RANGE FINDER USING 8051

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Acknowlegdement

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NIT Rourkela

Abhilipsha Sahu
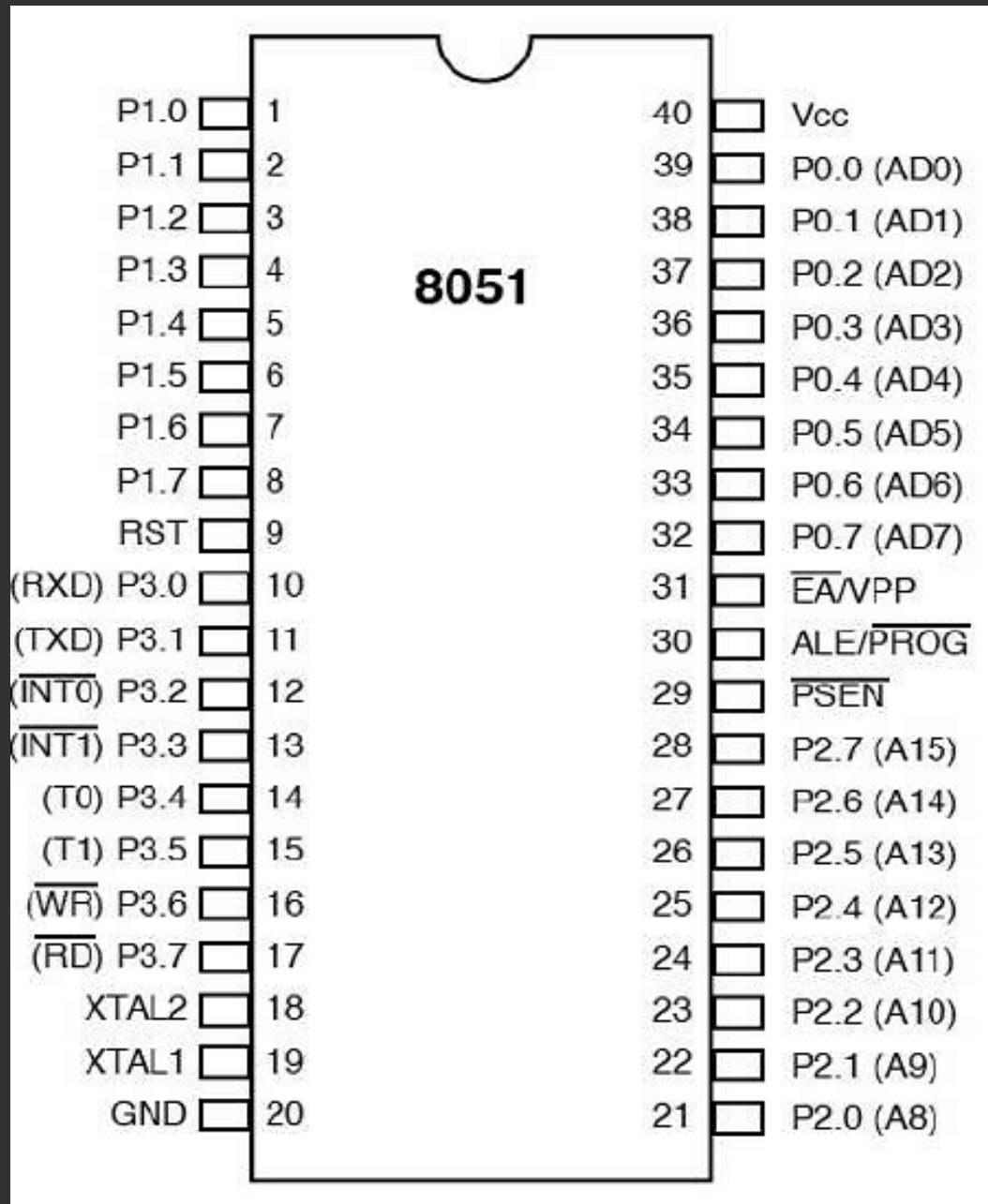Bismay Pradhan
Himanshu Sinha

Abstract

In this paper we shall study how a 8051 microcontroller is interfaced with an ultrasonic sensor and has been used to measure the length . A ultrasonic sensor work by emitting sound waves at a frequency ranging from 23khz to 40 kHz. The Ultrasonic Sensors used can achieve the 1% to 3% accuracy under perfectly controlled conditions . Ultrasonic sensors are used as proximity sensors , in automobile self-parking technology , anti-Collison safety systems and as well as robotic obstacle detection systems. Further the circuit has been simulated using PROTEUS Demo version .

Components used :-

- ATMEL 89S52 (8051 based microcontroller)
- 8051 Development Board
- ATMEGA 8L Development Board
- HC- SR04(Ultrasonic Sensor Module)
- 7 Segment Displays
- Transistors(npn type)

ATMEL 89S52 (8051 based microcontroller)

Pin			Pin
P1.0	1	40	Vcc
P1.1	2	39	P0.0 (AD0)
P1.2	3	38	P0.1 (AD1)
P1.3	4	37	P0.2 (AD2)
P1.4	5	36	P0.3 (AD3)
P1.5	6	35	P0.4 (AD4)
P1.6	7	34	P0.5 (AD5)
P1.7	8	33	P0.6 (AD6)
RST	9	32	P0.7 (AD7)
(RXD) P3.0	10	31	$\overline{EA}$/VPP
(TXD) P3.1	11	30	ALE/$\overline{PROG}$
($\overline{INT0}$) P3.2	12	29	$\overline{PSEN}$
($\overline{INT1}$) P3.3	13	28	P2.7 (A15)
(T0) P3.4	14	27	P2.6 (A14)
(T1) P3.5	15	26	P2.5 (A13)
($\overline{WR}$) P3.6	16	25	P2.4 (A12)
($\overline{RD}$) P3.7	17	24	P2.3 (A11)
XTAL2	18	23	P2.2 (A10)
XTAL1	19	22	P2.1 (A9)
GND	20	21	P2.0 (A8)

8051

Specifications

8051 microcontroller is designed by Intel in 1981. It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, and 2 16-bit timers. It consists of four parallel 8-bit ports, which are programmable as well as addressable as per the requirement. An on-chip crystal oscillator is integrated in the microcontroller having a crystal frequency of 12 MHz.

8051 embedded in 8051 Development board
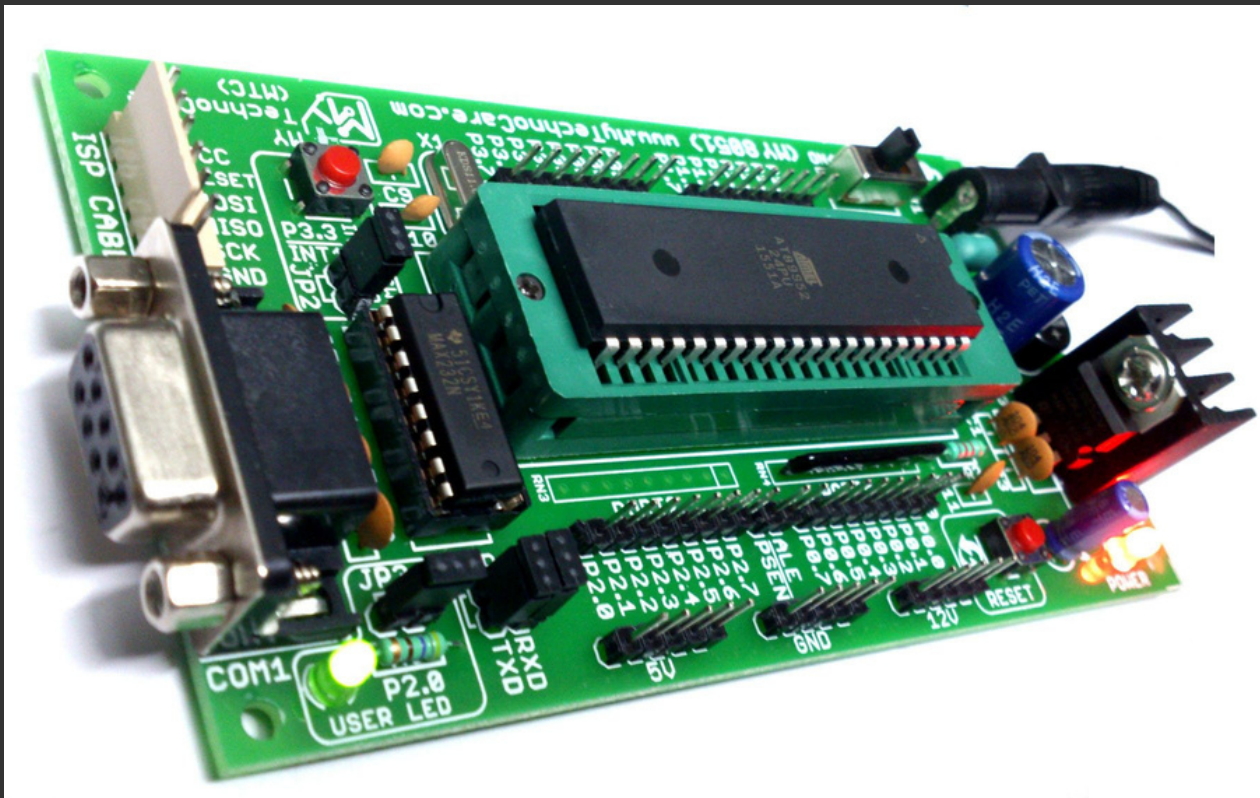
Pin Specifications of 8051

- Vcc - This port will give the supply voltage to the microcontroller.
- GND - This pin is connected to the ground
- Port 0 - Port 0 is an 8-bit open drain bidirectional I/O port. It is also multiplexed low-order address/data bus.
- Port 1- Port 1 is an 8-bit bidirectional I/O port with internal pullups.
- Port 2- Port 2 is an 8-bit bidirectional I/O port with internal pullups.
- Port 3- Port 3 is an 8-bit bidirectional I/O port with internal pullups.
- RST - A high on this pin resets the microcontroller.
- (ALE/(PROG))¯ - Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during access to external memory. This pin is also the program pulse input (PROG) during Flash programming.

- (PSEN)¯ - Program Store Enable (PSEN Bar) is the read strobe to external program memory.
- (EA)¯ - It is basically External Access Enable. EA Bar must be strapped to GND in order to enable the device to fetch code from external program memory locations.
- XTAL1-Gives input to the inverting oscillator amplifier and input to the internal clock operating circuit.
- XTAL2-Takes output from the inverting oscillator amplifier.

Atmega 8L

- High performance, Low power Atmel 8 bit Microcontroller
- Advanced RISC Architecture
- 8 KB of In-system self-programmable flash program memory
- 512 bytes EPROM
- Two 8-bit Timer/Counters and one 16-bit counter
- Programmable serial USART
- Master/Slave SPI Serial Interface
- 23 programmable I/O lines
- Operating Voltages between 2.7V - 5.5V
- speed Grades of 0 - 8 MHz

PIN Diagram (ATmega 8L)

(RESET) PC6	1	28	PC5 (ADC5/SCL)
(RXD) PD0	2	27	PC4 (ADC4/SDA)
(TXD) PD1	3	26	PC3 (ADC3)
(INT0) PD2	4	25	PC2 (ADC2)
(INT1) PD3	5	24	PC1 (ADC1)
(XCK/T0) PD4	6	23	PC0 (ADC0)
VCC	7	22	GND
GND	8	21	AREF
(XTAL1/TOSC1) PB6	9	20	AVCC
(XTAL2/TOSC2) PB7	10	19	PB5 (SCK)
(T1) PD5	11	18	PB4 (MISO)
(AIN0) PD6	12	17	PB3 (MOSI/OC2)
(AIN1) PD7	13	16	PB2 ($\overline{SS}$/OC1B)
(ICP1) PB0	14	15	PB1 (OC1A)

## Atmega 8L Development Board
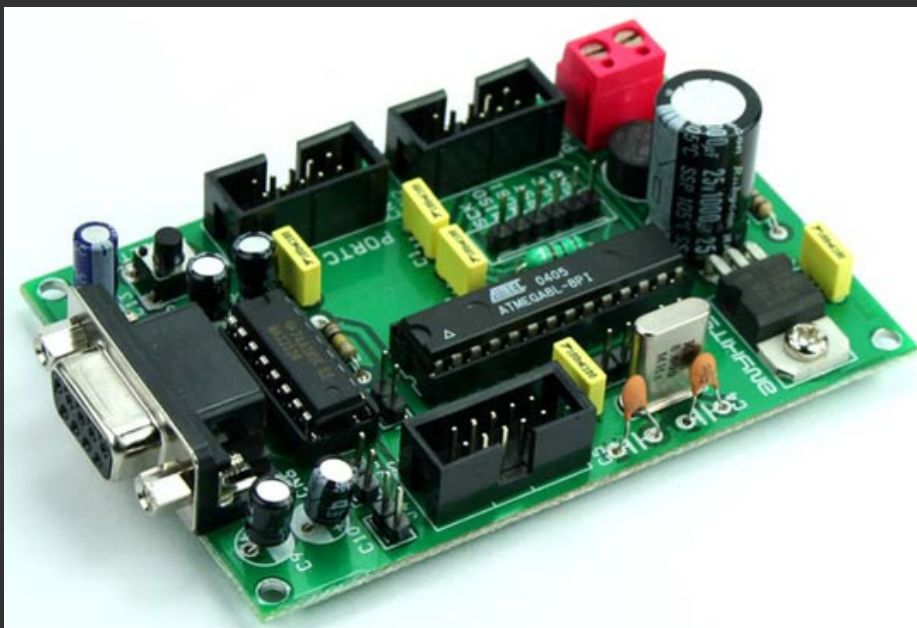
HC SR-04(Ultrasonic Sensor)

HC SR04 is a module used for non-contact distance measurement for distances from 2cm to 400cm. It uses sonar (like bats and dolphins) to measure distance with high accuracy and stable readings. It consists of an ultrasonic transmitter, receiver and control circuit. The transmitter transmits short bursts which gets reflected by target and are picked up by the receiver. The time difference between transmission and reception of ultrasonic signals is calculated.
Using the speed of sound and

'Speed = Distance/Time'

equation, the distance between the source and target can be easily calculated.
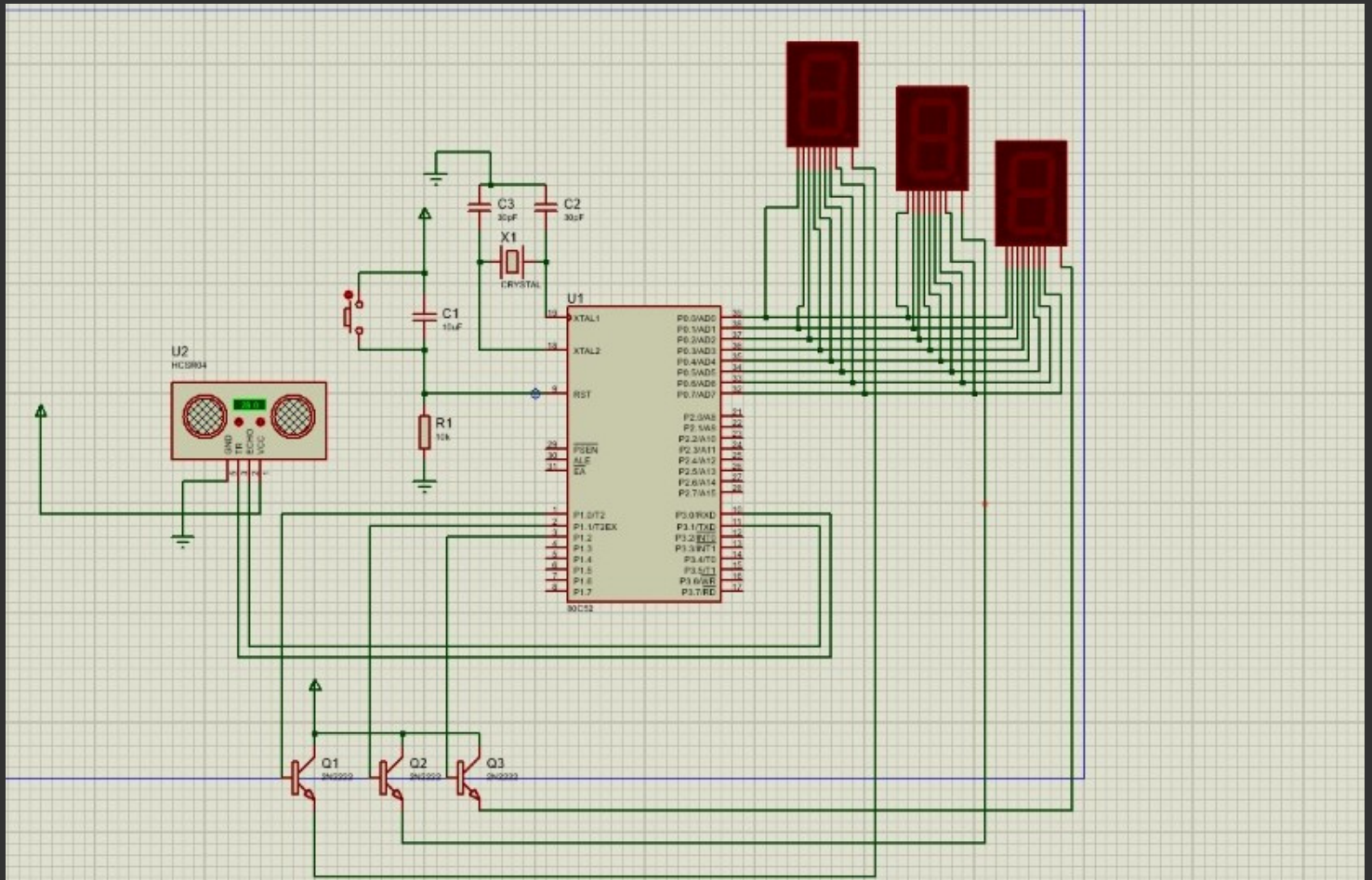
PIN Diagram (HC sr-04)
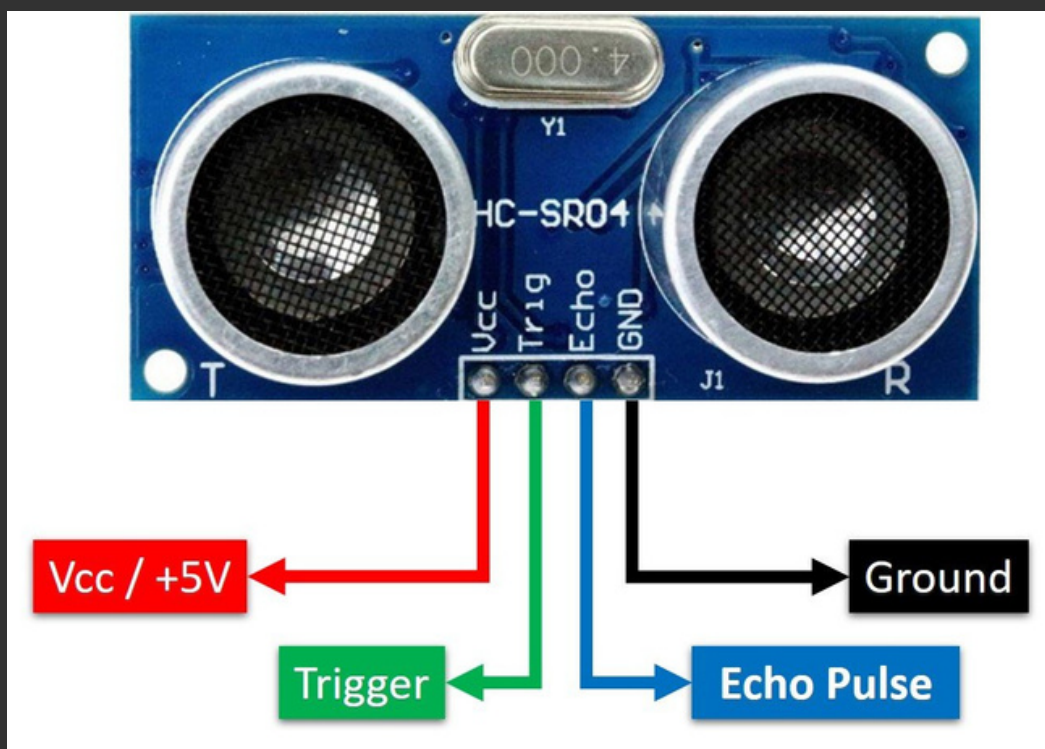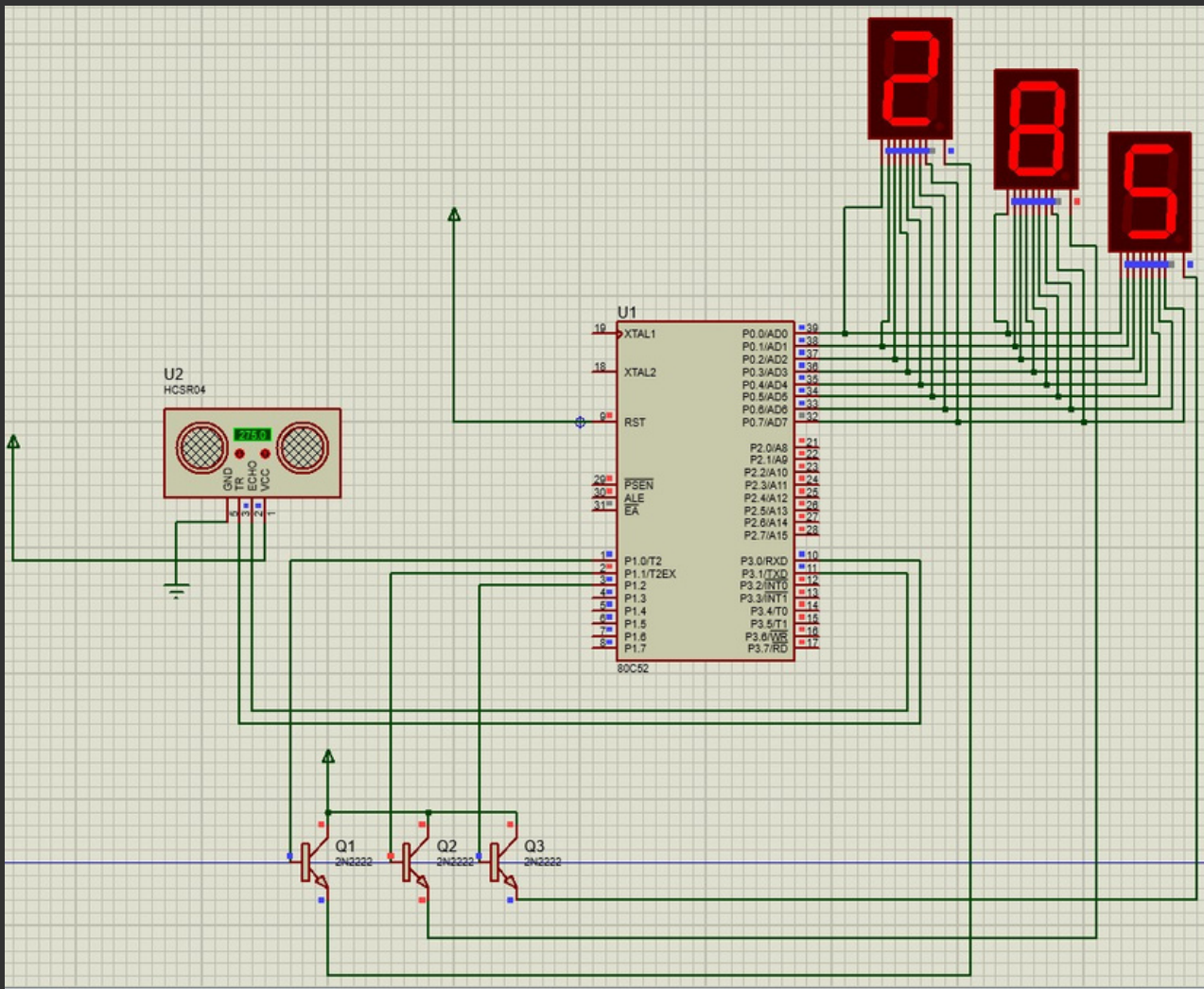
Pin Specifications Of HC - SR 04

HC-SR04 ultrasonic distance sensor module has four pins:

- VCC — 5V, input power
- TRIG — Trigger Input
- ECHO — Echo Output
- GND — Ground
- Trig -> Trigger activates the sensor and connect to GIO output pin
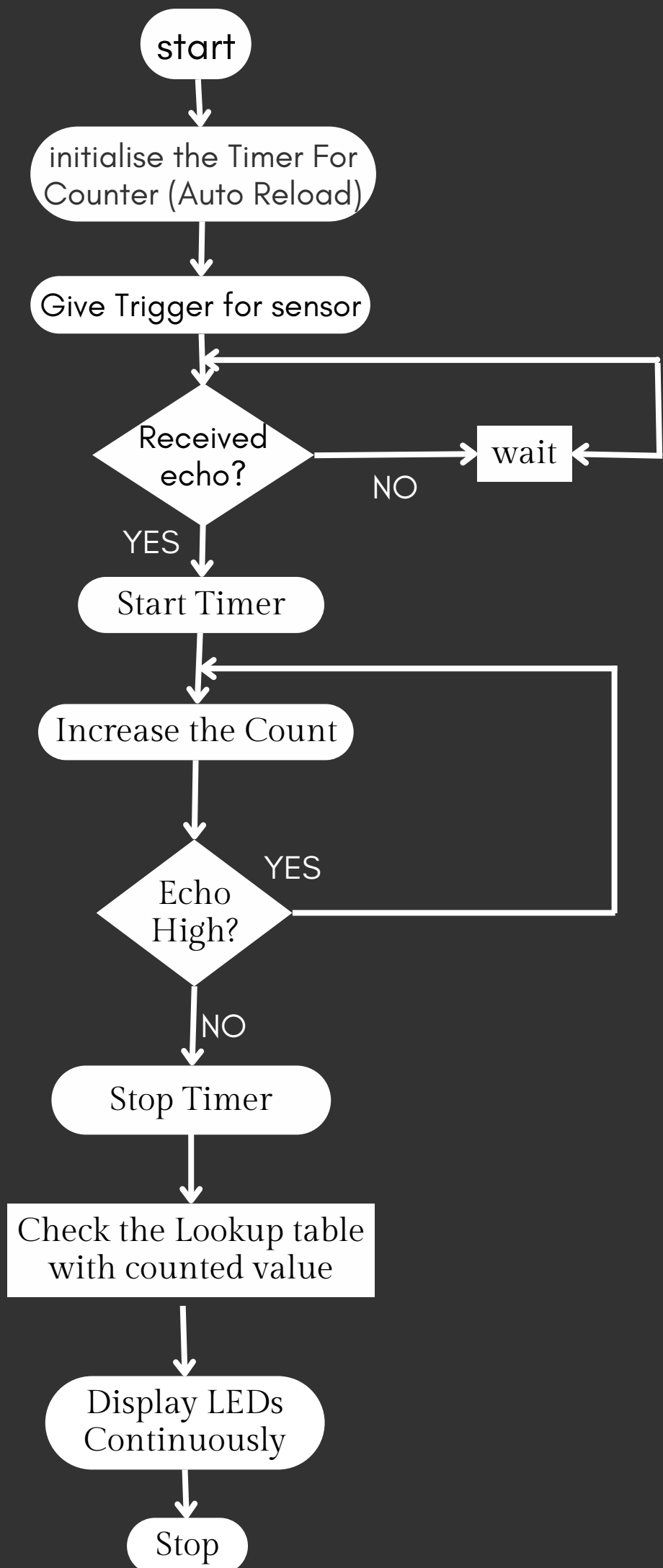- Echo -> Receives the signal, read by GPIO input pin

Circuit Diagram

Results

Output File:-
https://github.com/Bismay27/8051-RangeFinder

WorkFlow

start
↓
initialise the Timer For Counter (Auto Reload)
↓
Give Trigger for sensor
↓
Received echo? —NO→ wait
↓ YES
Start Timer
↓
Increase the Count
↓
Echo High? —YES→ (loops back to Increase the Count)
↓ NO
Stop Timer
↓
Check the Lookup table with counted value
↓
Display LEDs Continuously
↓
Stop

Conclusion

The project of finding length , height, width was conducted successfully using Proteus demo version. The errors came out within the range of +5 to -5% due to improper time cycle calculation and within accuracy of ultrasonic sensor. This Project can be used in places where using a measuring tape becomes difficult such as measuring the height of room. Moreover the efficiency of this project can be increased by using better ultrasonic sensors such as GY- US 42 etc.

References

- Programming and Customising the 8051 microcontroller *by Myke Predko*
- The 8051 Microcontroller based embedded systems *by Manish K. Patel*
- *https://www.electronicshub.org/*
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