Arduino Uno)
- a breadboard
- a sensor (LM393 MODULE)
- jumper wires
- an LCD Display

The required wiring and pins to connect the LCD display and the sensor with Arduino is given below :

- Arduino GND Breadboard -ve power rail
- Arduino 5v Breadboard +ve power rail
- LM393 -ve pin Breadboard -ve power rail
- LM393 +ve pin Breadboard +ve power rail
- LM393 S Arduino Analog pin A0
- LCD 1 Breadboard -ve power rail
- LCD 2 Breadboard +ve power rail
- LCD 3 Potentiometer centre pin
- LCD 4 Arduino Digital pin 12
- LCD 5 Breadboard -ve power rail
- LCD 6 Arduino Digital 11
- LCD 11 Arduino Digital Pin 5
- LCD 12 Arduino Digital Pin 4
- LCD 13 Arduino Digital Pin 3
- LCD 14 Arduino Digital Pin 2
- LCD 15 220 Ω (ohm) resistor and the other pole of 220 Ω resistor to Breadboard positive power rail
- LCD 16 Breadboard -ve power rail
- Potentiometer +ve Breadboard negative power rai

When all the connections and wiring are done, the code should be written in IDE and the codes written in IDE tells the Arduino to function so that the measurement obtained from sensor can be read in LCD display.

CODING OF IDE :

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(7,8,10,11,12,13);
int num_Measure = 128 ; // Set the number of measurements
int pinSignal = A0; // pin connected to pin O module sound sensor
int redLed = 5;
long Sound_signal;    // Store the value read Sound Sensor
long sum = 0 ; // Store the total value of n measurements
long level = 0 ; // Store the average value
int soundlow = 40;
int soundmedium = 100;
void setup ()
{
 pinMode (pinSignal, INPUT); // Set the signal pin as input
 Serial.begin (9600);
 lcd.begin(16,2);
}

void loop ()
{
 // Performs 128 signal readings
 for ( int i = 0 ; i <num_Measure; i ++)
 {
  Sound_signal = analogRead (pinSignal);
   sum =sum + Sound_signal;
 }

 level = sum / num_Measure; // Calculate the average value
 Serial.print("Sound Level: ");
 lcd.print("Sound Level= ");
 Serial.println (level-33);
 lcd.print(level-33);
 if(level-33<soundlow)
 {
  lcd.setCursor(0,2);
  lcd.print("Intensity= Low");
   digitalWrite(redLed,LOW);
 }
 if(level-33>soundlow && level-33<soundmedium)
 {
  lcd.setCursor(0,2);
  lcd.print("Intensity=Medium");
   digitalWrite(redLed,LOW);
 }
 if(level-33>soundmedium)
 {
  lcd.setCursor(0,2);
  lcd.print("Intensity= High");
  digitalWrite(redLed,HIGH);
 }
 sum = 0 ; // Reset the sum of the measurement values
 delay(200);
 lcd.clear();
}
```

RESULT

We use the LM393 Sensor to detect the sound. This sound sensor uses the onboard electric microphone as well as the LM393 amplifier to detect any sound that is beyond the threshold setting. The level of the threshold can be set by the on-board potentiometer. This module will output a HIGH signal when the sound is lower than the threshold, as well as LOW when the sound is higher than the threshold. This way we can measure the intensity of sound easily.

DISCUSSIION

By doing this project we have gained in-depth knowledge of electronics and arduino circuits. We have conducted extended study on the dynamics of how sound sensor is worked, circuit details, and specification of LM393 sensor. We have also studied the process of implementing it. The knowledge of circuit connection & coding was the primary key to helping us successfully execute the project and we got our first deep dive into the world of electronics.

CONCLUSION :

The work was successful in building a monitoring intensity of sound at different place. Compared to expensive sensor, the Arduino-based monitoring system successfully reduces the power consumption, cost and complexity of the process. The performance of the system was accurate and reliable with some error in measurement and limitations of the used sensor.

The project was interesting and was practically helpful to learn to use microcontrollers (Arduino), programming language C and basic electronics. This was a very helpful project in learning and understanding the world of microcontrollers, and using microcontrollers in real life.

REFERANCE

1. Software | Arduino
2. Arduino Based Audio Meter - Engineer Experiences