

MPMC LAB MINI PROJECT REPORT
TOPIC: Ultrasonic Object Detection System with Buzzer
using 8051 Microcontroller

Submitted By Group R12

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AIM

The goal of this project is to create an efficient and reliable object detection system that can be used in various applications such as security systems, robotics, and automation. By interfacing an ultrasonic sensor with an 8051 microcontroller, we can accurately measure distances and trigger appropriate responses.

COMPONENTS REQUIRED

- 8051 Microcontroller
- ISP Module
- Buzzer
- Ultrasonic Sensor (HC-SR04)
- Crystal Oscillator
- Capacitors (22uf)

THEORY

HC-SR04 is an ultrasonic ranging module designed for embedded system projects like this. It has a resolution of 0.3cm and the ranging distance is from 2cm to 500cm. It operates from a 5V DC supply and the standby current is less than 2mA. The module transmits an ultrasonic signal, picks up its echo, measures the time elapsed between the two events and outputs a waveform whose high time is modulated by the measured time which is proportional to the distance. The HC-SR04 has four pins namely Vcc, Trigger, Echo, GND. The trigger signal for starting the transmission is given to this pin. The trigger signal must be a pulse with 10µs high time. When the module receives a valid trigger signal it issues 8 pulses of 40KHz ultrasonic sound from the transmitter. The echo of this sound is picked by the receiver.

WORKING

The ultrasonic sensor emits sound waves (ultrasonic pulses) and measures the time it takes for the waves to bounce back after hitting an object. The reflected waves are sensed by the sensor, and it outputs a logic high (1) to the microcontroller's echo pin (INT0). The microcontroller starts a timer (Timer 0) when the echo pulse is received and stops the timer when the pulse state changes. The value in Timer 0 gives the time period or length of the pulse, which is proportional to the distance to the object.

When the echo pulse is received, the timer starts counting and stops when the pulse state changes. The value in Timer 0 (TH0 and TL0) gives the time period or length of the pulse. The 40KHz pulse train is transmitted just after the 10uS triggering pulse and the echo output is obtained after some more time. The next triggering pulse can be given only after the echo is faded away and this time period is called cycle period. The cycle period for HC-SR04 must not be below 50mS.

PROCEDURE

- Connect the Trigger pin of the HC-SR04 module to any I/O pin of the 8051.
- Connect the Echo pin of the module to interrupt pin INT0 of the microcontroller.
- Connect crystal oscillator and capacitors to 18 and 19 pin
- Connect ISP module to microcontroller
- Connect buzzer to pin P0.1
- Write the assembly language code in Keil uvision software and flash in to the chip

CODE

```
//Ultrasonic Sensor Interfacing with 8051
//Detects object proximity and activates a buzzer
```

```
ORG 0x0000 //Start address
```

```
//Define I/O port addresses
```

```
TRIG_PIN EQU P3.5    //Trigger pin (output)
```

```
ECHO_PIN EQU P3.2    //Echo pin (input)
```

```
BUZZER_PIN EQU P1.0  //Buzzer pin (output)
```

```
//Initialize Timer0 for delay
```

```
MOV TMOD, #01H    //Timer0 in mode 1 (16-bit)
```

```
SETB TRIG_PIN    //Set trigger pin high
```

```
MAIN:
```

```
    CALL SEND_PULSE    //Send ultrasonic pulse
```

```
    CALL MEASURE_DISTANCE    //Calculate distance
```

```
    CJNE R0, #20, NO_BUZZER    //If distance < 20 cm, activate buzzer
```

```
    CLR BUZZER_PIN    //Otherwise, turn off buzzer
```

```
    SJMP MAIN    //Repeat
```

NO_BUZZER:

SETB BUZZER_PIN //Activate buzzer

SJMP MAIN //Repeat

//Subroutine to send ultrasonic pulse

SEND_PULSE:

MOV TH0, #0 //Clear Timer0

MOV TLO, #0

CLR TRIG_PIN // Set trigger pin low

NOP //Wait for 10us (approximate)

NOP

NOP

SETB TRIG_PIN //Set trigger pin high

RET

// Subroutine to measure distance

MEASURE_DISTANCE:

MOV R0, TH0 //Load Timer0 value

MOV A, #59 //Conversion factor for cm

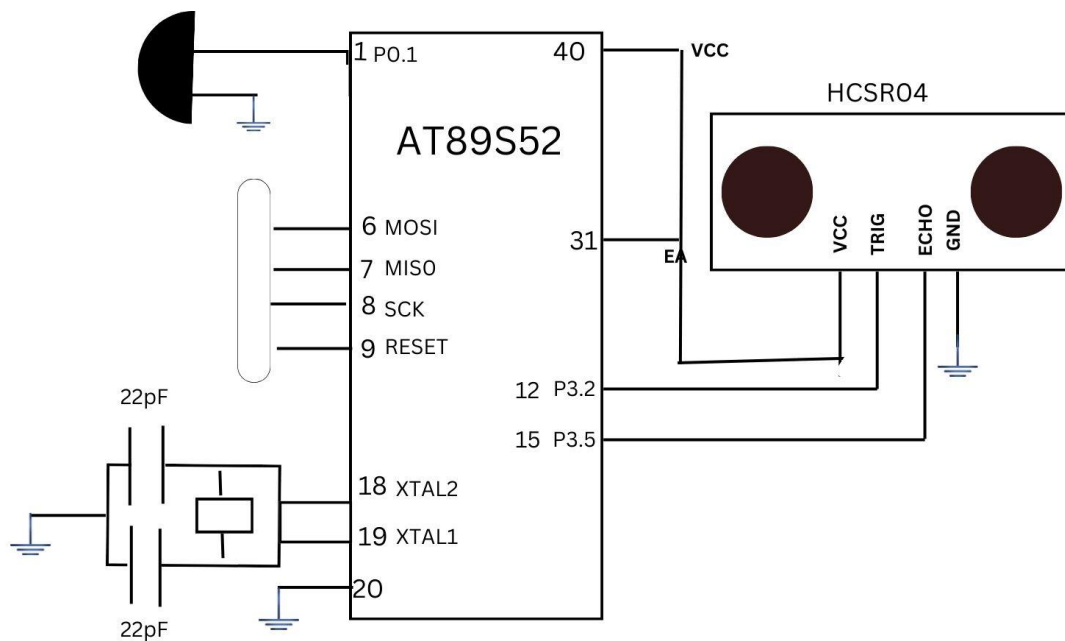
DIV AB //Divide Timer0 by 59

MOV R0, B //Result in R0

RET

END

CIRCUIT



RESULT

The project aims to create an ultrasonic object detection system using an 8051 microcontroller (such as the AT89S52) and an ultrasonic sensor. The Ultrasonic Object Detection System with Buzzer Intensity Control demonstrates an effective way to detect objects and provide audible alerts. This project can be further enhanced by adding additional features such as LCD display, multiple sensors, and real-time monitoring.

Inferences:

Distance Measurement: The ultrasonic sensor calculates the distance to the object based on the time taken for the ultrasonic waves to bounce back.

Threshold Setting: The system can be configured with a specific threshold distance. If an object is closer than this threshold, the buzzer is activated.

Applications:

Parking Assist: Can be used in parking systems to alert drivers when they are too close to obstacles.

Security Systems: Detects intruders or unauthorized access.

Industrial Automation: Monitors object presence on conveyor belts or assembly lines.

Overall, this project demonstrates the practical application of ultrasonic sensors and microcontrollers in real-world scenarios.

