CSE316 Microcontroller Project

4x4x4 LED CUBE

by

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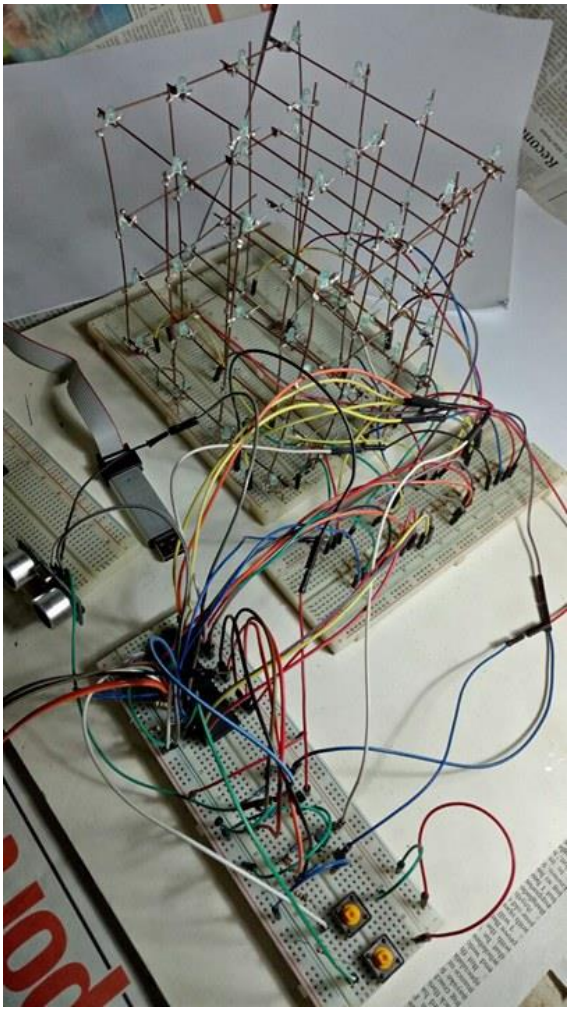

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Introduction

Our project consists of building a 3 dimensional LED array that will be able to display various graphics through the concept of persistence of vision. The LED cube will be able to change designs on button click. There are two buttons, a NEXT button for the next design and a PREVIOUS button for the previous design.

We have used a total of 4x4x4 = 64 cubes for this project that outputs different designs.

We have also used Sonar Sensor (HC-SR04) that changes its design as we approach towards it or go far away from it

Hardware Requirements

Hardware : List of hardwares

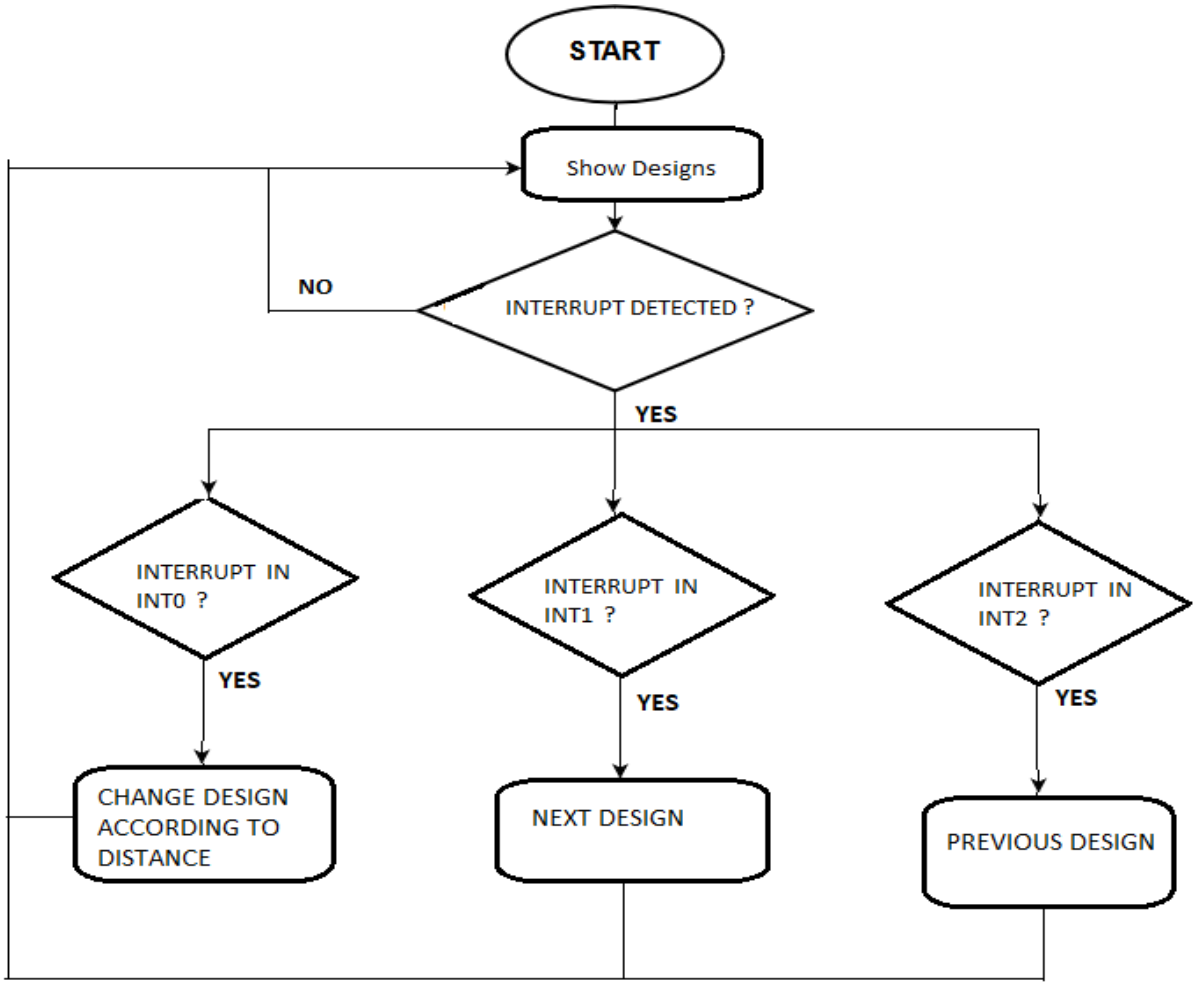
Equipments
Atmega32 microcontroller
Sonar Sensor (HC-SR04)
64 Blue LEDs
BreadBoards
4 NPN Transistors
Thick wires
Resistors
Capacitors
2 Push Button Switches
Male-Male, Male-Female Wires
USB ISP 2.0 AVR Programmer

Software Requirements

List of **Softwares used**

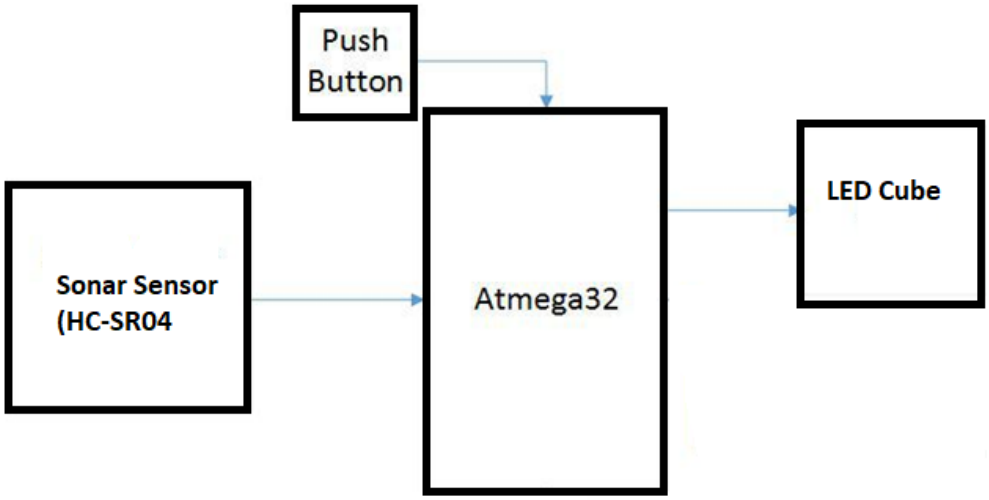
- ATmel Studio 6.2 (to compile .c code and build .hex file)
- eXtreme Burner - AVR (to load .hex file onto ATmega32)
- Proteus 8 Professional (for circuit design)

Flowchart


START
Show Designs
INTERRUPT DETECTED ?
NO
YES
INTERRUPT IN INT0 ?
INTERRUPT IN INT1 ?
INTERRUPT IN INT2 ?
YES
YES
YES
CHANGE DESIGN ACCORDING TO DISTANCE
NEXT DESIGN
PREVIOUS DESIGN

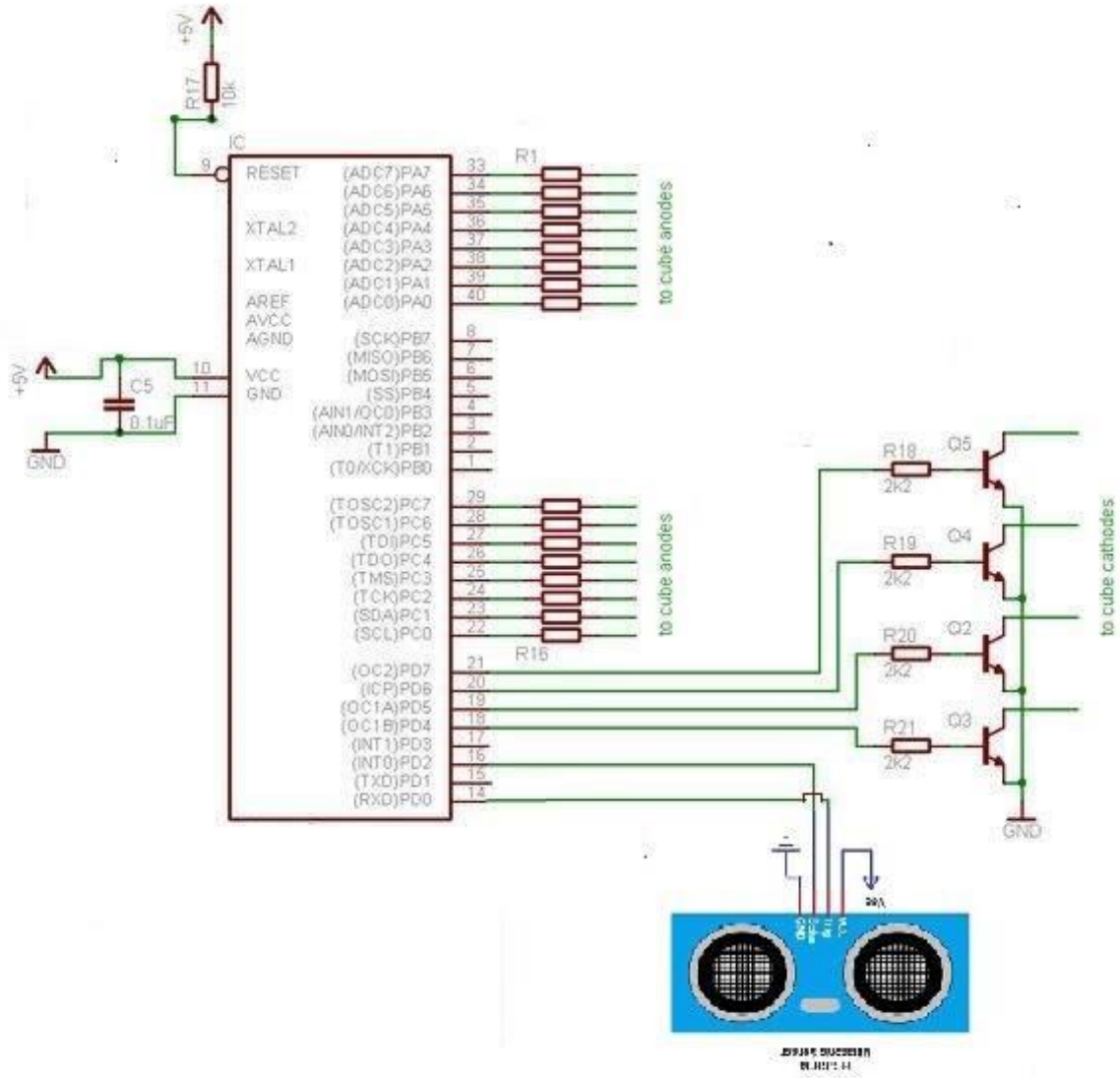
Block Diagram

showing **Input and Output**



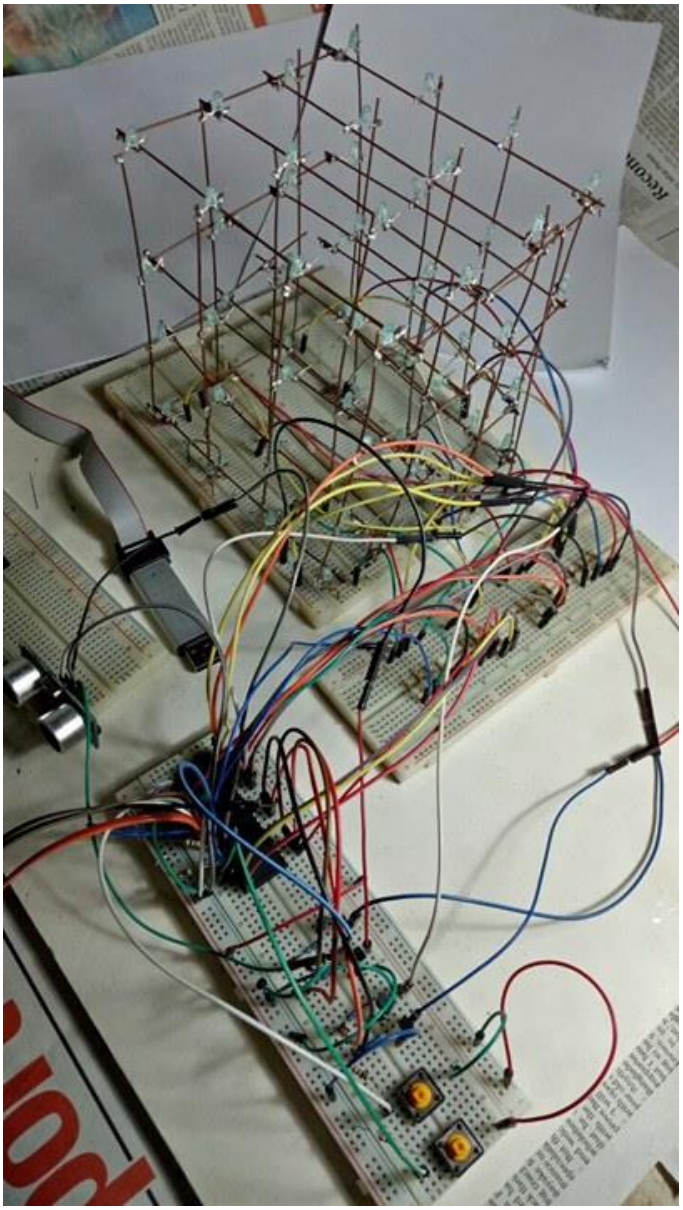
Circuit Diagram

showing **Complete Connection**



Actual Circuit

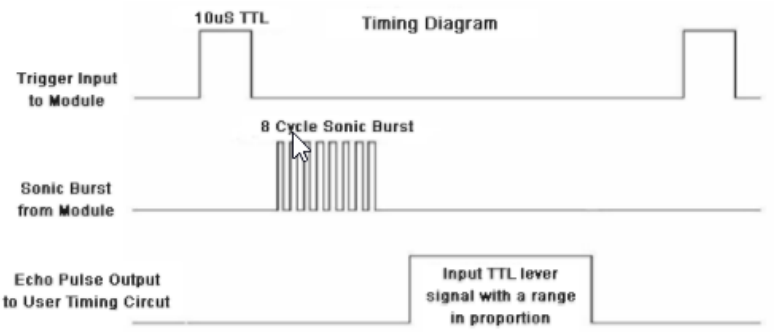
Snapshot **of the working circuit.**



Description of Hardwares used

Describing **all the hardware parts and their connections.**

Sonar Sensor (HC-SR04): Sonar sensor is a device that can measure the distance to an object by using sound waves. **Sonar sensor "HC-SR04"** provides an output signal proportional to distance based on the echo. The sensor here generates a sound vibration in ultrasonic range upon giving a trigger, after that it waits for the sound vibration to return. Now based on the parameters, sound speed (220m/s) and time taken for the echo to reach the source, it provides output pulse proportional to distance.



As in the figure, first we need To initiate the sensor for measuring distance, that is a HIGH logic signal at trigger pin of sensor for more than 10uS, after that a sound vibration is sent by sensor, after a echo, the sensor provides a signal at the output pin whose width is proportional to distance between source and obstacle.

This distance is calculate as, distance (in cm) = width of pulse output (in uS) / 58. Here the width of the signal must be taken in multiple of uS(micro second or 10^-6

USB ISP Programmer

This was used to burn the .hex and .eep file into the Atmega32 flash memory and EEPROM. It is powered off of 5V USB bus. Our whole project is powered using its USB port power supply.

Push Button: Push button is basically a small controlling device that is pressed to operate any electrical device. In this article we use push button with AVR microcontroller Atmega32 to give you a basic of idea how to develop codes for controlling device.

In this project we used two push buttons for the purposes of changing the designs. We used interrupt INT1 and INT2 on our project for the push button where pushing the button with INT1 lead us to next design whereas INT2 button lead us to previous design.

Problems Faced

Describing **the practical issues and observations made while putting the project together.**

- First of all, to make the 4x4x4 LED Cube was more difficult than we had expected. Soldering took a lot of time and required a lot of patience.
- To make the circuit more cleaner, we first preferred to use Veroboard, but it didn't work out well. So we shifted to using the male-male, male-female wires.
- ATmega 32 that we had bought earlier had some internal problems, it took quite a time to understand this while we were thinking there is error in our code.
- We had quite a problem in setting the interrupt of both push buttons and sensor together, while it was working fine while setting the interrupt of these in different codes.
- Overall, both the hardware implementation and software implementation was quite difficult than expected.