AUTOMATIC TRAFFIC LIGHT CONTROLLER USING 8051 MICROCONTROLLER

Mini Project Report

Bachelor of Technology
In
Electronics and Communication Engineering

Under the Guidance of

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CERTIFICATE

This is to certify that the project entitled, "**Automatic Traffic Light Controller using 8051 Microcontroller**", submitted by group

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ABSTRACT

Traffic control is the big issue in today's era. Traffic jam is one of the major problems in a densely populated city like whereas its population and number of running vehicles are much more than its capacity. Faulty traffic signaling systems, inadequate manpower, narrow road spaces and overtaking tendency of drivers create pro-longed traffic jams. Due to traffic jam a substantial portion of working hours have to be left on streets which indirectly put adverse impact on economy and unavoidable road accident which results loss of lives. The number of vehicles is ever increasing while the city infrastructures are developing at a much slower rate. The management of traffic in big cities is also a tough job and only manual efforts can't stop this kind of problem so we need machines. Today's traffic control system is able to handle such a situation but not that much effectively because they are static in nature. We need a system which is dynamic in nature so that it can handle traffic smoothly and such a system called Automatic Traffic Control System. Here we are creating the same dynamic traffic control system which has the ability to control the traffic as well as avoid the congestion of roads. It provides the instruction to the driver whether to drive through the intersection or yield at the intersection. In this report we proposed four methods of automatic traffic light control system using digital circuits as well as using microprocessor and microcontroller.

CONTENTS

1. INTRODUCTION

Traffic lights are used to control the vehicular traffic. In the modern era, everyone has different types of vehicles resulting in rise to the numbers of vehicles. That's why traffic lights are mandatory to avoid the traffic jams and accidents. There are three lights in the traffic signal, having different message for the drivers. Red light asks the driver to yield at the intersection, green light gives the driver free license to drive through the inter section whereas yellow light alerts the driver to wait if the next light is red one or get ready to go / turn the engine ON if the green light is next.

The basic idea behind the design is to avoid the collision of vehicles by providing appropriate signals to different directions for a limited time slot, after which the next waiting drivers will be given same treatment. In this way, a cycle will be established which will control the traffic.

Traffic control devices are markers, signs and signal devices used to inform guide and control traffic, including pedestrians, motor vehicle drivers and bicyclists. These devices are usually placed adjacent, over or along the highways, roads, traffic facilities and other public areas that required traffic control. Traffic management is one of the most critical issues faced by any cities with growing purchasing capacity of citizens and for the luxury that it offers, the number of vehicle increasing exponentially. Traffic management is one of the most critical issues faced by any cities with growing purchasing capacity of citizens and for the luxury that it offers, the

number of vehicles is increasing exponentially. The number of vehicles newly registered in India in the year 1951 was 306, in the year 1975 it was 2472, in the year 2000 it was 48857, while in the year 2011 it rise to 141866. Thus it can be seen that the increase in the number of vehicles has been exponential. Traffic signals are used to control the flow of vehicles. In the recent years, the need of transportation has gain immense importance for logistics as well as for common human. This has given rise to the number of vehicles on the road. Due to this reason, traffic jams and road accidents are a common sight in any busy city. Traffic signals provide an easy, cheap, automatic and justified solution to the road points where the vehicles may turn to their direction e.g. round about, culverts etc.

In India Transportation via road is the most widely used mode of transport throughout the country. Annually there large amount of increment in vehicles and it corresponds in increased number of road users. Metro cities like Guwahati are facing the problems like road jams and the problems like congestions are needed to be sort out and this is impossible by normal traffic lights. Unfortunately these traffic controlling using lights which is currently exist have outlived their purpose and as a result it is unable to handle number of vehicles on roads and also results in congestion which exists in most of the part of the cities in our country. But there are many other ways to improve the currently existing system one of them is by introducing automatic traffic control methods to control roadside vehicles and infrastructure as the number of road users are increasing rapidly.

2. LITERATURE REVIEW

2.1. AIM

Designing and analysis of different Automatic Traffic control system is the main concern here. Automatic traffic light control system can provides travel opportunities and additional travel choices for more people in more ways, wherever they live, work and play, regardless of age or disability.

The aims of this project work are:

- To design and implement an automatic traffic control system.
- To develop a suitable algorithm to implement the design.
- To simulate the automatic traffic control.

2.2. OBJECTIVE

The first objective is to make each of the traffic lights or semaphores smart. That is, aware of the time of day, basic turn red, green or yellow rules and perhaps what traffic looks like in all directions based upon locally mounted signals . In achieving these aims,

the following objectives will also be followed:

- To design a simple system that is easily adaptable to the existing traffic conditions at the junction, involving a minimum of physical changes in the intersection.
- To reduce the stress of the traffic warder.
- To reduce the occurrence of possible accident.

3. THEORY OF THE PROJECT

3.1. COMPONENTS SPECIFICATION

3.1.1. MICROCONTROLLER

The name itself specifies its meaning by splitting the word micro-controller into two MICRO is derived from a Greek word Micros which means small (in size, quantity, number and dignity) and Controller is the logic circuitry that does the control action based on the program written. A single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit that is being used to operate or to control a machine using fixed program that is stored in nonvolatile memory is known as a Microcontroller. Also called a "computer on a chip," or on chip microcomputer.

3.1.1A. 8051 MICROCONTROLLER

It is Very popular general purpose microcontroller. Widely used for small scale embedded systems. It was introduced by Intel in 1971.At that time it was known as System on Chip. This family is known as MCS 51 family. Other members are 8031 and 8052. 8031 is the cut down version of 8051 and 8052 is the enhanced version of 8051. Many vendors such as Atmel, Philips, and Texas Instruments produce MCS-51 family microcontroller chips. 8-bit microcontroller. It has 8 bit data bus and 16-bit address bus. It can address a 64K(216) byte code memory space and a separate 64K byte of data memory space. It has various Special Function

Registers (SFR) such as the Accumulator, the B register, and many other control registers. 34 8-bit general purpose registers in total.

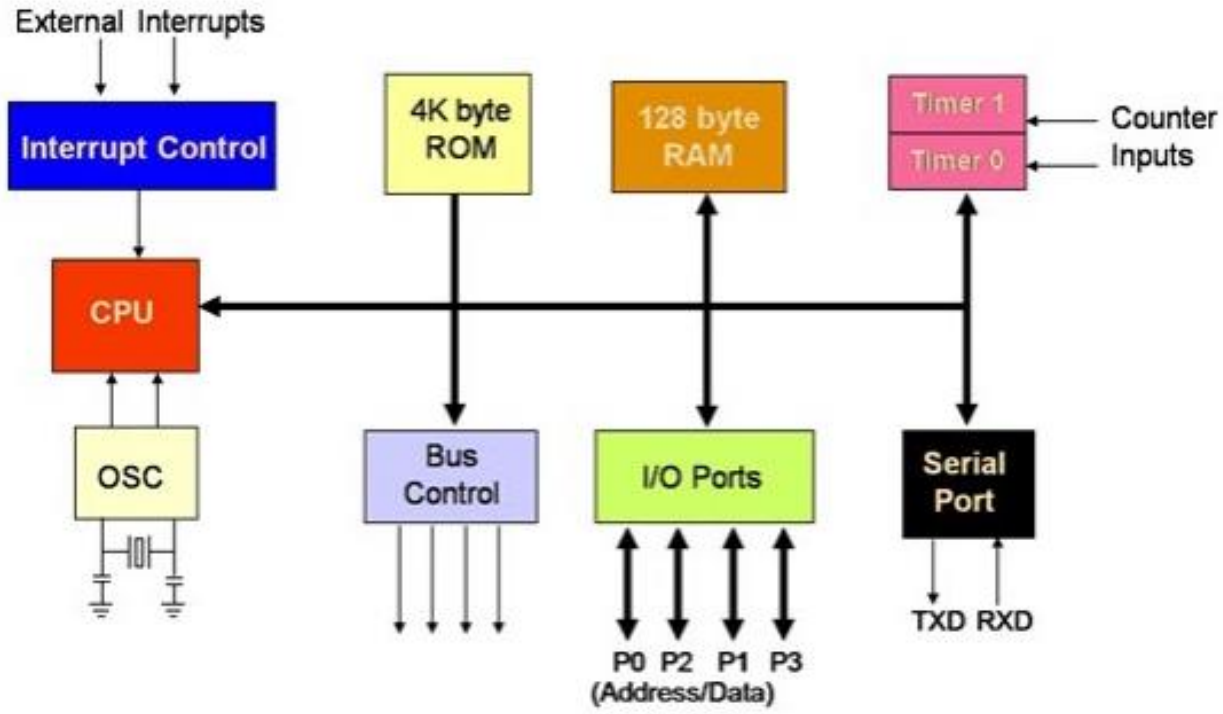

Fig : Block diagram of 8051 microcontroller

Vcc(pin 40): Vcc provides supply voltage to the chip. The voltage source is +5V. GND(pin 20):Ground XTAL1 and XTAL2(pins 19,18):These 2 pins provide external clock.

***EA*(pin 31):** The *EA* (External Access) pin is used to control the internal or external memory access. The signal 0 is for external memory access and signal 1 for internal memory access

- There is no on-chip ROM in 8031 and 8032 .
- The *EA* pin is connected to GND to indicate the code is stored externally.

***PSEN* (pin 29):** Program store enable This is an output pin and is connected to the OE pin of the ROM. The *PSEN* (Program Store

Enable) is for reading external code memory when it is low (0) and *EA* is also 0. The ALE (Address Latch Enable) activates the port 0 joined with port 2 to provide 16 bit external address bus to access the external memory. The ALE multiplexes the P0: 1 for latching address on P0 as A0-A7 in the 16 bit address buss, 0 for latching P0 as data I/O.

- *PSEN* and ALE are used for external ROM
- For 8051, *EA* pin is connected to Vcc

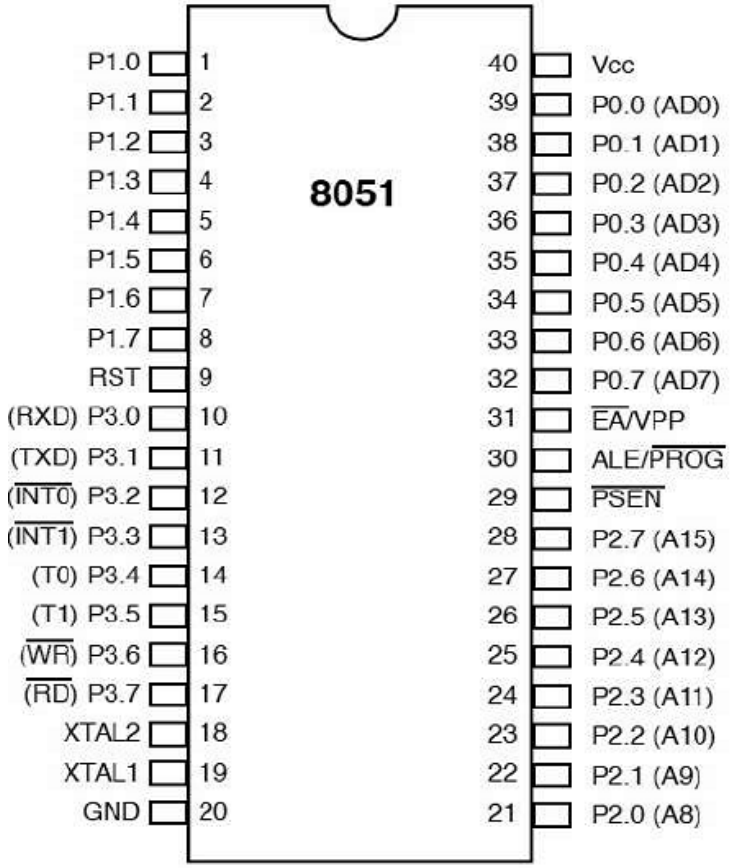

Fig : Pin Diagram of 8051 Microcontroller

RST(pin 9): Reset

It is an input pin and is active high normally low. The high pulse must be high at least 2 machine cycles.

4 I/O port take 32 pins(4 x 8 bits) plus a pair of XTALS pins for crystal clock . A pair of timer pins for timing controls, a group of pins *EA*, ALE, *PSEN*, *WR*, *RD* for internal and external data and code memory access controls .

The 8051 requires an external oscillator circuit. The oscillator circuitusually runs around 12MHz. The crystal generates 12M pulses in one second. The pulse is used to synchronize the system operation in a controlled pace. An 8051 machine cycle consists of 12 crystal pulses (clock cycle). The first 6 crystal pulses (clock cycle) is used to fetch the opcode and the second 6 pulses are used to perform the operation on the operands in the ALU. Port P1 (Pins 1 to 8): The port P1 is a port dedicated for general I/O purpose. The other ports P0, P2 and P3 have dual roles in addition to their basic I/O function.

Port P0 (pins 32 to 39): When the external memory access is required then Port P0 is multiplexed for address bus and data bus that can be used to access external memory in conjunction with port P2. P0 acts as A0-A7 in address bus and D0-D7 for port data. It can be used for general purpose I/O if no external memory presents.

Port P2 (pins 21 to 28): Similar to P0, the port P2 can also play a role (A8-A15) in the address bus in conjunction with Port P0 to access external memory.

Port P3 (Pins 10 to 17): P3.0 can be used for serial receive input pin(RXD) P3.1 can be used for serial transmit output pin(TXD) in a serial port, P3.2 and P3.3 can be used as external interrupt pins(INT0' and INT1'), P3.4 and P3.5 are used for external counter input pins(T0 and T1), P3.6 and P3.7 can be used as external data memory write and read control signal pins(WR' and RD')read and write pins for memory access.

Micro-controller works according to the program written in it. The program is written in such a way, so that this controller energizes or de-energizes the relays according to the information received by the pushbuttons and the sensing probe. The 8051 series of microcontrollers are highly integrated single Chip microcomputers with an 8-bit CPU, memory, interrupt controller, timers, Serial I/O and digital I/O on a single piece of silicon.

The 8051 is an 8-bit Machine. Its memory is organized in bytes and practically all its instruction deal with byte quantities. It uses an Accumulator as the primary register for instruction Results. Other operands can be accessed using one of the four different addressing modes available: register implicit, direct, indirect or immediate. Operands reside in one of the five memory spaces of the 8051.

The five memory spaces of the 8051 are: Program Memory, External Data Memory, Internal Data Memory, Special Function Registers and Bit Memory.

The Program Memory space contains all the instructions, immediate data and constant tables and strings. It is principally addressed by the 16-bit Program Counter (PC), but it can also be accessed by a few instructions using the 16-bit Data Pointer (DPTR). The maximum size of the Program Memory space is 64K bytes. Several 8051 family members integrate on-chip some amount of either masked programmed ROM or EPROM as part of this memory.

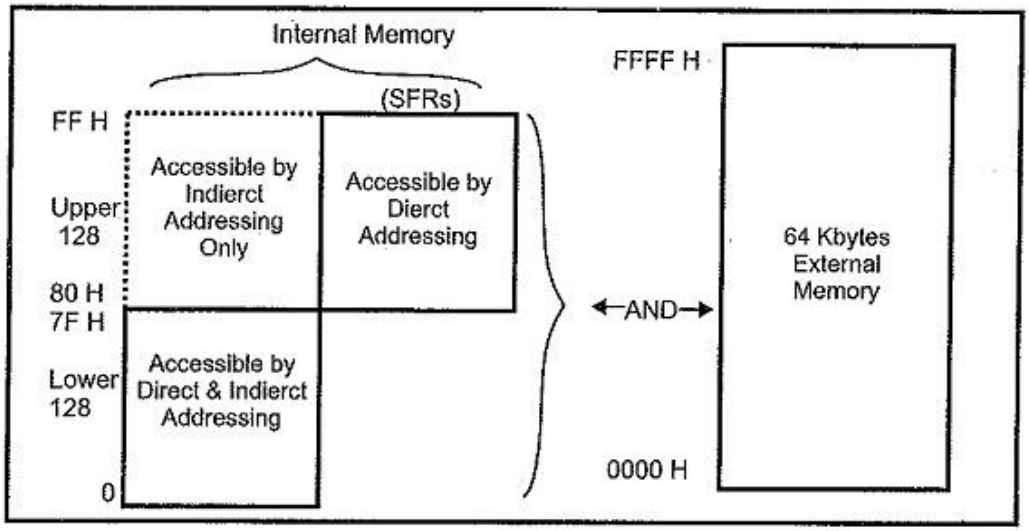

Fig : Memory representation of 8051 microcontroller

3.1.2. 7 SEGMENT DISPLAY

The seven segments displays are the oldest yet one of the efficient types of display used in embedded applications. This display has nothing more than 8 LED inside it. These 8 LEDs are separated into each segments which can be named as a,b,c,d,e,f,g,DP. These entire 8 segment LEDs have one end of their pins pulled out of the module as shown above and the other ends are connected together and pulled out as the Common pin. So to make an LED of a particular segment glow we just have to power common pin along with the segment pin.

One important advantage of a 7-segment display is that, it is very easy to use. Unlike other display modules a 7-segment display can be made to work even without a Microcontroller or a Microprocessor.

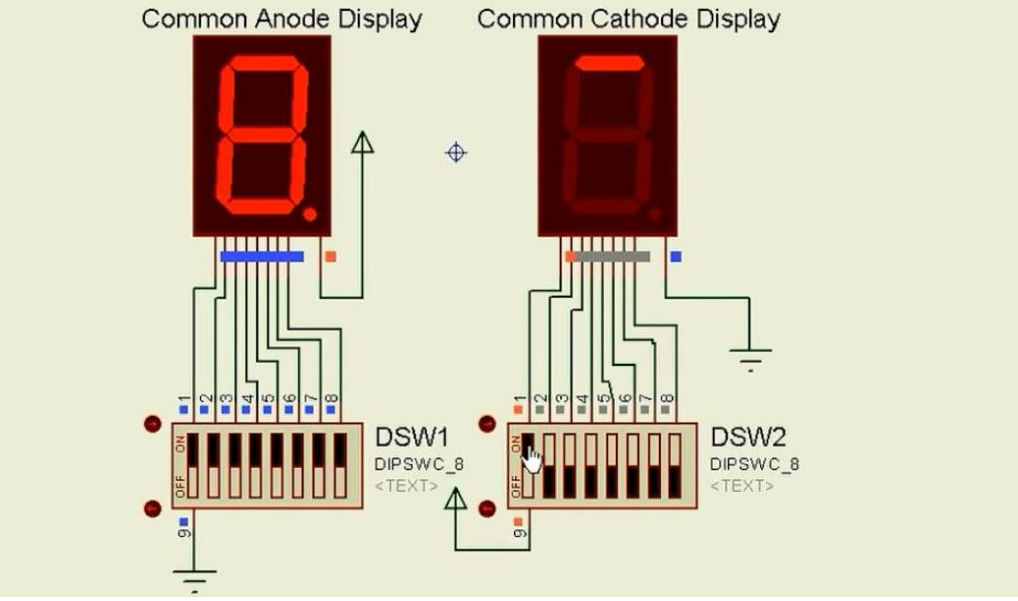

Fig : 7 Segment Display

3.1.3. LED

A light-emitting diode (LED) is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons. The color of the light (corresponding to the energy of the photons) is determined by the energy required for electrons to cross the band gap of the semiconductor.[5] White light is obtained by using multiple semiconductors or a layer of light-emitting phosphor on the semiconductor device

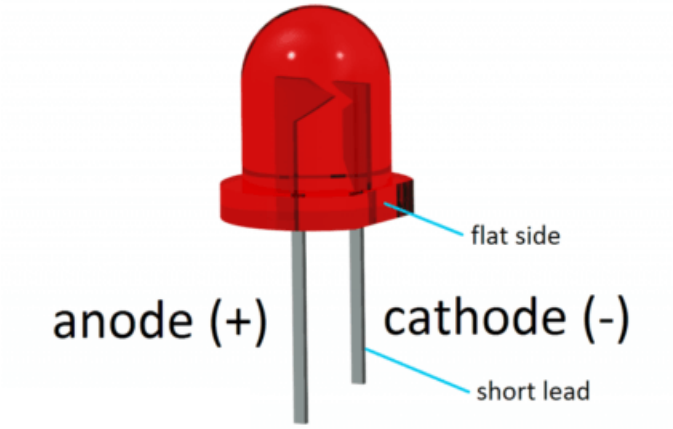

Fig: LED

3.1.4. RESPACK- 8

Respack is a device just similar to resistance box used for the variation of the resistances as per use of the circuit but there is subtle difference in the respack that is the resistance present in it are of same value and here the respack used RESPACK-8 which consists of 8 resistances of equal value i.e. 1 K ohm.

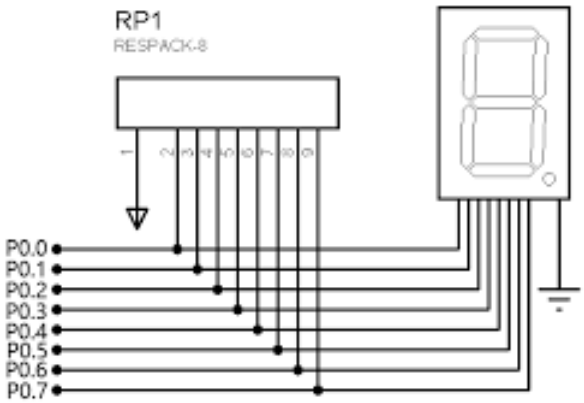

Fig : Block Diagram of Respack- 8

4. SOFTWARE USED

4.1. PROTEUS- 8- PROFESSION

The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

The micro-controller simulation in Proteus works by applying either a hex file or a debug file to the microcontroller part on the schematic. It is then co-simulated along with any analog and digital electronics connected to it. This enables its use in a broad spectrum of project prototyping in areas such as motor control, temperature control and user interface design.

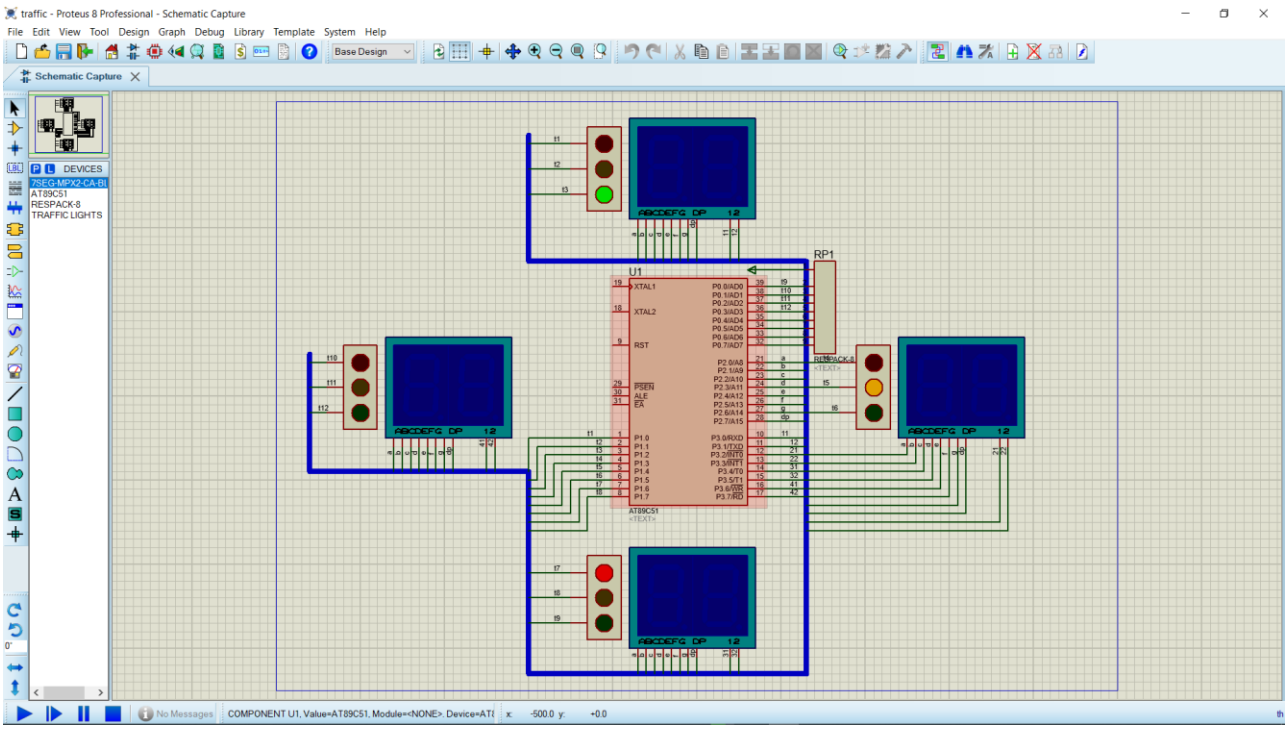

Fig: Circuit Design in Proteus software

4.2. KEIL µVISION

Keil MicroVision is a free software which solves many of the pain points for an embedded program developer. This software is an integrated development environment (IDE), which integrated a text editor to write programs, a compiler and it will convert your source code to hex files too.

5. CODE USED

```
                ORG  00H
                LJMP  MAIN
                ORG  300H
TBL:        DB  0C0H,0F9H,0A4H,0B0H,99H,92H,82H,0F8H,80H,90H
                ORG  30H
MAIN:           MOV  P2,#00H
                MOV  P3,#00H
                ACALL  FRONT
                MOV  DPTR,#TBL
                CLR  A
                MOV  40H,#10
                MOV  43H,#10
                MOV  46H,#20
                MOV  49H,#20
                MOV  R0,#35
                MOV  R6,#30
                MOV  R7,#40
X1:             MOV  A,40H
                MOV  B,#10
                DIV  AB
                MOV  41H,A
                MOV  42H,B
A1:             SETB  P3.0
                CLR  P3.1
```

```
        MOV  A,41H
        MOVC  A,@A+DPTR
        MOV  P2,A
        ACALL  DELAY
        MOV  P3,#00H
        SETB  P3.1
        CLR  P3.0
        MOV  A,42H
        MOVC  A,@A+DPTR
        MOV  P2,A
        ACALL  DELAY
        MOV  P3,#00H
        SJMP  X3
X2:     SJMP  X1
X3:     MOV  A,43H
        MOV  B,#10
        DIV  AB
        MOV  44H,A
        MOV  45H,B
        SETB  P3.2
        CLR  P3.3
        MOV  A,44H
        MOVC  A,@A+DPTR
        MOV  P2,A
        ACALL  DELAY
        MOV  P3,#00H
        SETB  P3.3
```

```
CLR P3.2
MOV A,45H
MOVC A,@A+DPTR
MOV P2,A
ACALL DELAY
MOV P3,#00H


MOV A,46H
MOV B,#10
DIV AB
MOV 47H,A
MOV 48H,B
SETB P3.4
CLR P3.5
MOV A,47H
MOVC A,@A+DPTR
MOV P2,A
ACALL DELAY
MOV P3,#00H
SETB P3.5
CLR P3.4
MOV A,48H
MOVC A,@A+DPTR
MOV P2,A
ACALL DELAY
MOV P3,#00H
```

```
MOV  A,49H
MOV  B,#10
DIV  AB
MOV  50H,A
MOV  51H,B
SETB  P3.6
CLR  P3.7
MOV  A,50H
MOVC  A,@A+DPTR
MOV  P2,A
ACALL  DELAY
MOV  P3,#00H
SETB  P3.7
CLR  P3.6
MOV  A,51H
MOVC  A,@A+DPTR
MOV  P2,A
ACALL  DELAY
MOV  P3,#00H


DJNZ  R0,X2
MOV  R0,#35

DJNZ  40H,Q1
```

```
                MOV 40H,#20

Q1:             DJNZ 43H,Q2
                MOV 43H,#10
                ACALL RIGHT

Q2:             DJNZ 46H,Q3
                MOV 43H,#20
                MOV 46H,#10

Q3:             DJNZ 49H,Q4
                MOV 49H,#10
                ACALL BACK

Q4:             DJNZ R6,X4
                ACALL LEFT
                MOV 40H,#10
                MOV 43H,#10
                MOV 46H,#30

X4:             DJNZ R7,L1
                LJMP MAIN
L1:             LJMP X1

DELAY:          MOV R4,#5
H2:             MOV R5,#0FFH
H1:             DJNZ R5,H1
```

```
                DJNZ  R4,H2
                RET

FRONT:          MOV  P1,#54H
                MOV  P0,#02H
                RET

RIGHT:          MOV  P1,#0A1H
                MOV  P0,#02H
                RET

BACK:           MOV  P1,#09H
                MOV  P0,#05H
                RET

LEFT:           MOV  P1,#4AH
                MOV  P0,#08H
                RET
```

6. WORKING

a seven-segment display is used as a counter display, and three LEDs are used for the purpose of traffic light control. An 8051 Microcontroller is the brain of this whole project and is used to initiate the traffic signal at the intersections on road. This circuit diagram makes use of a crystal oscillator for generating frequency clock pulses. The LEDs are interfaced to the Port zero of the

microcontroller and are powered with 5v power supply. Seven-segment display is connected to the port2 pins of the 8051 microcontroller with a common anode configuration.

The LEDs get automatically switched on and off by making the corresponding port pins of the microcontroller high, based on the 8051 microcontroller and its programming done by using KEIL software. At a particular period of time, only the green light holds ON and the other lights remains OFF, and after sometime, the changeover traffic light control from green to red takes place by making the succeeding change for glowing of yellow LED. This process continues as a cycle and the timing for changing the LEDs can be displayed with the use of a seven-segment LED display in this project.

7. ADVANTAGES AND DISADVANTAGES

7.1. ADVANTAGES

- Traffic control signals provide for an orderly movement of traffic.
- They help in reducing the frequency of an accident of some special nature i.e. of right angles accidents.
- They intercept heavy traffic to allow other traffic to cross the road intersection safety.
- They provide authority to the drivers to move with confidence.

- They control the speed of vehicles on main as well as on secondary roads.
- They direct traffic on different routes without excessive congestion.
- The provide economy over manual control at the intersection.

7.2. DISADVANTAGES

- Traffic control signals may result in a re-entrant collision of vehicles.
- They may cause a delay in the quick movement of traffic.
- They delay the traffic by stopping the vehicles at the intersection during peak hours.
- During signals breakdown, there are serious and wide-spread traffic difficulties during peak hours.

8. RESULT

Traffic control system using Microcontroller designed to reduce traffic Problems, i.e.; in general the four sides of the road at a signal point are controlled using Switches.

Traffic only moves from the North to South and vice versa at the same time; and at this time the traffic from the east and west is stopped. In this case, the controller considers the combination of all

the waiting densities for the North and South as that of one side and whose of the east and west combined as another side.

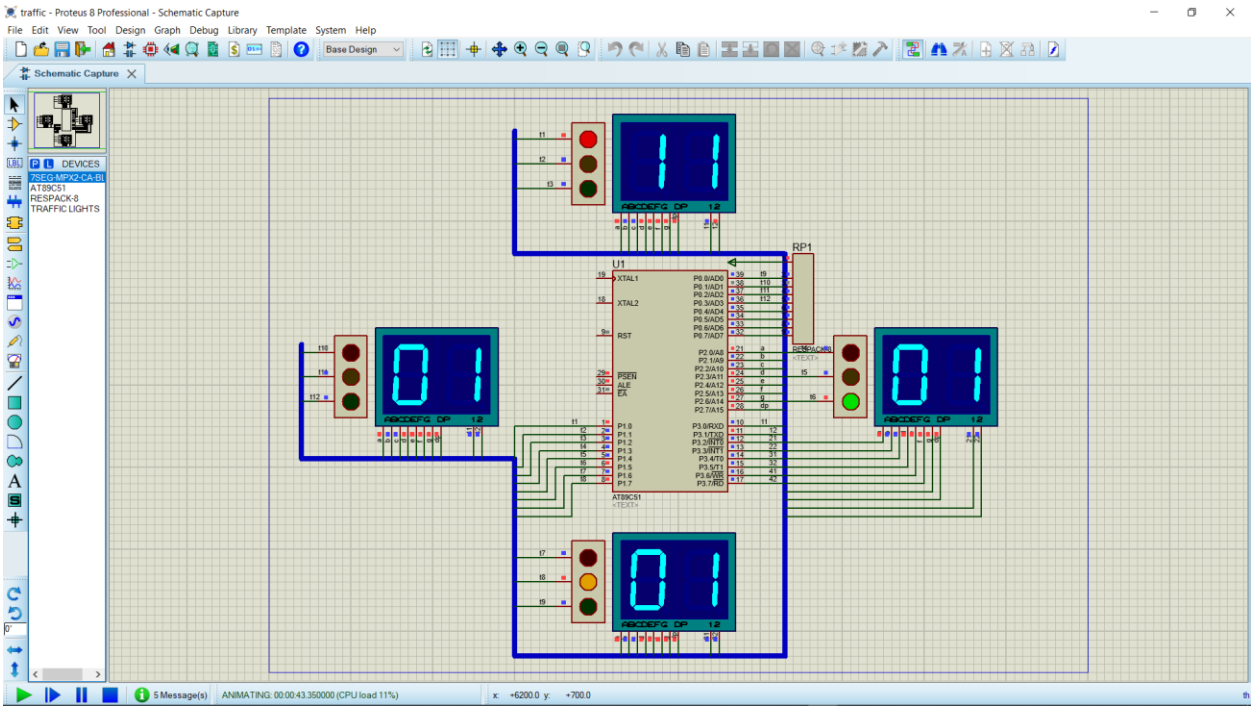

Fig: Simulated Image of circuit

9. CONCLUSION

Our country meets with road accidents every day. To reduce this blockages and unwanted time delay in traffic an intelligent control system is designed in this project. This project may be very well used in where the traffic signals is kept and in many other places where to full fill the need of the automation. In the future to implement this project's idea into real life practices. To believes that this may bring a new change in traffic control system.

10. PRECAUTIONS

- Despite the temptation, don't go with the flow of traffic if it's considerably faster than the speed limit–generally 10-15MPH is pushing it.

- Come to a complete stop–don't just yield–before making a right turn on red. When turning right on red, the light acts as a stop sign and will be enforced as such. It's not only safer, but it's legally required for you to stop and check for oncoming traffic regardless.

- Choose wisely and decide beforehand if it's safe to creep towards the middle of an intersection while yielding to oncoming traffic and attempting to make a left turn on a solid green light.

11. REFERENCE

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