



# EE306 MTE Project Progress Report

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# Topic: Sound Detection using an Arduino UNO-R3 Microcontroller

## Index:

- Introduction to Arduino
- The ATmega328 Microcontroller
- Introduction to Sound Sensor - EC4747
- Sound Detection: Applications
- Proposed Circuit
- Progress Made
- Future Direction

# Introduction to Arduino





# What is Arduino UNO-R3

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.

Programs can be loaded onto it from the easy-to-use Arduino Programming Environment. It also has an extensive support community, which makes it a very easy way to get started working with embedded electronics. The R3 is the third, and latest, revision of the Arduino Uno.



# What makes Arduino UNO-R3 more popular than preceding models?

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features an ATmega16U2 programmed as a USB-to-serial converter. This auxiliary microcontroller has its own USB bootloader, which allows advanced users to reprogram it.

The USB controller chip changed from ATmega8U2 (8K flash) to ATmega16U2 (16K flash). This does not increase the flash or RAM available to sketches.



# Pros and Cons of Arduino

## Pros:

- Inexpensive
- Open-source (Both hardware and software)
- Large Community Support
- Extensive set of Libraries
- Ease of Programming
- Cross-platform IDE Software
- Ready-to-Use Structure

## Cons:

- Bulky Structure
- Processing power of the board is weaker than the microcontroller itself



# Specifications

<b>Processor:</b>	ATmega328 @ 16 MHz
<b>RAM size:</b>	2048 bytes
<b>Program memory size:</b>	31.5 Kbytes
<b>Motor channels:</b>	0
<b>User I/O lines:</b>	20 <sup>1</sup>
<b>Max current on a single I/O:</b>	40 mA
<b>Minimum operating voltage:</b>	7 V
<b>Maximum operating voltage:</b>	12 V
<b>Reverse voltage protection?:</b>	N
<b>External programmer required?:</b>	N

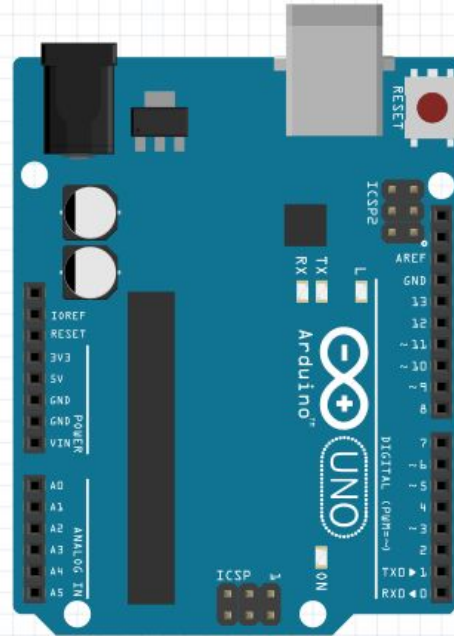
Fig. General Specifications

<b>Size:</b>	2.95" × 2.1"
<b>Weight:</b>	28 g

Fig. Dimensions

# Construction of Arduino UNO-R3

MCU : Atmega 328  
Input voltage : 7V-12V  
Operating voltage : 5V  
CPU Speed : 16MHZ  
Analog In/Out : 6/0  
Digital IO/PWM : 14/6  
EEPROM : 1KB  
SRAM : 2KB  
Flash : 32KB  
UART : 1  
USB : Regular

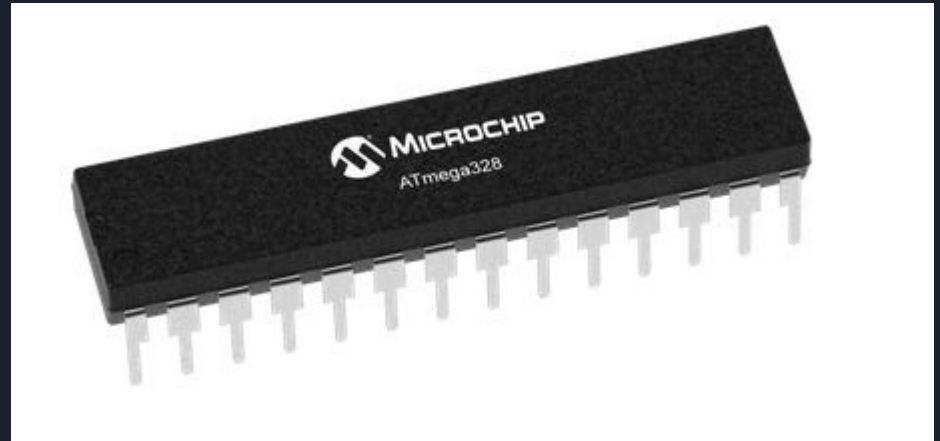


ARDUINO PIN		MICROCONTROLLER PIN
0	-	PD0(RXD)
1	-	PD1(TXD)
2	-	PD2(INT0)
3	-	PD3(INT1)
4	-	PD4
5	-	PD5
6	-	PD6
7	-	PD7
8	-	PB0
9	-	PB1
10	-	PB2(SS')
11	-	PB3(MOSI)
12	-	PB4(MISO)
13	-	PB5(SCK)
A0	-	PC0
A1	-	PC1
A2	-	PC2
A3	-	PC3
A4	-	PC4(SDA)
A5	-	PC5(SCL)



# The ATmega328 Microcontroller

The ATmega328 is a single-chip microcontroller created by Atmel in the megaAVR family (later Microchip Technology acquired Atmel in 2016). It has a modified Harvard architecture 8-bit RISC processor core.



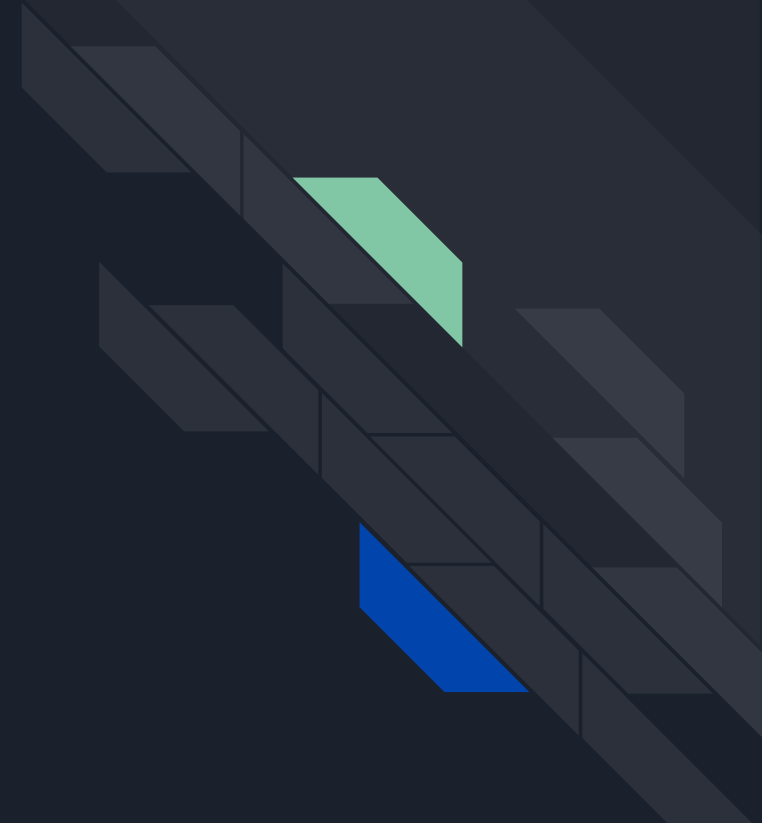


# Features of the Microcontroller

The high-performance Microchip 8-bit AVR® RISC-based microcontroller combines 32 KB ISP Flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented Two-Wire serial interface, SPI serial port, 6-channel 10-bit A/D converter, programmable watchdog timer with internal oscillator, and five software selectable power saving modes.

Name	Value
Program Memory Type	Flash
Program Memory Size (KB)	32
CPU Speed (MIPS/DMIPS)	20
SRAM (B)	2,048
Data EEPROM/HEF (bytes)	1024
Digital Communication Periphe...	1-UART, 2-SPI, 1-I2C
Capture/Compare/PWM Periph...	1 Input Capture, 1 CCP, 6PWM
Timers	2 x 8-bit, 1 x 16-bit
Number of Comparators	1
Temperature Range (°C)	-40 to 85
Operating Voltage Range (V)	1.8 to 5.5
Pin Count	32

# Introduction to Sound Detection Module EC-4747





# Sound Detection Module EC-4747

Sound Detection Module Sensor EC-4747 is a Single channel signal output Sensor. The output is effective to the low-level sound signal with good fidelity, When there is sound, outputs low level and signal light.

It can be used for Acoustic control light, give sound and light alarm working with the Photosensitive sensor, and sound control, sound detect. This sensor only recognizes the availability of sound (vibration principle) cannot identify the size of the sound or the specific frequencies of sound.



# Features and Specifications

- Uses LM393, Electret condenser microphone
- Signal output Indication
- Single channel signal output
- The output effective signal is low level.
- Can detect the intensity of the sound environment
- With the retaining bolt hole, convenient installation.

IC Chip	LM393
Operating Voltage(VDC)	3.3 to 5
Induction Distance	0.5 Meter
Length (mm)	43
Width (mm)	17
Height (mm)	8
Weight (gm)	3

Fig. Specifications

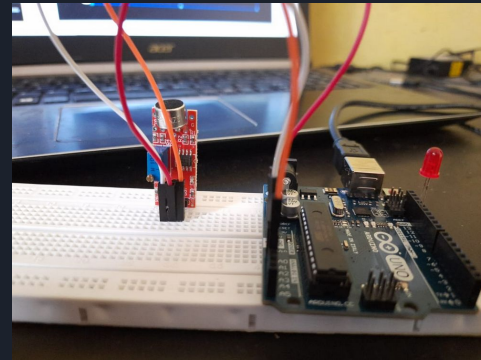
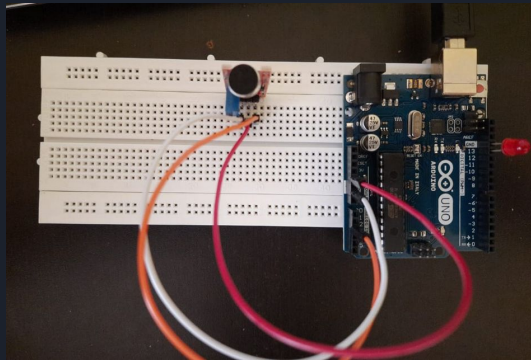


# Sound Detection: Applications

- Consumer electronics such as phones, computers, music systems
- Security and Monitoring systems such as burglar alarms, door alarm, etc.
- Home automation such as lighting your house by detecting whistle/clap instead of physically turning the light switch
- Ambient sound recognition and sound level recognition

# Proposed Circuit

The sound sensor has four pins- two output pins (one analog and one digital), one ground pin, and one positive power pin. We connect the positive power pin to the 5V power pin on the Arduino board and the ground pin to the ground power pin on the board. Then we connect the digital output pin to one of the analog input pins on the board. Then we connect the LED to the 13-pin and the ground pin. The LED acts as the response for our sound detection circuit. The sound sensor also lets us tune the sensitivity of the module.





# Progress Made So Far:

- Studied the working of Arduino UNO both theoretically and practically
- Designed the basic sound detection circuit
- Wrote the code for the basic sound detection circuit with LED output





## Future Direction:

- Debugging the code and fine tuning the sensitivity control for the desired output
- Upgrading the circuit by changing the response and making it more responsive to the intensity of sound.