

# PROJECT REPORT



## *Ultrasonic distance measurement using 8051 microcontroller*

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**Slot:** A2

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## **ABSTRACT**

This is an ultrasonic range finder circuit made using a type of 8051 microcontroller. Here we use AT89s51 microcontroller and an ultrasonic transducer module HC-SR04. The ultrasonic module sends a signal to the object, then picks up its echo and outputs a waveform whose time period is proportional to the distance. The microcontroller accepts this signal, performs necessary processing and displays the corresponding distance on the 3 digit seven segment display. This circuit can be used for parking cars or in robotics for motion judgement.

## WORKFLOW

- AT89s51 microcontroller and the ultrasonic transducer module HC-SR04 are the main component of the circuit.
- Ultrasonic module sends a signal which echoes back after being reflected from the object and this time is proportional to the distance.
- The microcontroller accepts this signal, performs necessary processing and displays the corresponding distance on the 3 digit seven segment display.

The ultrasonic module is interfaced to the microcontroller through P3.0 and P3.1 pins. Port0 used for transmitting the 8 bit display data to the display and port pins P1.0, P1.1, P1.2 are used for transmitting display drive signals for the corresponding display units D1, D2, D3. Push button switch S1, capacitor C3 and resistor R9 forms a de-bouncing reset circuitry. Capacitors C1,C2 and crystal X1 are associated with the clock circuit.

Port 0 and Port 1 are set as output ports for sending digit drive patterns and digit drive signals respectively. Port pin 3.0 is set as an output pin for sending the trigger signal to the ultrasonic module for starting transmission and port pin 3.1 is set as an input pin for receiving the echo. When 10  $\mu$ S pulse is given to the Ultrasonic Module HC 04 ,it sends eight 40kHz pulse whose echo comes back after reflecting from object, pulse width is directly proportional to the distance. Now the distance is calculated by using the formula  $\text{echo pulse width in } \mu\text{S} / 58 \text{ cm}$  in through the microcontroller and the output is displayed using seven segment display using port P1 and when the distance crosses a threshold value set by instructor it glows the led.

## THEORY

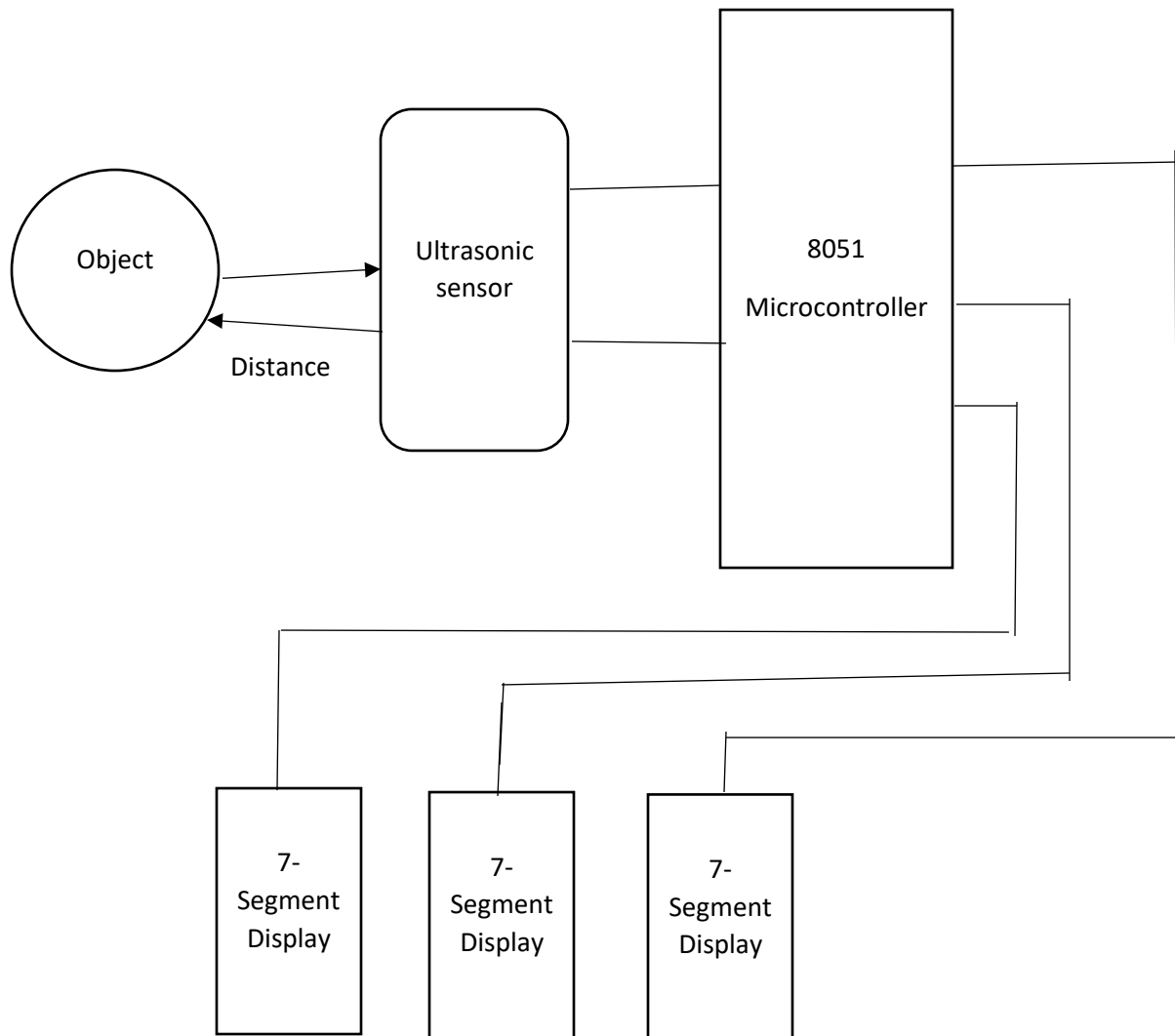
HC-SR04 is an ultrasonic ranging module designed for embedded system projects like this. It has a resolution of 0.3cm and the ranging distance is from 2cm to 500cm. It operates from a 5V DC supply and the standby current is less than 2mA. The module transmits an ultrasonic signal, picks up its echo, 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 supporting circuits fabricated on the module makes it almost stand alone and what the programmer need to do is to send a trigger signal to it for initiating transmission and receive the echo signal from it for distance calculation. The HR-SR04 has four pins namely Vcc, Trigger, Echo, GND and they are explained in detail below.

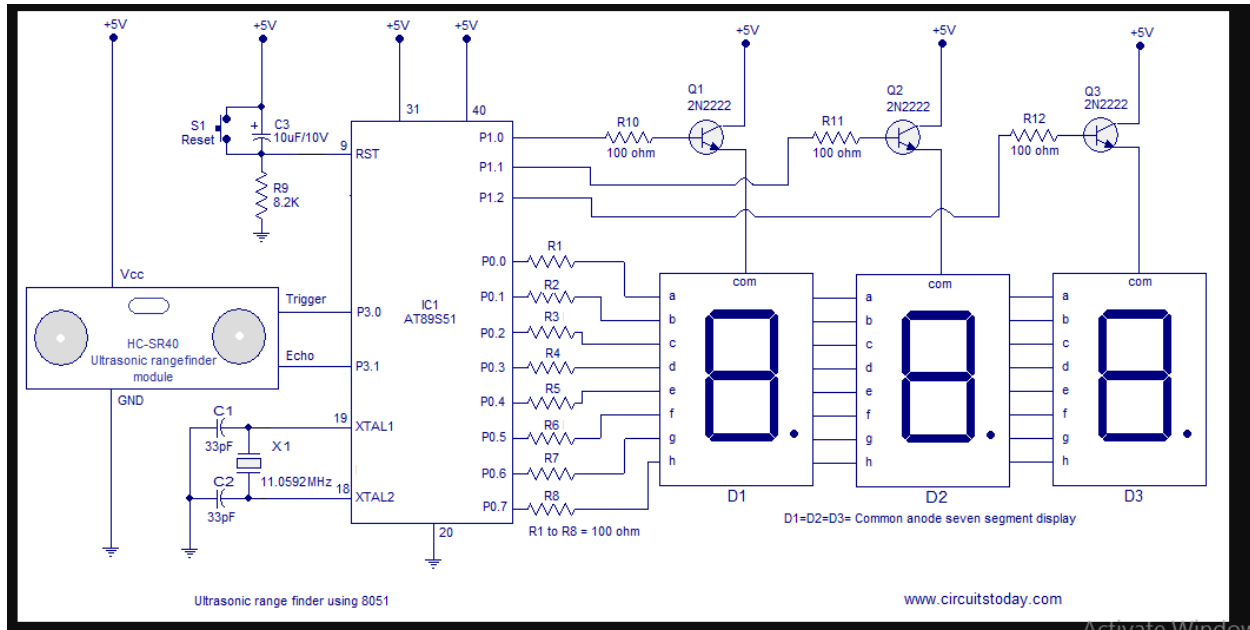
- 1) **VCC:** 5V DC supply voltage is connected to this pin.
- 2) **Trigger:** The trigger signal for starting the transmission is given to this pin. The trigger signal must be a pulse with 10uS high time. When the module receives a valid trigger signal it issues 8 pulses of 40 KHz ultrasonic sound from the transmitter. The echo of this sound is picked by the receiver.
- 3) **Echo:** At this pin, the module outputs a waveform with high time proportional to the distance.
- 4) **GND:** Ground is connected to this pin.

Distance in cm = echo pulse width in uS/58

# BLOCK DIAGRAM



# CIRCUIT DIAGRAM



## **RESULT & DISCUSSIONS**

This project detects the exact distance from any device and gives a response if distance is less than a certain value to avoid collision.

## **ADVANTAGE**

- Obstacle collide avoidance
- automotive parking sensors
- obstacle warning systems
- terrain monitoring robots
- industrial distance measurements

## **DISADVANTAGE**

- Range is small
- Less accuracy



## **CONCLUSION**

Hence project has been completed successfully.

## **FUTURE WORK**

Finding new applications to apply this method and keeps on improving human surrounding so that he/she can live in comfort.

## REFERENCE

- ▶ Circuits today
- ▶ Electronic hub