Automatic Traffic Light Control System

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TRAFFIC LIGHT CONTROL SYSTEM

A REPORT

Submitted to

ASSAM DON BOSCO UNIVERSITY

by

DEEPJYOTI MAHANTA

ROLL NO.: DC2015MSP0006

in partial fulfilment of the Requirements for the Degree

of

MASTER OF SCIENCE

IN

PHYSICS

DEPARTMENT OF PHYSICS

SCHOOL OF APPLIED SCIENCE

ASSAM DON BOSCO UNIVERSITY

Guwahati, Assam, India

BATCH (2015-2017)

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Under Supervision of

Kaustubh Bhattacharyya

Senior Assistant Professor, Department of ECE, SoT, ADBU

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D E C L A R A T I O N

I hereby declare that the project work entitled "TRAFFIC LIGHT CONTROL SYSTEM" submitted to the Assam Don Bosco University, Guwahati, Assam, in partial fulfilment of the requirement for Major project of 4th semester of Master of Science in Physics. It is an original work done by me under the guidance of name of Mr. Kaustubh Bhattacharyya(Senior Assistant Professor, Dept. of ECE, School of Technology, Assam Don Bosco University) and has not been submitted for the award of any degree.

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June, 2017

C E R T I F I C A T E

This is to certify that the Project Report entitled "TRAFFIC LIGHT CONTROL SYSTEM" submitted by DEEPJYOTI MAHANTA (Roll No. DC2015MSP0006) to the Assam Don Bosco University, Guwahati, Assam, in partial fulfilment of the requirement for Major project of Master of Science in Physics. It is a bonafide record of the project work carried out by him under my supervision during the year July 2016 to June 2017.

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June, 2017

C E R T I F I C A T E

This is to certify that the Project Report entitled "TRAFFIC LIGHT CONTROL SYSTEM" submitted by DEEPJYOTI MAHANTA (Roll.No. DC2015MSP0006) to the Assam Don Bosco University, Guwahati, Assam, in partial fulfilment of the requirement for the Major project of 4th semester of Master of Science in Physics. It is a bonafide record of the project work carried out by him during the year July 2016 to June 2017.

Dr.Monmoyuri Baruah
Head
Department of Physics
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June, 2017

EXAMINATION CERTIFICATE

This is to certify that DEEPJYOTI MAHANTA bearing Roll No. DC2015MSP0006 of the Department of Physics has carried out the Project Work entitled "TRAFFIC LIGHT CONTROL SYSTEM" in a manner satisfactory to warrant its acceptance and also defended it successfully. I wish him all the success in his future endeavors.

Examiners:

1. External Examiner

2. Internal Examiner

3. Internal Examiner

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I feel profound happiness in forwarding this project and indebted to all who generously helped by sharing valuable experience and devoting their precious time, without which this project report would have never been accomplished.

I extend my heartfelt gratitude to my project guide Mr. Kaustubh Bhattacharyya, Senior Assistant Professor, Department of ECE, SoT, ADBU, under his guidance this project has been carried out and he has provided the timely valuable inputs which enhanced my performance.

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At last I would like to thank my parents for rendering their continuous love and care during the course of this work, also to my friends to help me out to carry out my work directly or indirectly.

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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 Guwahati whereas its population and number of running vehicles are much more than its capacity. Faulty traffic signalling 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 Guwahati is also a tough job and only manual efforts can't stop this kind of problem so we need machines. We need a system that can handle such a situation effectively. 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. Here we are dealing with the traffic via IC. It will work in a way, 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.

Acronyms

Some of the commonly used terms are given below:

- DIP: Dual In Line Package
- CMOS: Complementary Metal oxide Semiconductor
- LED: Light Emitting Diodes
- ALE: Arithmetic Latch Enables
- IC: Integrated Circuit
- ALU: Arithmetic and Logical operation
- PIPO: Parallel In Parallel Out
- SID: Serial Input Data
- SOD: Serial Output Data
- PPI: Programable Peripheral Interface
- RAM: Random Access Memory
- EPROM: Erasable Progrmmable Read Only Memory
- CPU: Central Processing Unit

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Symbols

- V_{cc} : $SupplyVoltage$
- V_{ee} : $Negative$
- μF : $MicroFarad$
- C: Capacitance
- R: Resistance
- V: Voltage
- V_{out} : $OutputVoltage$

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Chapter 1

Introduction

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1.1 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 [1].

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 [1]. 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 abouts, 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.

1.2 Motivation

The motivation for developing Traffic control system come from many reasons but the biggest motivation behind Automatic Traffic Light Control system is the convenience. Convenience is really another way of saying "time saver" and in today's world where everything moving faster, every second has value. Most of the technology we use today is based of convenience, for example phones get us information from other people faster.The main aspiration of the designed system is to compute total traffic density at targeted area which is then further used to reduce the traffic congestion caused by vehicles. During the busy hours of a day, the traffic is at its peak and there are various problems related to traffic congestion. One such problem is fuel consumption.

Traffic lights are a very important. This project will be very useful and will be widely used. It can be implemented whereever necessary.

1.3 Theoretical Background

The increase in urbanization and traffic congestion create an urgent need to operate our transportation system with maximum efficiency. Real-time traffic signal control is an integral part of modern urban traffic control systems aimed at achieving optional utilization of the road network. Providing effective real time traffic signal control for a large complex traffic network is an extremely challenging distributed control problem. Signal system operation is further complicated by the recent trend that views traffic signal system as a small component of an integrated multimodel transportation System. Optimization of traffic signals and other control devices for the efficient movement of traffic on streets and high ways constitutes a challenging part of the traffic management

system.

1.3.1 Road Traffic

Vehicles moving on a path, travelling from one point to another along that path. Traffic congestion is a condition on road networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common example is the physical use of roads by vehicles. Road traffic congestion control involves directing vehicular and pedestrian traffic around a construction zone, accident or other road disruption, thus ensuring the safety of emergency response teams, construction workers and the general public. Road Traffic Congestion control involves controlling the congestion of vehicles or number of vehicles on a particular road and ensuring continuous vehicle flow without unpardonable delay. Traffic signals involves controlling traffic flow depending on automated timers and lights.

1.3.2 Automatic Traffic Light Control

Automatic control in engineering and technology is a wide generic term covering the application of mechanisms to the operation and regulation of processes without continious direct human intervention. When some analog circuits or any embedded system is used to control the Traffic Lights where no man power is needed is called Automatic Traffic Control.

Designing of a system to control counter based automatically Traffic Light control circuit is designed by 555 timer's IC and a decade counter. The timer generates pulses with appropriate as per theoretical calculation and these pulses are fed to ten stage decade counter. The ten-stage decade counter can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events that counter memorized outputted by corresponding pin.

The 8085 microprocessor is a popular microprocessor used in industries for various applications. Such as Traffic light control Circuit. In this microprocessor based Traffic Light Control circuits the traffic lights are interfaced to microprocessor system through

ports of programmable peripheral interface 8255. So the traffic light can be automatically switched ON/OFF in desired sequence.

In the microcontroller based Traffic Light Control system,the pins of the various input output ports of the microcontroller are connected directly to the leds. The 8051 is programmed in a manner that the respective Leds glow by setting the required bit using assembly language and a certain amount of delay is provided depending on the user .

1.4 Literature Review

On 10 December 1868, the first traffic light were installed outside the British House of Parliament in London, by the railway engineer J.P. Knight [1] . They resembled railway signals of the time ,with semaphore arms and red and green gas lamps for night use. The gas lantern was turned with a lever at its base so that the appropriate light faced traffic. Unfortunately, it exploted on 2 January 1869, injuring the policeman who was operating it[1]

The modern electric traffic light is an American invention. As early as1912 in Salt Lake City, Utah, policeman Lester Wire invented the first red-green electric traffic light [1]. On 5 August 1914, the American Traffic Signal Company installed a traffic signal system on the corner of East 105th Street and Euclid Avenue in Cleveland, Ohio [1]. It had two colors, red and green and a buzzer, based on the design of James Hoge, to provide a warning for color changes. The design by James Hoge allowed police and fire station to control the signals in case of emergency. The first four -way, three-color traffic light was created by police officer William Potts in Detroit[1] , Michigan in 1920 . In 1923,Garrett Morgan patented a traffic signal device. It was Morgan's experience while driving along the street of Cleveland that led to his invention of a traffic signal device. Ashville, Ohio claims to be the location of the oldest working traffic light in the United states, used at an intersection of public roads until1982 when it was moved to a local museum.

The first interconnected traffic signal system was installed in Salt Lake City in 1917, with six connected intersections controlled simultaneously from a manual switch. Au-

tomatic control of interconnected traffic lights was introduced March 1922 in Houston, Texas. The first automatic experimental traffic lights in England were deployed in Wolverhampton in 1927 [1].

From the past decades, management of traffic has been one of the biggest issues of modernization. Researchers have followed a long way to overcome the traffic crises. Right from the very beginning of, "Manual Traffic Control" in which man power was required to control the traffic. Depending on countries and states the traffic polices are allotted to different areas to control traffic. These men carry sign board, sign light and whistle to control the traffic. They are instructed to wear specific uniforms in order to be easily identified by the drivers[2] .

K. Vidhya and et al.[3] proposed a density based traffic signal system which changes the signal timings automatically by sensing the traffic density at the junctions. In major cities, the traffic signal timing allotted are fixed. The research mainly aims to control the traffic signal by capturing the image and then converting them into the grayscale image and then to the threshold image. The Contour image helps to count the number of vehicles present in the junction. The output screen shows the numbers of vehicles present at the junction and the green signal will glow based on the traffic density. They analyzed the image sequence and then estimate traffic congestion and finally predict the traffic light timings. Raspberry pi microcontroller is used to sense the traffic density and provides the signal timings.

A. Ms Promila Sinhmar [4] proposed a intelligent traffic light and density control using IR sensors and microcontroller which optimizes the traffic light control using microcontroller. The microcontroller used in this research is 89451RD2 which is MCS51 family based. IR transmitter and IR receiver is placed on either side of the road. When a vehicle is passed on a road between IR transmitter and IR receiver, the IR system automatically gets activated and counts the number of vehicles present and store in its memory. Based on the vehicles count the microcontroller takes decision for traffic signal timings. In their research they proposed, first to take input or image from the vehicles or object. Second is to process the given input by microcontroller to the computer and then finally it displays the traffic light control using closed loop system.

Khalil M. Yousef and et al. [5] proposed an intelligent traffic light flow control system using wireless sensors networks. This paper is mainly focusing on managing the traffic light control efficiently and utilizes the system design. An adaptive traffic control system using wireless sensor networks are dynamically used for both single and multiple intersection to control the traffic conditions. Their research contains Traffic System Communication Algorithm (TSCA) and the Traffic signals Time Manipulation Algorithm (TSTMA), both the algorithms are used for efficient traffic control by the dynamic changes in the traffic signals. In single intersection, traffic congestion can be solved by calculating average waiting time and average queue length whereas an efficient traffic flow control globally on multiple intersection. Their future work can simulate the human behaviors and package the entire system using FPGA technology. And also, different types of intersection and different types of crossing directions also considered.

A.D.Jadhav, et.al.[6] proposed an Intelligent Traffic Light Control System which aims at reducing the delay on roads by reducing the amount of traffic. They analyzed the traffic flow of each road along with the signals and assigns time period to glow the respective light. The proposed system tries to minimize the possibilities of traffic jams, to some extent by clearing the road with higher density of vehicles The road which is recorded with more traffic density then other roads will be assigned with a green signal and all other roads will be assigned with red. This paper focuses to reduce traffic congestion on roads which results in long waiting times, loss of fuel and money.

1.5 Statement of the Problem

Traffic congestion is an increasing problem in cities and sub urban spend more of their time commuting to work, school, shopping, and social event as well as dealing with traffic light jams and accidents. Traffic became heavy in all directions, more to and from cities as well as between sub urban locations. Sub urban business locations require huge parking lots because employees have to drive; there were few buses or trains or trolleys to carry scatter workers to their work place. The hope of reduced congestion in sub urban had not been realized; long commutes and traffic jams could be found

everywhere.

The first step is to design a circuit which is a switching based traffic light control circuit. This circuit needs a man power to operate the traffic light. Hence we need to design an automatic traffic light system, in which to Counter based circuit can make the automation of the traffic light system. In this counter based traffic light control system controlling can be done automatically without man power. While using counter based circuit we can use many ICs like IC555 and IC4017 and hence if there is some fault we will be unable to detect those faults and due to this we can go for a microprocessor based system, because if there is some problem in the circuit we can configure it by simply changing the program or correcting the program. Further we can modify the microprocessor based traffic light control system by replacing microprocessor with a Microcontroller based traffic light control system because, in microprocessor chip ROM ,RAM and I/O ports are not present in a single chip but in microcontroller all the above mentioned things are embedded in a single IC. So in Microcontroller based traffic light control system the power consumption and the cost will also be less.

1.6 Aims and Objective

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.

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.

1.7 Significance Of the Study

The significance of this project work are:

- It will help in reducing the occurrence of possible collision or accident and thereby improve the confidence of the driver and the pedestrian plighting through the highways.
- The Project to allay the fear of time wastage at the junctions because of unevenly directions of traffic system.
- Since the system is capable of working for 24 hours uninterrupted thereby assured constant availability of traffic control service hence reduce human effort and energy

1.8 Methodology

At first present traffic problem at any city of India is practically observed. Then current traffic control system is critically observed to check its feasibility to solve the present problem in traffic control. Then some past research work regarding on traffic control system is studied. Finally four system are proposed to regulate the traffic control properly at the city of its different cross junction point.

The work that I have chosen is an 4 Way Traffic controller. 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.

In the First switching based traffic light control circuit, the traffic lights are controlled using switches i.e., when the first switches is on the Green light is on in East and West and the Red Light is on in North and South.similarly when the second switch is on then Green light is on in the North and south and the Red light is on in the East and west and when the third switch is on all Yellow lights are on.

In the counter based traffic light control circuit, we are going to design a circuit, to control traffic lights on a four-way signal. This circuit is designed by 555 timer's IC and a decade counter. The timer generates pulses and these pulses are fed to ten stage decade counter. The ten-stage decade counter have a memory of ten. It can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events that counter memorized outputted by corresponding pin.

Traffic light control system using microprocessor and also using microcontroller is a unique traffic light controller makes simple use of assembly language programming with Intel 8085 microprocessor. It permits accident free control as a separate set of signals has been assigned to a direction. For instance, if one desires to move towards north, east or west from south, he is provided a single light signals for the respective directions. Consequently, the probability of confusion leading to an accident is reduced.

1.9 Organization Of the Report

The organization of this report is as follows. The report consists of six chapters. The implementation of switching based traffic light control circuit is discussed in chapter2. In this chapter, a complete description of the switching based circuit along with the components required for its implementation is reported. The experimental details of each components is discussed. Also the results and discussion obtained after carrying out the work is discussed. The implementation of counter based traffic light control circuit is

discussed in Chapter 3. The chapter starts with a general introduction of counter based Traffic light control system.In this chapter a complete description of the counter based circuit along with the components required for its implementation is recorded. The experimental details of each component is discussed. Also the results and discussion obtained after carrying out the work is discussed. The implementation of microprocessor based Traffic light control circuit is discussed in chapter4. The chapter starts with a general introduction of microprocessor based Traffic light control system. In this chapter a complete description of the microprocessor based circuit along with the components required for its implementation is recorded. The experimental details of each component is discussed. Also the results and discussion obtained after carrying out the work is discussed. The implementation of microcontroller based Traffic light control circuit is discussed in chapter5. The chapter starts with a general introduction of microcontroller based Traffic light control system. In this chapter a complete description of the microcontroller based circuit along with the components required for its implementation is recorded. The experimental details of each component is discussed. Also the results and discussion obtained after carrying out the work is discussed. The chapter concludes with a proper conclusion obtained from the chapter. In chapter 6 the conclusions and future work is discussed followed by Bibliography.

Chapter 2

Designing Of Switching Based Circuit

Contents

2.1 Introduction

The main objective of this switching based traffic light control system is to provide sophisticated control and coordination to confirm that traffic moves as smoothly and safely as possible. This project makes use of Led lights for indication purpose and switch is used for changing of signals.

2.2 List of Components

Table 2.1: Component used in switching circuit

Components	Specification	Quantity
Power Source	5 Volts	1
DIP Switch	Manual electronic switch	1
Resistors	1 Kilo Ohm	12
LEDs	Red, Yellow, Greean	12

Table 2.1 refers the components which is used in Switching based Traffic Light Control System.

2.2.1 DIP Switch

A DIP switch as shown in Figure 2.1 is a manual electric switch that is packaged with others in a group in a standard dual in-line package (DIP).The term may refer to each individual switch, or to the unit as a whole. This type of switch is designed to be used on a printed circuit board along with other electronic components and is commonly used to customize the behavior of an electronic device for specific situations.

DIP switches are an alternative to jumper blocks. Their main advantage is that they are quicker to change and there are no parts to lose. The DIP switch with sliding levers was granted US Patent 4012608 in 1976 [7]. It was applied for 1974 and was used in 1977 in ATARI flipper game [7].

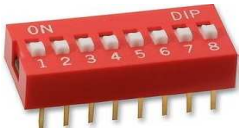

Figure 2.1: DIP Switch

2.2.2 Resistor

Resistor restricts the flow of electric current for example a resistor is placed in series with a Led to limit the current passing through the Led.

We have used twelve Resistors in this switching circuit project; their work is to deliver required current to the components and to limit the current flow in the circuit. Figure 2.2 shows the circuit symbol for resistance [7].

Figure 2.2: Circuit symbol of Resistance

2.2.3 Light Emitting Diodes

LEDs are semiconductor devices like transistor and other diodes. LEDs are made out of silicon. What makes an LED give off light there are the small amount of chemical impurities that are added to the silicon such as gallium, arsenide, indium and nitride. When current passes through the LED, it emits photons as a by product. Normal light bulbs produce light by heating a metal filament until its while hot. Because LEDs produce photons directly and not via heat, they are far more efficient than incandescent bulbs.

LEDs emit light when an electric current pass through them [7]. Figure2.3 shows the circuit symbol for LED,

When a light emitting diode is forward biased electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence. Electroluminescence is an optical and electrical phenomenon in which a material emits light in response to the passage of an electric current or to a strong electric field.

2.3 Switching Circuit Of Traffic Light Control System

Figure 2.4 shows the working circuit of switching based Traffic Light control system. First of all we have connected all the negative terminal of the LED's in a common point.

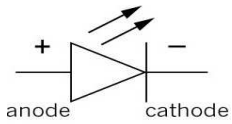

Figure 2.3: Circuit Symbol for LED.

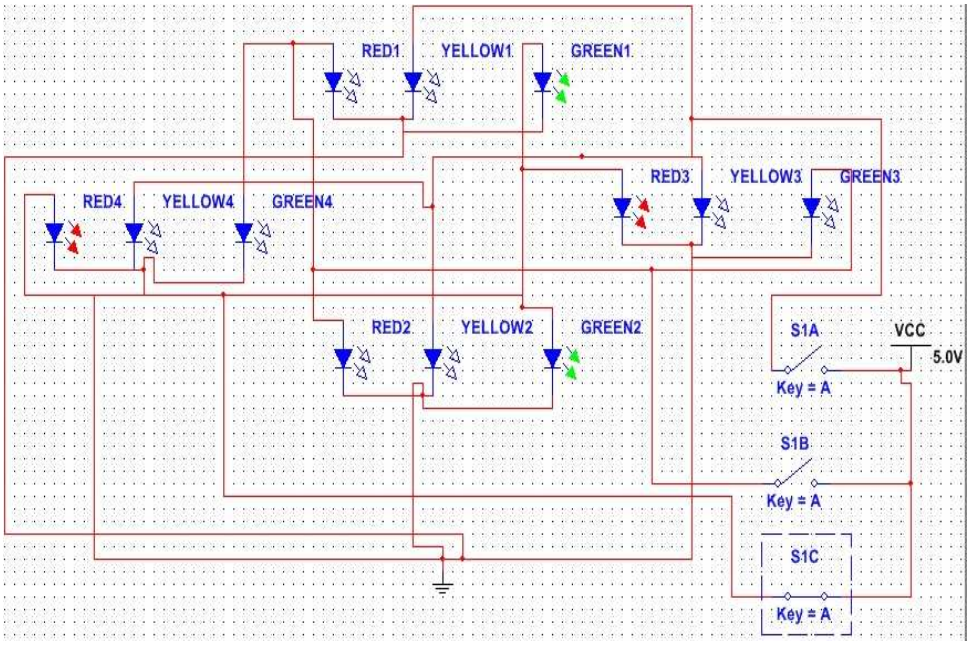

Figure 2.4: Switching Circuit of Traffic Light control system.

Then we have connected the positive terminal of Red LED's in the North and South position to a single point and in that point we have connected the Green LED's in the East and West positions. Similarly the Red LEDs of East and west and Green LED's of North and South have connected in a single point. Above connections are done because we have to glow the Red light which are in face to face each other and to glow the green lights in the opposite directions. Such as when the Red lights of east and west are glowing then the Green lights of the North and South should be glow. Similarly when the Red lights of the North and South are glowing then the Green lights of the East and West should glow. We have connected the positive terminal of Yellow LEDs to a single

point. 1 Kilo Ohm resistance is connected to all the LEDs to resists it from damaging. Three switches are used to control the Traffic Signal. We have used 5 volt battery as a power supply to operate the circuit.

2.4 Results and Discussions

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

Based on our analysis of the present traffic control system, the following assumptions became necessary in order to develop a feasible system.

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 who's of the east and west combined as another side.

2.5 Summary

The main objective of this switching based traffic light control system is to provide sophisticated control and coordination to confirm that traffic moves as smoothly and safely as possible. Switching based traffic light control circuit, the traffic lights are controlled using switches i.e., when the first switches is on the Green light is on in East and West and the Red Light is on in North and South. Similarly when the second switch is on then Green light is on in the North and south and the Red light is on in the East and west and when the third switch is on all Yellow lights are on.

Chapter 3

Designing Of Counter Based Circuit

Contents

3.1 Introduction

The main objective of this Counter based traffic light control system is to provide sophisticated control and coordination to confirm that traffic moves as smoothly and safely as possible. This counter based circuit makes use of LED lights for indication purpose and IC555 and Decade counter is used for auto changing of signal at specified range of time interval. LED lights gets automatically turns on and off by making IC 555 as a astable multivibrator.

3.2 Block Diagram

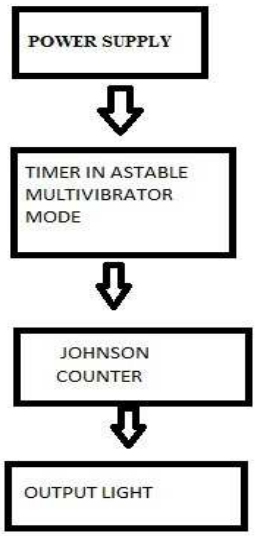

Figure 3.1: Block diagram of the counter base circuit

From Figure 3.1, we can say that the counter based traffic control circuit is designed by 555 timer's IC and a decade counter. The timer generates pulses and these pulses are fed to ten stage decade counter as a clock input. The ten-stage decade counter have a memory of ten. It can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events that counter memorized outputted by corresponding pin.

3.3 List Of Components

Table 3.1 refers the components which is used in Counter based Traffic Light Control system.

3.3.1 555 Timer IC

The NE555N is a highly stable device for generating accurate time delays or oscillation. Additional terminals are provided for triggering or resetting if desired. In the time delay

Table 3.1: Component used in counter based circuit

Components	Specification	Quantity
Power Source	12 Volts	1
Timer (IC NE555N)	4.5V to 15 volt ,200ma	1
Decade counter (IC 4017)	3v to 15V	1
Resistors	5.6 k ohm, 150 k ohm, 100 ohm	6
LEDs	Red, Yellow, Greean	12
Capacitor	10micro farad , 01 micro farad	2
Diodes	1N4148	8

mode of operation, the time is precisely controlled by one external resistor and capacitor. The timer IC is a general purpose IC that can be used for precision timing pulse generation, sequential timing, time delay generation , pulse width modulation , pulse position modulation and linear ramp generation. The 555 can operate in both astable and monostable modes with timing pulse ranging from micro second [8]. Figure3.2 shows the pin configuration of IC NE555.

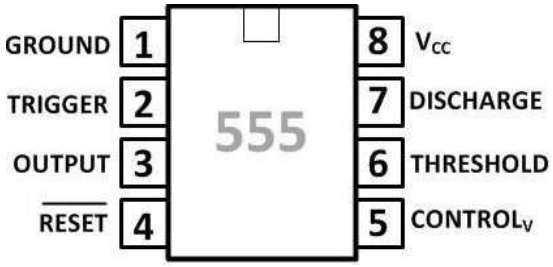

Figure 3.2: IC NE555N

It can be operated by various power supplies being in range of +3 volts to 18 volts .It can be bear the 250 Ma of current all its output. External components can exchange its timing intervals. Duty cycle of timer IC is adjustable, its trigger and resets inputs are logic compatible. In this counter based traffic light control circuit we have used IC555 because the timer generates pulses and these pulses are fed to ten stage decade counter. The ten-stage decade counter have a memory of ten. It can count up to ten pulses.

Table 3.2 refers the Pin description of Timer IC555

Table 3.2: Pin configuration of Timer IC NE555N

Pin Number	Name	Purpose
01	Ground	Connected to Ground (Low=0)
02	Trigger	Out rises , interval starts when input is below 1/3 Vcc
03	Output	This output is driven to +Vcc or ground.
04	Reset	Timing interval can be interrupted by connecting it to Low.
05	Control	Control access to the internal voltage divider.
06	Threshold	Interval ends when the current is > CTRL
07	Discharge	Open Collector, May discharge the capacitor.
08	Vcc	Positive Supply between 5 Volts and 18 volts.

3.3.2 IC 4017

The IC 4017 is a versatile IC of the CMOS family which has got wide range of application. The 4017 is a 5 stage Johnson counters having 10 decode outputs. Inputs include a clock, a RESET and a CLOCK INHIBIT signal. Schmitt trigger action in the CLOCK input circuit provides pulse shaping that allows unlimited CLOCK input pulse rise and fall times [9].

These counters are advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the clock inhibit signal is high. A high RESET signal clears the counter to its zero count. Use of the Johnson counter configuration permits high speed operation [9].

The decoded outputs are normally low and go high only at their respective decoded time slot. Each decoded output remains high for one full clock cycle. A carry out signal completes one cycle every 10 clock input cycles in the CD4017 and is used to ripple-clock the succeeding device in a multi-device counting chain.

It has got numerous application, for example in circuits where sequential switching are required and also it decorative lighting, where the lights are switched on and off sequentially giving it a "running effect"[10].

In the counter based traffic light control system we have used decade counter because The timer generates pulses and these pulses are fed to ten stage decade counter.The ten-stage decade counter have a memory of ten. It can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events

that counter memorized outputted by corresponding pin.

Figure3.3 shows the pin configuration IC4017, figure3.4 Logic Diagram of the IC4017 shows the and figure3.5 shows the timing diagram of the IC4017 .

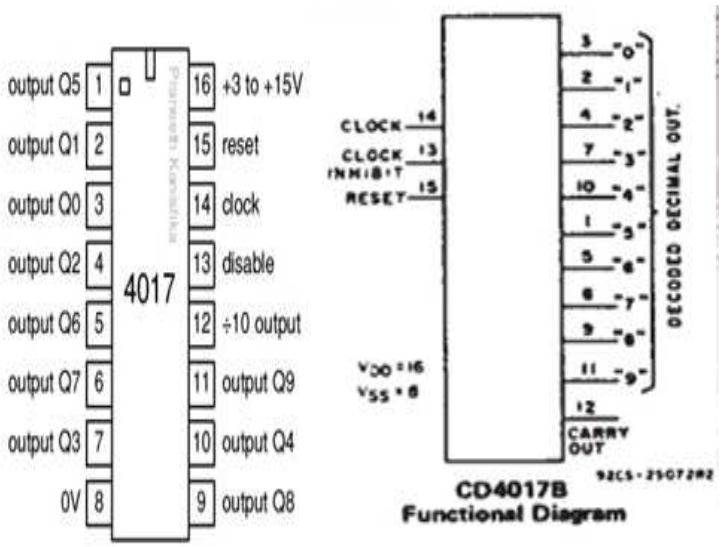

Figure 3.3: IC 4017 (Decade Counter).

3.3.3 Capacitor

Capacitor stores electric charge. They are used with resistors in timing circuits because it takes time for a capacitor to fill with charge. They are used to smooth varying DC supplies by acting as a reservoir of charge. They are also used in filter circuits because capacitors easily pass AC signals but they block DC signals.

Capacitance measures the ability to store charge. A large capacitance means that more charge can be stored. Capacitance is measured in Farads, symbol "F". However, 1F is very large, so prefixes are used to show the smaller values. Three prefixes are used Micro, Nano and Pico [7] .Figure 3.6 shows the circuit symbol of Capacitor.

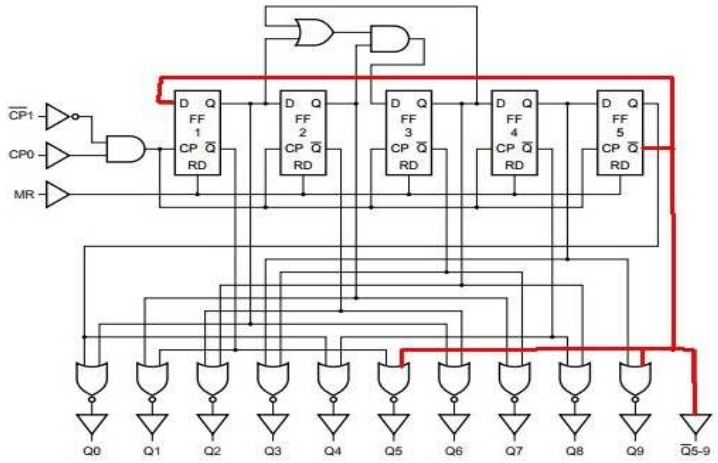

Figure 3.4: Logic Diagram of the IC 4017

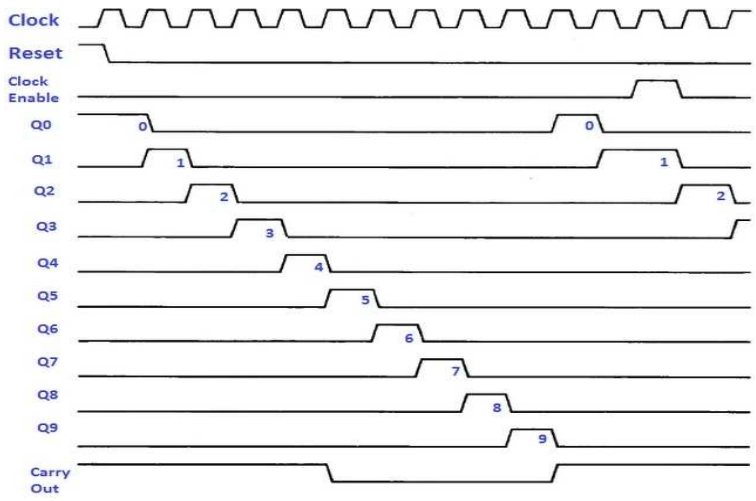

Figure 3.5: Timing Diagram of the 4017 Decade counter

In this counter based traffic light control circuit two capacitor has been used . In counter based traffic light control circuit we used the IC555 timer as an astable multivibrator. Initially, when the output is high , capacitor starts charging towards Vcc through R1 resstance and R2 resistance. In the astable multivibrator circuit we used R1=5.6 KΩ and R2= 150KΩ and Capacitor C=10 μ. Therefore the theoretical on time

is 1.07sec and theoretical off time is 1.035 sec.

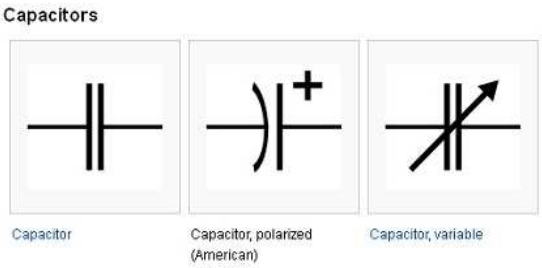

Figure 3.6: Circuit Symbol of Capacitor.

3.3.4 Diodes

A Diode is the simplest two terminal unilateral semi-conductor devices. It allows current to flow only in one direction and blocks the current that flows in the opposite direction. The characteristics of a diode closely match to that of a switch. An ideal switch which opens does not conduct current in either direction and in closed state conducts in both directions. In this Project Eight diodes have been used in the circuit, which are doing the operation of switching [10]. Figure 3.7 shows the circuit symbol for Diode. The detail about the LEDs that are used here are explain in Section 2.2.3

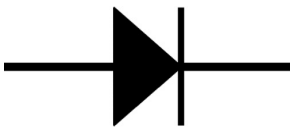

Figure 3.7: Circuit Symbol for Diodes.

3.4 Counter Based Traffic Light Control System

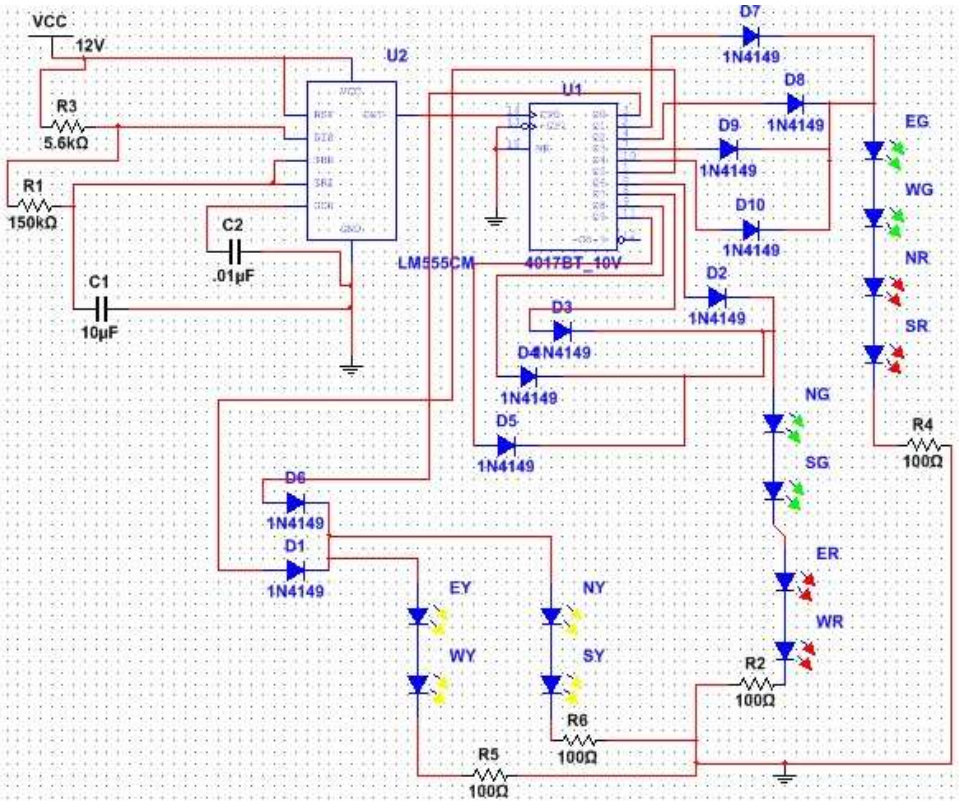

Figure 3.8: Counter based Traffic Light control system.

Figure 3.8 shows the working circuit of counter based Traffic light control circuit. IC (NE555N) is a timer IC used for precision timing, pulse generation, sequential timing, and time delay generation. First Pin of the Timer IC is connected to ground while Trigger (pin2) and Threshold (Pin6) are common a 100μF capacitor which are directly connected to Ground from that common point. From discharge (pin 7) a resistor of 5.6KΩ is connected to the Vcc. A resistor of 150KΩ is connected between the Pin 7 and Pin 6. This will drop the voltage 1/3 of the Vcc and hence trigger will be operated. While Vcc (pin8) is common with RESET (pin4) and hence Circuit starts works with resetting the previous value. IC(CD4017) is Decade counter chip which deliver sequential output (Low after each High), Decade counter clock (pin14) is common with output of Timer

(pin3) , Pin 8 is ground while RESET (Pin 15) in this is connected to Ground and Clock inhibit is connected(pin 13) and Vcc is High as Previous. Now this IC will deliver ten sequential outputs Q0 - Q9, Q0 is directly connected to Yellow LEDs (North/South) and Q1, Q2, Q3, Q4 are common and directly connected to Green LEDs (North/South) and its connected with Red LEDs (East/West) and negative of the Yellow LEDs is common with these two colour LEDs. And a resistor of 100Ω resistance is connected to secure the LEDs. Similarly Q5 is connected to Yellow LEDs (East/West). The Q6, Q7, Q8, Q9 are common and are connected with the Positive of Green LEDs (East/West) and Red LEDs are connected with these Green lights and a resistor of 100Ω connected with these Red LEDs(East/West), its starts work when a voltage Source of 12 Volts is connected to the Board. Figure.3.8 shows the Counter based traffic light control system.

3.5 Calculation of the On time and the Off time

An astable multivibrator, often called a free running multivibrator, is a rectangular wave generating circuit. In astable multivibrator, the circuit does not require an external trigger to change the state of the output, hence the name is free running. However, the time during which the output is either high or low is determined by two resistors and a capacitor, which are externally connected to the 555 timer [8].

Theoretical on time is calculated using equation 3.1 and the off time is calculated using equation 3.2

$$T_{ON} = 0.69(R_1 + R_2)C \tag{3.1}$$

$$T_{OFF} = 0.69(R_2)C \tag{3.2}$$

$$T_{TOTALTIME} = 0.69(R_1 + 2R_2)C \tag{3.3}$$

$$\%dutycycle = T_{ON}/T_{TOTALTIME} \times 100 \tag{3.4}$$

The different observations are tabulated in Table 3.3

3.6 Result and Discussion

Table 3.3: Calculation of ON Time,OFF Time and the Total Time

Sl. No.	R1 (KΩ)	R2 (KΩ)	Capacitor (μF)	Theoretical ON time (T_{ON})(sec)	Practical On time (sec)	Theo. OFF time (T_{OFF}) (sec)	Practical Off time (sec)	Theo. Total time (T=T_{ON}) +T_{OFF}	Practical Total Time (T)
1	5.6	150	10	1.07	1.10	1.035	1.08	2.1	2.18
2	5.6	150	20	2.14728	2.18	2.07	2.1	4.21728	4.28
3	5.6	150	100	10.7364	10.8	10.395	10.45	21.1314	21.25

Automatic Traffic control system is mainly designed to reduce traffic problems, i.e. in general the four sides of the road at signal point are controlled at regular intervals of time with a certain time delay.

Based on our analysis of the present traffic control system, the following assumptions became necessary to develop a feasible system:

1. The system will only work for an isolated four-way junction with traffic coming from the four cardinal directions.

2. Traffic only moves from the North to the 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 those of the east and west combined as another side.

3.7 Summary

Designing of a system to control automatically the traffic lights on a four-way signal was the main concern. This circuit is designed by 555 timer's IC and a decade counter. The timer generates pulses with appropriate as per theoretical calculation and these pulses are fed to ten stage decade counter. The ten-stage decade counter can count up to ten pulses. So for every peak at clock, the counter admits it as an event and remembers it. The number of events that counter memorized outputted by corresponding pin.

Chapter 4

Traffic Light Control System Using 8085 Microprocessor

Contents

4.1 Introduction

The main aim of this project is to design a traffic light control system using 8085 microprocessor , interfacing with peripheral devices and program implementing the process. In Microprocessor based traffic light control system the traffic lights are interfaced to Microprocessor system through ports of Programmable peripheral Interface 8255. So the traffic lights can be automatically ON/OFF in desired sequence.

4.2 Microprocessor

A microprocessor is a computer processor which incorporates the function of a computer's central processing unit IC. The microprocessor is a multipurpose, clock driven, register based programmable electronic device which accepts binary data as input, processes it according to instructions stored in its memory and provides results as output. Microprocessor is the heart of Computer systems. We are learning this so that we could understand the complete mechanism and structure of the systems that we use daily like a computer, washing machine, television etc. A microprocessor can perform various functions depending upon the application. It is used to build a system which can perform multiple tasks by avoiding the use of traditional transistor individually and thus making the system compact in size. It is the basic building block of the third-generation computers that make them compact and versatile. These days every single piece of electronics that we embedded in our surrounding has microprocessor (intelligence) in them.

Advantage of microprocessors is that these are general purpose electronic processing devices which can be programmed to execute several tasks. One advantage of a microprocessor is its speed, which is measured in Hertz. For instance, a microprocessor with 3GHz is capable of performing 3 billion tasks per second. Another advantage of a microprocessor is that it can quickly move data between various memory locations [11].

4.2.1 Why We Use Microprocessor?

Microprocessor helps to perform various tasks on a single chip ie; many different programs or operations can be done simultaneously.

In Our work we were using 555 timers and 4017 decode counter for the purpose of traffic control while using the IC's the problem was that as the number of IC's increases power consumption of the circuit is increases resulting voltage fluctuation in IC also there is some short circuit the IC's may got burnt. If a circuit is comprised of too much components and if there is some fault in any of the component then the whole circuit has to be redesign and still if we not figure out the fault then it will be mess. But if we use

microprocessor and there is some problem in the circuit we can configure it by simply changing the program or correcting the program or if by some means the microprocessor get damage then we will have to just change the microprocessor, no need to redesign the whole circuit. For burning of Program the microprocessor needs only 12 volts but for executing it only needs 5 volts ie; Power consumption is less compare to the IC's.

4.3 8085 Microprocessor

The Intel 8085 is an 8 bit microprocessor produced by Intel and introduced in 1977. The 8085 microprocessor is a conventional Von Neuman design based on the Intel 8080. It is designed by using nMOS technology. The "5" in the model number came from the fact that the 8085 requires only a +5 Volt power supply. It has 8 bit data bus and 16 bit address bus. It can work up to 5 MHz frequency. The 8085 has extensions to support new interrupts, with three maskable interrupts (RST 7.5, RST6.5, RST 5.5) one non maskable interrupt (TRAP) and one externally serviced interrupt (INTR). The RSTn.5 interrupts refer to actual pins on the processor, a feature which permitted simple systems to avoid the cost of separate interrupt controller. The 8085 has sufficient memory for the given scenario. Basic unit to be interfaced are supported by 8085. The 8085 microprocessor is less complicated in aspect of coding [11].

4.3.1 Architecture of 8085 Microprocessor

Figure 4.1 shows the various registers of Intel 8055. Registers are used by the microprocessor for temporary storage and manipulation of data and instructions. Data remain in the registers till they are sent to the memory or I/O devices [11].

Accumulator: It is a 8-bit register which is used to perform arithmetical and logical operation. It stores the output of any operation.

Temporary Register: It is a 8-bit register which is used to hold the data on which the accumulator is computing operation. It is also called as operand register because it provides operands to ALU.

Registers: These are general purposes registers. Microprocessor consists 6 general

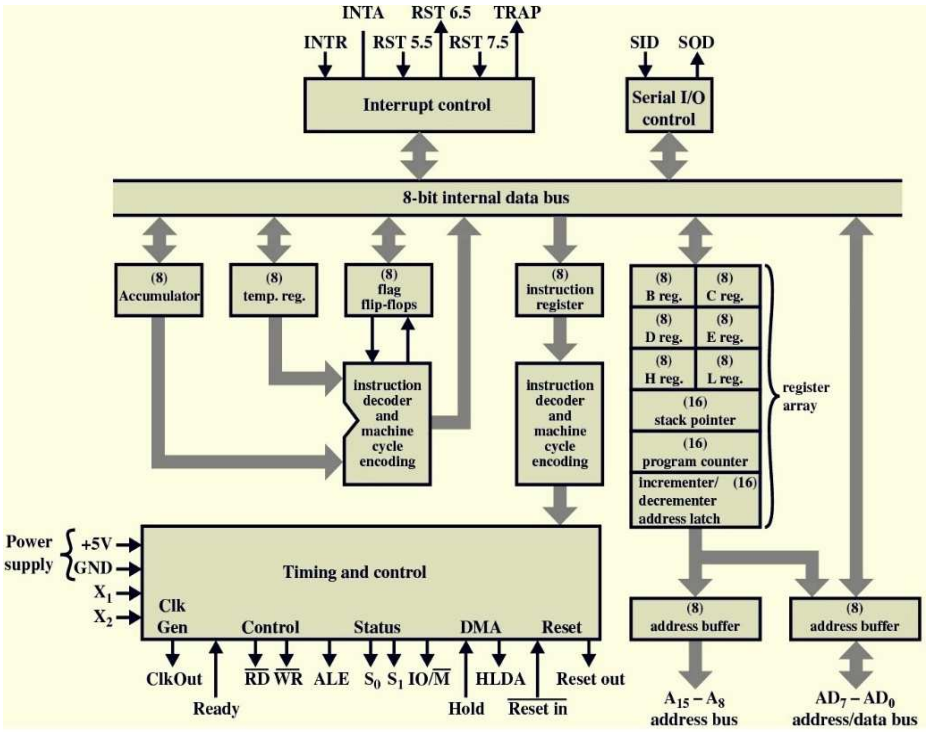

Figure 4.1: Architecture of 8085 Microprocessor.

purpose registers of 8 bit each named as B, C, D, E, H and L. Generally these registers are not used for storing the data permanently. It carries the 8 bits data. These are used only during the execution of the instructions

These registers can also be used to carry the 16 bits data by making the pair of 2 registers. The valid register pairs available are BC, DE, and HL. These registers are programmed by user.

ALU: ALU performs the arithmetic operations and logical operation.

Flag Register: It consists of 5 flip-flop which changes its status according to the result stored in an accumulator. It is also known as status register. It is connected to the ALU. These are five flip-flops in the flag register are as

- Sign (S)

- Zero(Z)
- Auxiliary carry (AC)
- Parity(P)
- Carry (C)

Instruction Register: It is an 8 bit register. When an instruction is fetched from memory then it is stored in this register.

Instruction Decoder: Instruction decoder identifies the instructions. It takes the information from instruction register and decodes the instruction to be performed.

Program Counter: It is a 16 bit register used as memory pointer. It stores the memory address of the next instruction to be executed. So we can say that this register is used to sequencing the program. Generally the memory has 16 bit addresses so that it has 16 bit memory. The program counter is set 0000H.

Stack Pointer: It is also a 16 bit register used as memory pointer. It points to the memory location called Stack. Generally stack is a reserved portion of memory where information can be stores or taken back together.

Timing And Control Unit: It provides timing and control signal to the microprocessor to perform the various operation .It has three control signals. It controls all external and internal circuits. It operates with reference to clock signal. It synchronizes all data transfers.

There are three control signals:

- **ALE-** Arithmetic Latch Enables, it provides control signal to synchronize the components of microprocessor.
- **RD-** This is active low used for reading operation.
- **WR-**This is active low used for writing operation

There are three status signal used in microprocessor S0, S1 and IO/M. It changes its status according the provided input to these pins.

Serial Input Output Control-These are two pins in this unit. This unit is issued for serial data communication.

Interrupt Unit: There are 6 interrupt pins in this unit. Generally an external hardware is connected to these pins. These pins provide interrupt signal sent by external hardware to microprocessor and microprocessor sends acknowledgement for receiving the interrupt signal. Generally INTA is used for acknowledgement.

Register Section: Many registers has been used in microprocessor. PIPO shift register, it consists of PIPO (Parallel input Parallel output) register.

4.3.2 Pin Configuration Of 8085 Microprocessor

Figure4.2 shows the Pin configuration of Intel 8085.

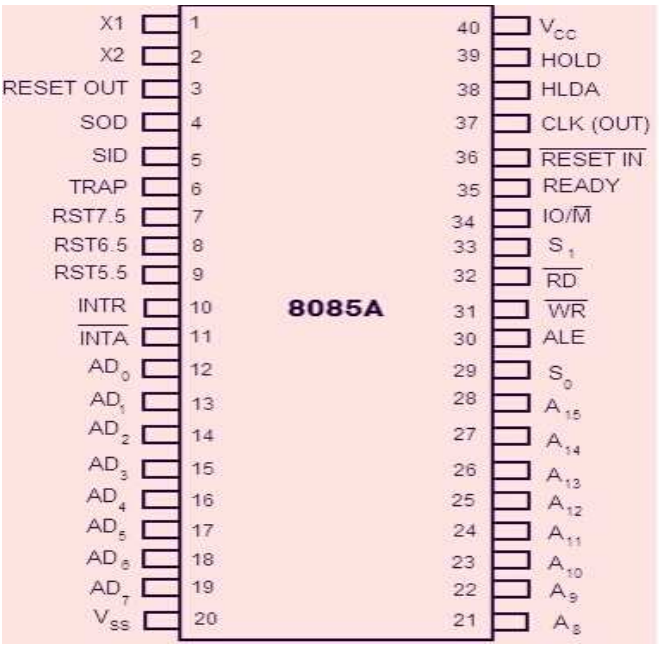

Figure 4.2: Pin configuration of 8085 Microprocessor.

Power Supply and Clock Frequency Signals: **Vcc :** +5 Volt Power Supply **Vss :** Ground

X1, X2: Crystal or R/C network or LC network connections to set the frequency of internal clock generator. The frequency is internally divided by two. Since the basic operating timing frequency is 3 MHz, a 6 MHz crystal is connected externally. CLK (output)-Clock output is used as the system clock for peripheral and devices interfaced with microprocessor.

ADDRESS BUS: A8-A15: It carries the most significant 8 bits of the memory address or the 8 bits of the I/O address.

DATA BUS: AD0-AD7: These multiplexed set of lines used to carry the lower order 8 bit address as well as data bus. During the opcode fetch operation, in the first clock cycle, the lines deliver the lower order address A0-A7. In the subsequent IO/memory, read/write clock cycles the lines are used as data bus. The CPU may read or write out data through these lines.

CONTROL AND STATUS SIGNAL: ALE: It is an output signal used to give information of AD0-AD7 Contents **RD:** This indicates that the selected memory location is to be read and that the data bus is ready for accepting data from the memory.

WR: This indicates that the data on the data bus is to be written into the selected memory location. IO/M: This status signal indicates that the read/write operation relates to whether the memory or I/O device. It goes high to indicate an I/O operation and it goes low for memory operation.

STATUS SIGNALS: S1 and S2: It is used to know the type of current operation of the microprocessor.

INTERRUPTS AND EXTERNALLY INITIATED OPERATIONS: They are the signal initiated by an external device to request the microprocessor to do a particular task or work. There are five hardware interrupts called TRAP, RST7.5, RST6.5, RST 5.5 and INTA.

DIRECT MEMORY ACCESS : When two or more devices are connected to a common bus , to prevent the devices from interfacing with each other, the tri-state gates are used to disconnect all devices the one that is communicating at a given instant. The CPU controls the data transfer operation between memory and I/O device directly. HOLD signal is generated by the DMA controller circuit. On receipt of this signal, the

microprocessor acknowledges the request by sending out HLDA signal and leaves out the control of the buses. After the HLDA signal the DMA controller starts the direct transfer of data [11].

READY: The processor sets the READY signal after completing the present job to access the data. The microprocessor enters into WAIT state while the READY pin is disabled.

SINGLE BIT SERIAL I/O PORTS: SID (input): Serial input data line. **SOD (output):** Serial Output data line. These signals are used for serial communication.

4.4 Intel 8255

The 8255 is a general purpose programmable I/O device designed for use with Intel microprocessors like 8055. It consists of three 8 bit bidirectional I/O ports that can be configured to meet different systems I/O needs. The three ports are port A, port B and port C. Port A contains one 8 bit output latch/buffer and one 8 bit i/p buffer. Port B is same as port A. However port C can be split into two parts Port C lower (PC0-PC3) and Port C upper (PC7-PC4) by the control word. The three ports are divided in two groups Group A (Port A and upper Port C) Group B (Port B and lower Port C). The two groups can be programmed in three different modes. If the first mode (mode 0); each group may be programmed in either input mode or output mode (Port A, Port B , Port C lower ,Port C upper). In mode 1, the second mode, each group may be programmed to have 8 lines of input or output (Port A or Port B) of the remaining 4 lines (Port C lower and Port C upper) 3 lines are used for hand shaking and interrupt control signals. The third mode of operation (mode 2) is a bidirectional bus and five lines (Port C upper 4 lines and borrowing one from other group) for hand shaking [12].

Figure 4.3 shows the Architecture of 8255

Figure 4.4 shows the pin configuration 0f 8255

Data Bus Buffer: It is a tri-state 8 bit buffer, which is used to interface the microprocessor to the system data bus. Data is transmitted or received by the buffer as per the instructions by the CPU. Control words and status information is also transferred

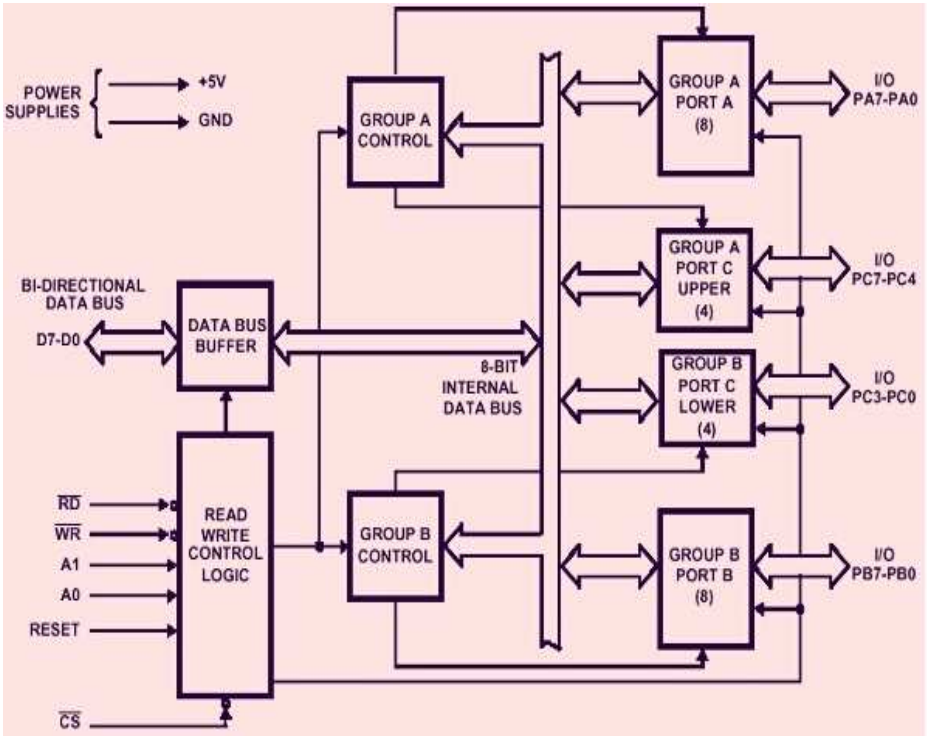

Figure 4.3: Architecture of 8255.

using this bus.

Read/Wrte Control Logic: This block is responsible for controlling the internal/external transfer of data/control/status word. It accepts the input from the CPU address and control buses, and in turn issues command both the control groups.

CS: It stands for chip select. A low on this input selects the chip and enables the communication between 8255A and the CPU. It is connected to the decoded address, and A0 and A1 are connected to the microprocessor address lines.

WR: It stands for write. This control signal enables the write operation. When this signal goes low, the microprocessor writes into a selected I/O port or control register.

Reset: This is an active high signal. It clears the control register and sets all ports in the input mode.

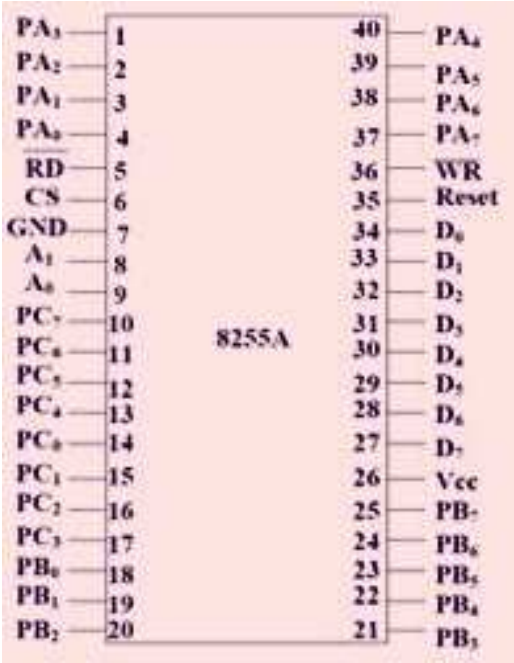

Figure 4.4: Pin configuration of 8255A.

RD: It stands for Read .This control signal enables the Read operation. When the signal is low, the microprocessor reads the data from the selected I/O port of the 8255.

A0 and A1: These input signals work with RD, WR and one of the control signal.

4.5 Traffic Light Control system using 8085 Microprocessor

The 8085 microprocessor is a popular microprocessor used in industries for various applications. Such as Traffic light control, temperature control etc. In this project, the traffic lights are interfaced to microprocessor system through ports of programmable

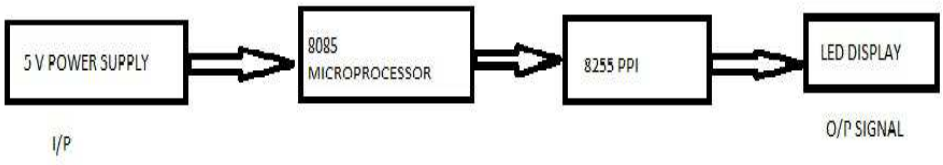

Figure 4.5: Block Diagram.

peripheral interface 8255. So the traffic light can be automatically switched ON/OFF in desired sequence. Figure4.5 shows the Block Diagram of Microprocessor base traffic Light control system.

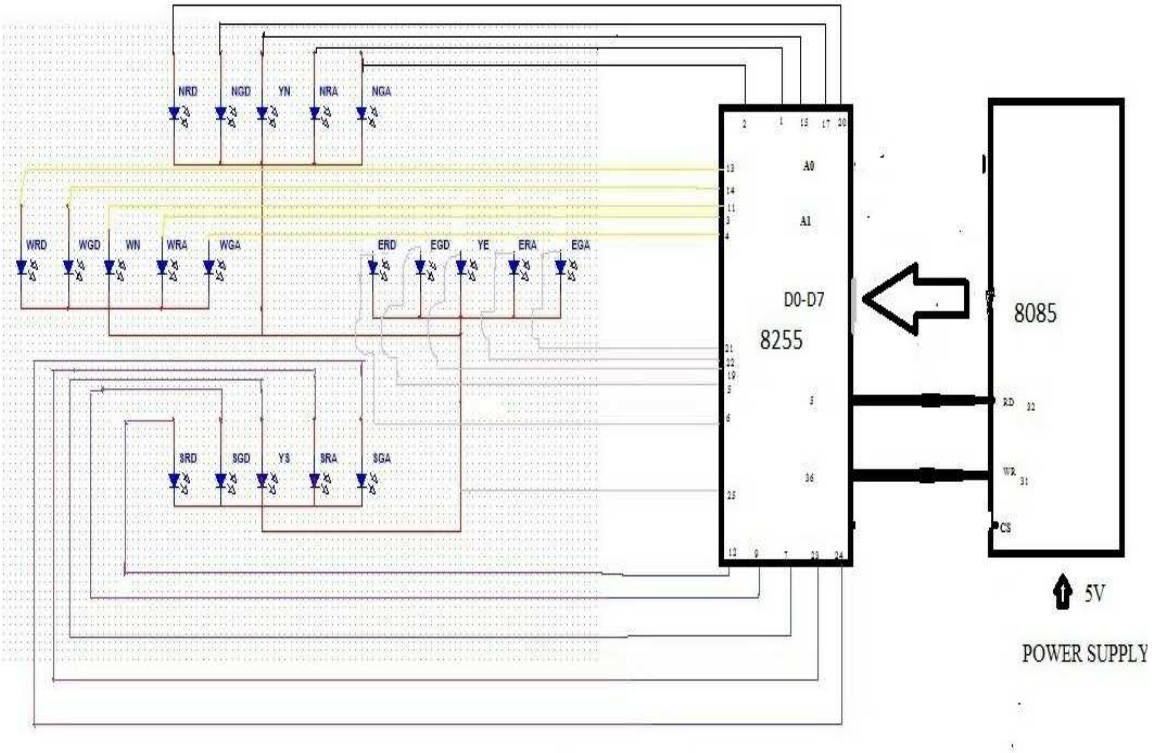

Figure 4.6: Simple arrangement and port connection for microprocessor based traffic control.

Figure 4.6 shows a simple arrangement and port connection for microprocessor based Traffic Light control. All ports of 8255 have been programmed as output ports. The control word to make all ports output ports in mode "0" operation is 80H. The connection of the pins of the ports to LED has been made through buffer. Positive logic has been used to switch ON LEDs. Five types of LEDs have been used red, Yellow, Green, Red,

green. Firstly, Red, Green and Yellow respective for general traffic symbol. Plus I have added two more light one red turn and green turn. Here red turn represents that the vehicle should not crossed the circle and go to its right lane and the green turn allows to go to its right lane.

The interface board has been designed to work with parallel port of Microprocessor system. The hardware of the system consists of two parts. The first part is Microprocessor based system with 8085 microprocessor as CPU and the peripheral device like EPROM , RAM , KEYBOARD , Programmable as Peripheral Interface 8255 , 26 pin Parallel port connector , 21 keys Hex key pad. The second part is the traffic light controller interface board, which consists of 20 LEDs and they are connected to 20 port lines of 8255 through Buffer. The traffic light interface board is connected to main board using 26 core flat cables to 26 pin port connector. The LED's can be switched ON/OFF in the specified sequence by the microprocessor. The normal function of traffic lights requires sophisticated control and coordination to ensure that traffic moves as smoothly and safely as possible. A variety of different control systems are used to accomplish this, ranging from simple, clockwork mechanism to sophisticated computerized control and coordination system that self adjust to minimize delay to people using the road.

4.6 Result

Traffic control system using 8085 Microprocessor is mainly designed to reduce traffic Problems, i.e.; in general the four sides of the road at a signal point are controlled automatically.

This unique traffic light controller makes simple use of assembly language programming with Intel 8085 microprocessor. It permits accident free control as a separate set of signals has been assigned to a direction. For instance, if one desires to move towards north, east or west from south, he is provided a single light signals for the respective directions. Consequently, the probability of confusion leading to an accident is reduced.

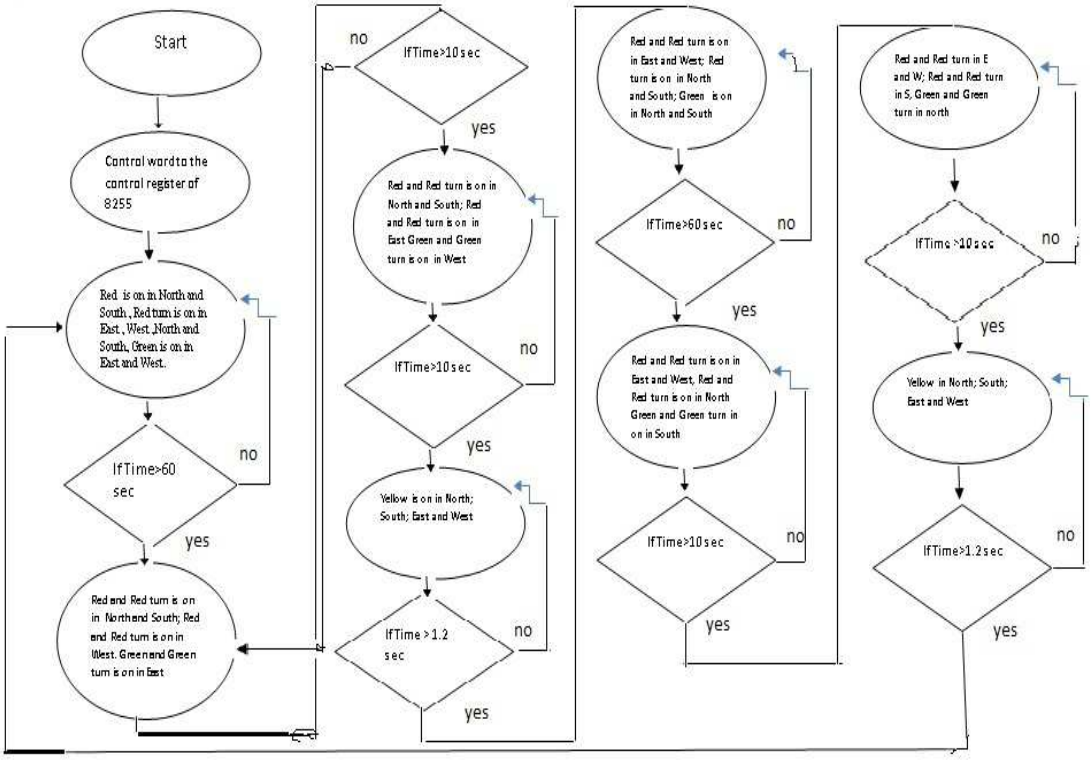

Figure 4.7: Flowchart of Microprocessor based Traffic light control system .

4.7 Summary

Designing of a system to control automatically the traffic lights on a four-way signal was the main concern.This circuit is designed by 8085 microprocessor , interfacing with peripheral devices and program implementing the process. In Microprocessor based traffic light control system the traffic lights are interfaced to Microprocessor system through ports of Programmable peripheral Interface 8255. So the traffic lights can be automatically ON/OFF in desired sequence.

Chapter 5

Traffic light control system using 8051 Micro-controller

Contents

5.1 Introduction

Traffic Light system was one of the fascinating applications of Embeded systems and have been using the same till this day. This is the four way traffic light system using embedded systems which was bit complex in nature as we need to consider the traffic flow in four different directions providing appropriate timings to each of the lights. This systems uses 8051 microcontroller (AT89C52) and Led's for indication. The Led's which was used as lights was connected to the Microcontroller by means of common Anode configuration.

5.2 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 non volatile memory is known as a Microcontroller. Also called a "computer on a chip," or on chip microcomputer [12].

5.2.1 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. The ALU performs one 8-bit operation at a time. It has 4 kB of ROM memory for storing the program code and128 bytes of internal RAM for variablesIt has16 bit timers , 32 I/O lines and 6 interrupt sources . The 8051 has 256 bytes of internal addressable RAM, although only first 128 bytes are available for general use by the programmer. The first 128 bytes of RAM (from 0x00 to 0x7F) are called the direct memory, and can be used to store data. The lowest 32 bytes of RAM are reserved for 4 general register banks. The 8051 has 4 selectable banks of 8 addressable 8-bit registers, R0 to R7. This means that there are essentially 32 available general purpose registers, although only 8 (one bank) can be directly accessed at a time. The advantage of using these register banks is time saving on the context switch for interrupted program to store and recover the status. Otherwise the push and pop stack operations are needed to save the current state and

to recover it after the interrupt is over. The default bank is bank 0.The second 128 bytes are used to store Special Function Registers (SFR) that C51 program can configure and control the ports, timer, interrupts, serial communication, and other tasks[11].

Figure 5.1 shows the Architecture of 8051 Microcontroller

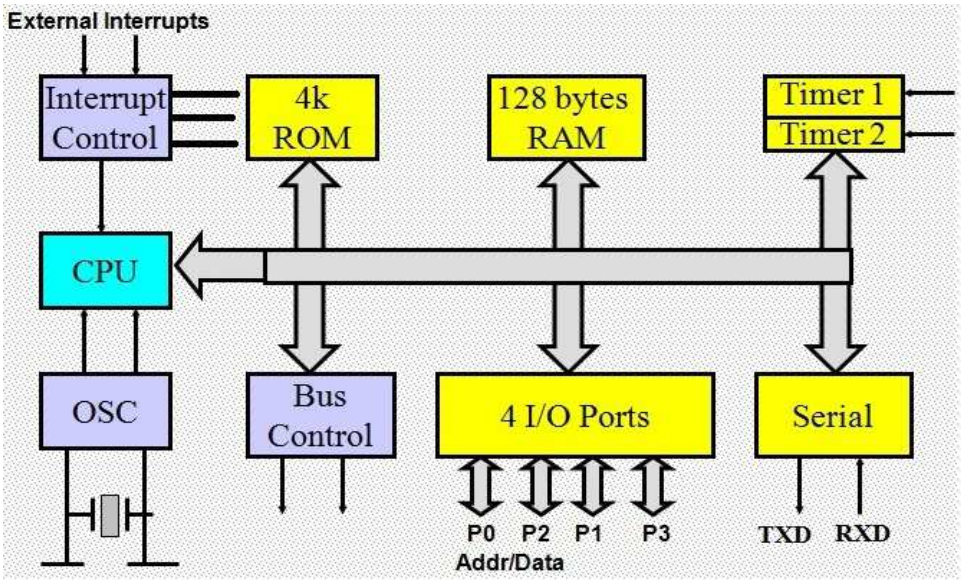

Figure 5.1: Architecture Of 8051 Microcontroller.

Figure 5.2 shows the pin configuration of 8051

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.

$\overline{EA}$**(pin 31):**The $\overline{EA}$ (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 $\overline{EA}$ pin is connected to GND to indicate the code is stored externally.

$\overline{PSEN}$ **(pin 29):**Program store enable This is an output pin and is connected to the OE pin of the ROM. The $\overline{PSEN}$ (Program Store Enable) is for reading external code memory when it is low (0) and $\overline{EA}$ is also 0. The ALE (Address Latch Enable)

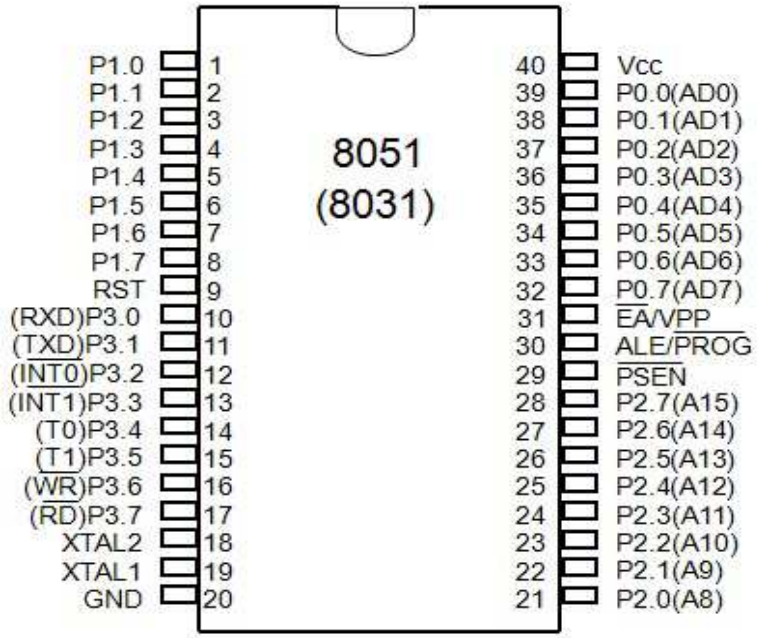

Figure 5.2: Pin Configuration of 8051 Microcontroller.

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.

- $\overline{PSEN}$ and ALE are used for external ROM
- For 8051, $\overline{EA}$ pin is connected to Vcc

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 $\overline{EA}$, ALE, $\overline{PSEN}$, $\overline{WR}$, $\overline{RD}$for internal and external data and code memory access controls .

The 8051 requires an external oscillator circuit. The oscillator circuit usually 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 [11].

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.

5.3 Traffic Lght Control System Using 8051 Microcontroller

Figure 5.3 shows the Block diagram of Microcontroller based Traffic Light Control system. The pins of the various input output ports of the microcontroller are connected directly to the given leds. The 8051 is programmed in a manner that the respective Leds glow by setting the required bit using assembly language and a certain amount of delay is provided depending on the user .

Figure 5.4 shows a simple arrangement and port connection for microprocontroller based Traffic Light control.

The 8051 microcontroller is a popular microcontroller used in industries for various applications. Such as Traffic light control, temperature control etc. In this project, 8051

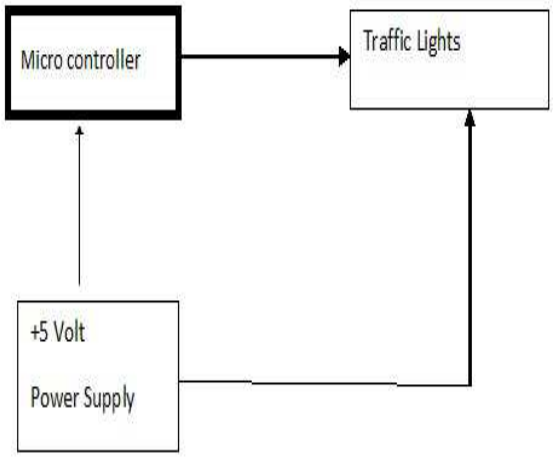

Figure 5.3: Block Diagram

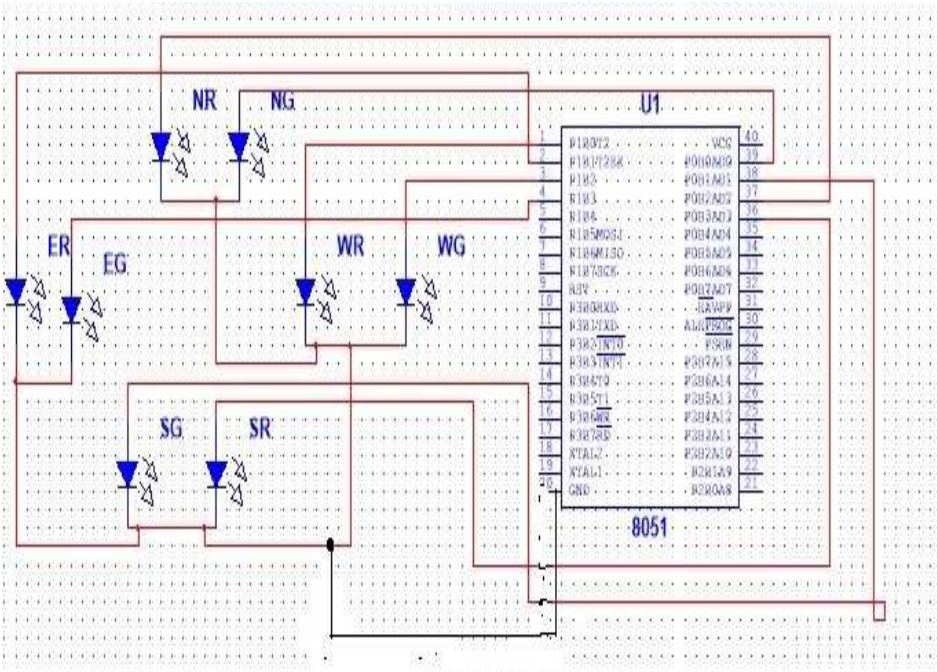

Figure 5.4: Traffic Lght Control System Using 8051 Microcontroller

Lab Trainer kit is proposed to smooth the progress of learning and developing designs of MCU from Intel and NXP. It has the facility to connect PC's 101/104 keyboard , to enter user programs in Assembly languages. Serial communication achieved using 8051 .It also supports C and assembly language in standalone kit (P89V51RD2). It is

designed as to facilitate on-board programmer for NXP 8051 MCU through ISP on serial port.

The pins of the various input output ports of the microcontroller are connected directly to the given leds. The 8051 is programmed in a manner that the respective Leds glow by setting the required bit using assembly language and a certain amount of delay is provided depending on the user

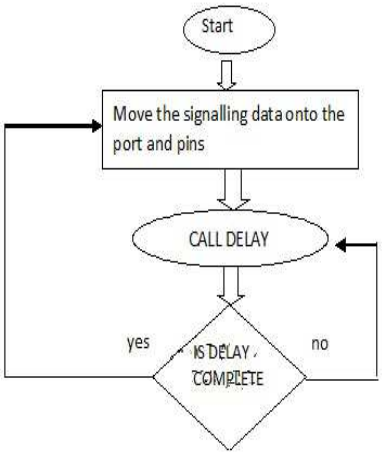

Figure 5.5: Flowchart of Traffic Lght Control System Using 8051 Microcontroller

5.4 Results

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.

Based on our analysis of the present traffic control system, the following assumptions became necessary in order to develop a feasible system:

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 who's of the east and west combined as another side.

5.5 Summary

Designing of a system to control automatically the traffic lights on a four-way signal was the main concern. This circuit is designed by 8051 microcontroller. The pins of the various input output ports of the microcontroller are connected directly to the given leds. The 8051 is programmed in a manner that the respective Leds glow by setting the required bit using assembly language and a certain amount of delay is provided depending on the user . The use of Embedded technology has proved to be very beneficial in present Traffic Light Control System and that will minimize waiting time of vehicle.

Chapter 6

Conclusion

Contents

6.1 Advantage

It will reduce the normal recurring. Significantly it will enhance operational tools congestion to effectively manage traffic incidents. It will improve Public Transport service. Reduce the emergency response times and safer travel. Similarly it will improve traffic guidance and traffic flow and reduce fuel consumption.

6.2 Limitation Of The Study

Traffic Congestion is a serious problem despite costly effort to create an integrated method of traffic control system. The number of private automobiles used mainly by people with middle class for income,has increased faster than any form of transportation in India and this has increased a demand of expansion of roads,parking space and improved automatic traffic light control system.

6.3 Conclusion

In this project I have implemented switching based, counter based. Traffic Light control system. The hardware equipment is tested and result is obtained. This project is cost effective. Implementation of this project in present day will effectively solve the traffic congestion which is a severe problem in many modern cities all over the world.

Automatic Traffic control system is based on a very effective way of optimizing traffic, with redefinition of threshold values for a real time application. This works to control traffic on four way roads according to traffic control barricades which is functioned by ICs. This proposed system will be able to build a developed country with less traffic jams and it will also help the emergency vehicle to reach in time to the destination. So, this intelligent system will help us to control traffic in more autonomous way.

In practice presently in India we are following time based control on traffic signals and we are experiencing a heavy traffic jams all over which in turn consumes lot of time and fuel. We hope this method will be adopted as soon as possible so that the limitations we are experiencing with present method can be overcome.

6.4 Future Scope

As the systems take care of few drawbacks of the existing system, there is scope for further improvement and expansion of this work. The system can be expanded with smart traffic light control and congestion avoidance system during emergencies emergency cars such as fire engines and ambulance and have priority over other traffic. This system gives highest priority to emergency vehicle to pass them.

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