BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

EEE 304 (January 2023)

Digital Electronics Laboratory

Final Project Report

Section: B1 Group: 02

Traffic Light Control with Pedestrian Crossing

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Academic Honesty Statement:

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"In signing this statement, We hereby certify that the work on this project is our own and that we have not copied the work of any other students (past or present), and cited all relevant sources while completing this project. We understand that if we fail to honor this agreement, We will each receive a score of ZERO for this project and be subject to failure of this course."

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1 Abstract

This project aims to design and implement a traffic light control system with pedestrian movement using digital logic circuits. The system consists of four traffic lights at a four-way intersection and four pedestrian buttons that allow pedestrians to cross the road safely. The system uses Verilog code to program the logic functions of the traffic lights and pedestrian signals, as well as a schematic design in Proteus to simulate the hardware implementation. The system also uses breadboard, IC7402, IC7408, IC4017, IC4001, 2-input OR and 3-input OR gates, 555 timer IC to build the physical circuit. The results show that the system works as expected and meets the specifications of the project. The system can be used as a prototype for real-world applications of traffic light control with pedestrian movement.

2 Introduction

Traffic management is a crucial aspect of urban planning and transportation engineering, which deals with the safe and efficient movement of vehicles, pedestrians, and other modes of transportation on roads and highways. Traffic light control systems are frequently employed to observe and manage the movement of cars through the intersection of numerous roads. They want to make sure that cars are moving smoothly throughout the transportation corridors. However, considering the different elements involved, synchronizing several traffic signal systems at nearby junctions is challenging. Variable flows that are nearing junctions cannot be handled by conventional methods. Additionally, the current traffic system does not consider the reciprocal interference between adjacent traffic light systems, the discrepancy in car flow over time, accidents, the passing of emergency vehicles, or pedestrian crossings. This results congestion and traffic jams. The main principle of a traffic management system is to use a set of signals to indicate when vehicles and pedestrians should stop or go. In a crowded city like Dhaka the necessity of traffic management is evident. According to some report, due to lack of proper planning and management in Bangladesh more than 10 million working hour is lost which cost us about 10% our nominal GDP. Ensuring a planned traffic system would increase our GDP. Traffic light can play a vital role in traffic management system. So the main objective of our project is to design a model for traffic management system using traffic light with pedestrian movement. We designed a model which can handle the movement of car and pedestrian simultaneously. In this project we will simulate a circuit for our model and verify it with Verilog code as well as hardware implementation. Our designed model can be very useful in maintaining a better traffic system.

3 Design

3.1 Problem Formulation

We will design a circuit which will control the movement of cars and pedestrians in a systematic way using traffic lights and implement it in hardware.

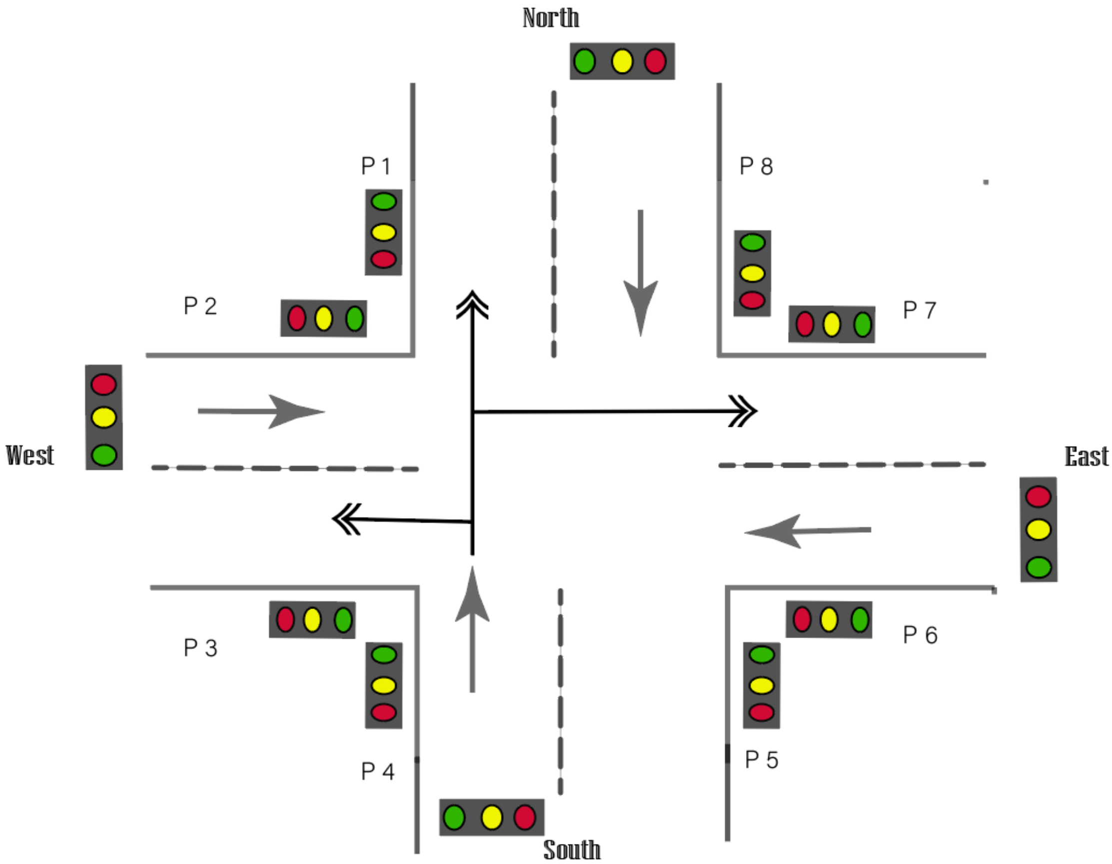


Figure 1:Model of traffic management for cars and pedestrians

This is a model of 4 way intersection road with all roads are divided by road-divider Islands and each side of the roads has dual lanes. In this model, the transport passing and pedestrian crossing both will be implemented without completely stopping all the roads. If a car is moving from south to north then it can South part signal will be green and other parts (East, West, North) signal will be red. For the pedestrian, pedestrian can move from P5, P2, P6 and P8 to divider as this Pedestrian signal will remain green and the other parts P1, P3, P7, P4 will remain red. After that when south to north light becomes yellow all pedestrian signal will become red for safety. Then another road signal will turn into green and this process will be continued and the same cycle will repeat.

3.1.1 Identification of Scope

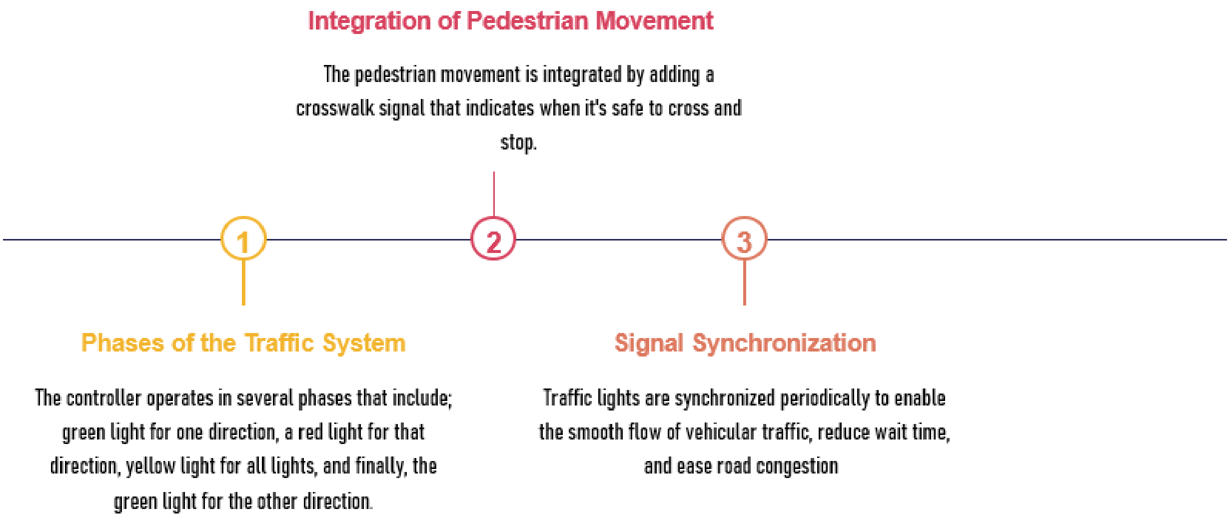
The main goal of our project is to ensure a better traffic management system considering both car and pedestrian movement. We have a great scope to use this project outcome to implement in real life traffic system. Thus it may reduce the traffic jam and can play a major role to prevent road accident specially it will ensure the degree safety for pedestrians. This project outcome may save our time, asset and even life. Regardless of having some limitations, it is still relevant to our modern day requirements. So the most important scope is to make a better and smart transportation management.

3.1.2 Literature Review

To find the best fixed-time signal plan, Rongrong Tian and Xu Zhang recommended using the TRANSYT traffic modeling software. They also recommended using the VISSIM micro-simulation software to validate and assess the TRANSYT model and to aid in determining the best signal plan. Finally, they recommended creating an adaptive frame signal plan and then fine-tuning and evaluating the plan using VISSIM with VS-PLUS emulator. It was demonstrated through micro simulation that the adaptive signal control's latency was significantly less than that of the fixed time control. An innovative technique for area-wide traffic signal time optimization under user equilibrium traffic was introduced by ianhua Guo et al.. The optimization model was created as a multi-dimensional search problem with the goal of minimizing the product of the variance in journey time per unit distance and the overall trip time connected with the urban street network. The model solution was created using a genetic algorithm. The logic frame and function module of the area-wide traffic signal control system are designed using a simulation control protocol that is included in the PARAMICS software tool and capable of conducting area-wide micro simulation. His findings demonstrate that after using the suggested model and the genetic algorithm to optimize area-wide signal timing, as measured by extended capacity ratio, mobility is improved. Giacomo Como _ Giacomo Nilsson concentrated on a group of dynamic feedback traffic signal control strategies built on a generalized proportional allocation mechanism. There is a differential inclusion that is produced, and there use a generalization of the reflection principle to demonstrate the existence and, in the particular instance of orthogonal phases, the uniqueness of continuous solutions. The generalized proportional allocation controllers are then interpreted as minimizers of a certain entropy-like function, which is then applied as a Lyapunov function for the closed-loop system, in order to demonstrate stability. A group-based signal control approach that may make judgments based on its comprehension of traffic conditions at the intersection level was proposed by Junchen Jin and Xiaoliang Ma. Each signal group is described as an intelligent agent in the context of stochastic optimum control for multi-agent systems, which is used to construct the control problem. The suggested solution is intended to work with the current signaling infrastructure. A genetic algorithm was used to off-line optimize the parameters. The proposed adaptive group-based control system outperforms the optimal GBVA control system, according to simulation results, primarily because of its real-time adaptive learning capability in response to changes in traffic demand. Traffic flow on urban streets was managed by Nasser R. Sabar et al. by selecting the proper signal time parameters. The proposed technique is based on the so-called memetic algorithm, which adaptably combines the advantages of local search and evolutionary algorithms. In that, two significant methods for enhancing the efficiency of conventional memetic algorithms were applied. To efficiently utilize the search space, a systematic neighborhood-based simple descent method was first used as a local search. Second, a control system for the local search application based on the standard and variety of the search process was suggested. The suggested algorithm was programmed in the industry-standard microscopic traffic simulator AIMSUN and evaluated on two distinct real-world case studies in Brisbane, Australia. .The results showed that the suggested approach was superior than genetic algorithms and fixed-time settings, proving that it was a useful method for solving traffic signal optimization issues. Mohammad Aslani et al utilized RL (Reinforcement learning) algorithms to design adaptive traffic signal controllers called actor-critic adaptive traffic signal controllers (A-CATs controllers).

3.1.3 Formulation of Problem

We have actually three basic tasks to fulfill in this project.



These are the main problem in this project. We will design a suitable logic circuit using various gates and IC's. After simulating the circuit, we will implement it in breadboard.

3.1.4 Analysis

We will consider 8 states and for each states we will consider either the green or yellow light will turn on for car movement. The red light is on when each of the light in particular direction is off. The pedestrian traffic light will have to be synchronized with the traffic light for the car. We formulated a truth table to summarize the logic that is implemented in this project. We will model the traffic light using red, green and yellow LED's. For clock generation we used counter IC CD4017 and 555 timer IC. The red light is connected to the output of NOR gate which has input of green or yellow light for all the car and pedestrian movement. Thus red will not be in on state if green or yellow light remains on. The clock for red and yellow light for traffic signals is generated by a timer and counter IC.

Truth Table:

State	N_G	N_Y	N_R	S_G	S_Y	S_R	E_G	E_Y	E_R	W_G	W_Y	W_R
A	1	0	0	0	0	1	0	0	1	0	0	1
B	0	1	0	0	0	1	0	0	1	0	0	1
C	0	0	1	1	0	0	0	0	1	0	0	1
D	0	0	1	0	1	0	0	0	1	0	0	1
E	0	0	1	0	0	1	1	0	0	0	0	1
F	0	0	1	0	0	1	0	1	0	0	0	1
G	0	0	1	0	0	1	0	0	1	1	0	0
H	0	0	1	0	0	1	0	0	1	0	1	0

State	P1_G	P1_Y	P1_R	P2_G	P2_Y	P2_R	P3_G	P3_Y	P3_R	P4_G	P4_Y	P4_R
N-G	1	0	0	1	0	0	0	0	1	1	0	0
N_Y	0	1	0	0	1	0	0	0	1	0	1	0
S_G	0	0	1	0	0	1	0	0	1	1	0	0
S_Y	0	0	1	0	0	1	0	0	1	0	1	0
E_G	1	0	0	0	0	1	0	0	1	0	0	1

E_Y	0	1	0	0	0	1	0	0	1	0	0	1
W_G	1	0	0	0	0	1	1	0	0	1	0	0
W_Y	0	1	0	0	0	1	0	1	0	0	1	0

State	P5_G	P5_Y	P5_R	P6_G	P6_Y	P6_R	P7_G	P7_Y	P7_R	P8_G	P8_Y	P8_R
N-G	1	0	0	0	0	1	0	0	1	0	0	1
N_Y	0	1	0	0	0	1	0	0	1	0	0	1
S_G	1	0	0	0	0	1	1	0	0	1	0	0
S_Y	0	1	0	0	0	1	0	1	0	0	1	0
E_G	1	0	0	1	0	0	1	0	0	0	0	1
E_Y	0	1	0	0	1	0	0	1	0	0	0	1
W_G	0	0	1	0	0	1	1	0	0	0	0	1
W_Y	0	0	1	0	0	1	0	1	0	0	0	1

3.2 Design Method

Previously stated we will design the project considering eight states. Here a design method for our project using FSM is shown:

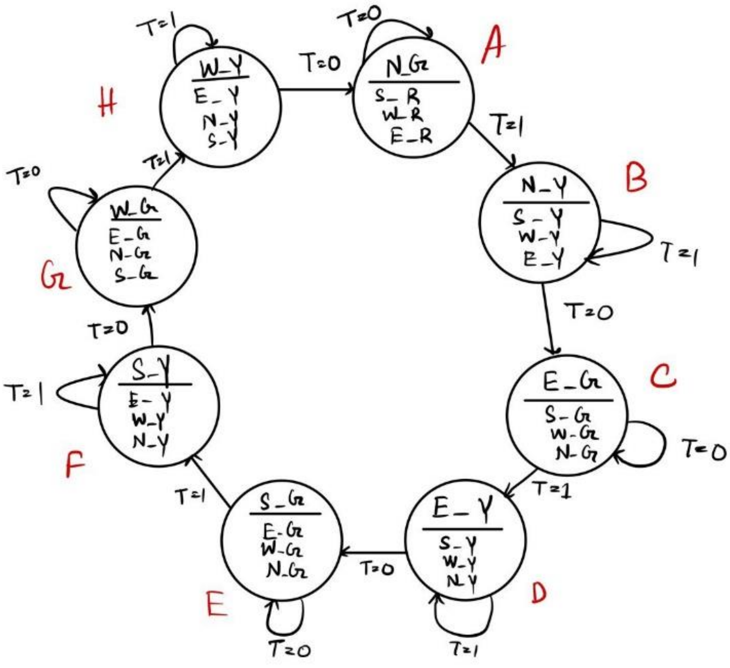


Figure 2: State Diagram

3.3 Circuit Diagram

Here is the circuit of our project:

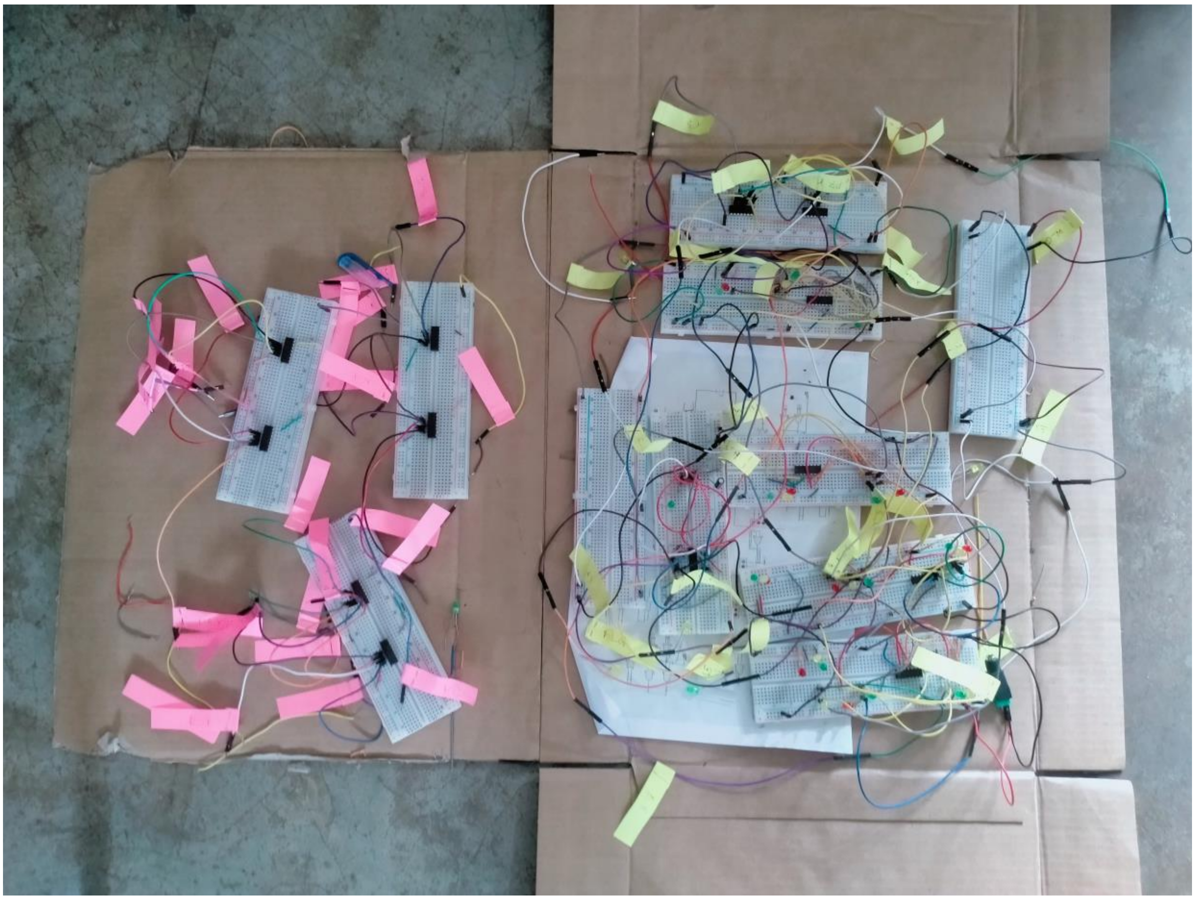


Figure 3: Circuit Connection of our project

3.4 Simulation Model

The circuit we designed in our project is simulated by a simulation software named 'Proteus'. The simulation result we obtained is quite satisfactory. Using this simulation model we constructed our circuit.

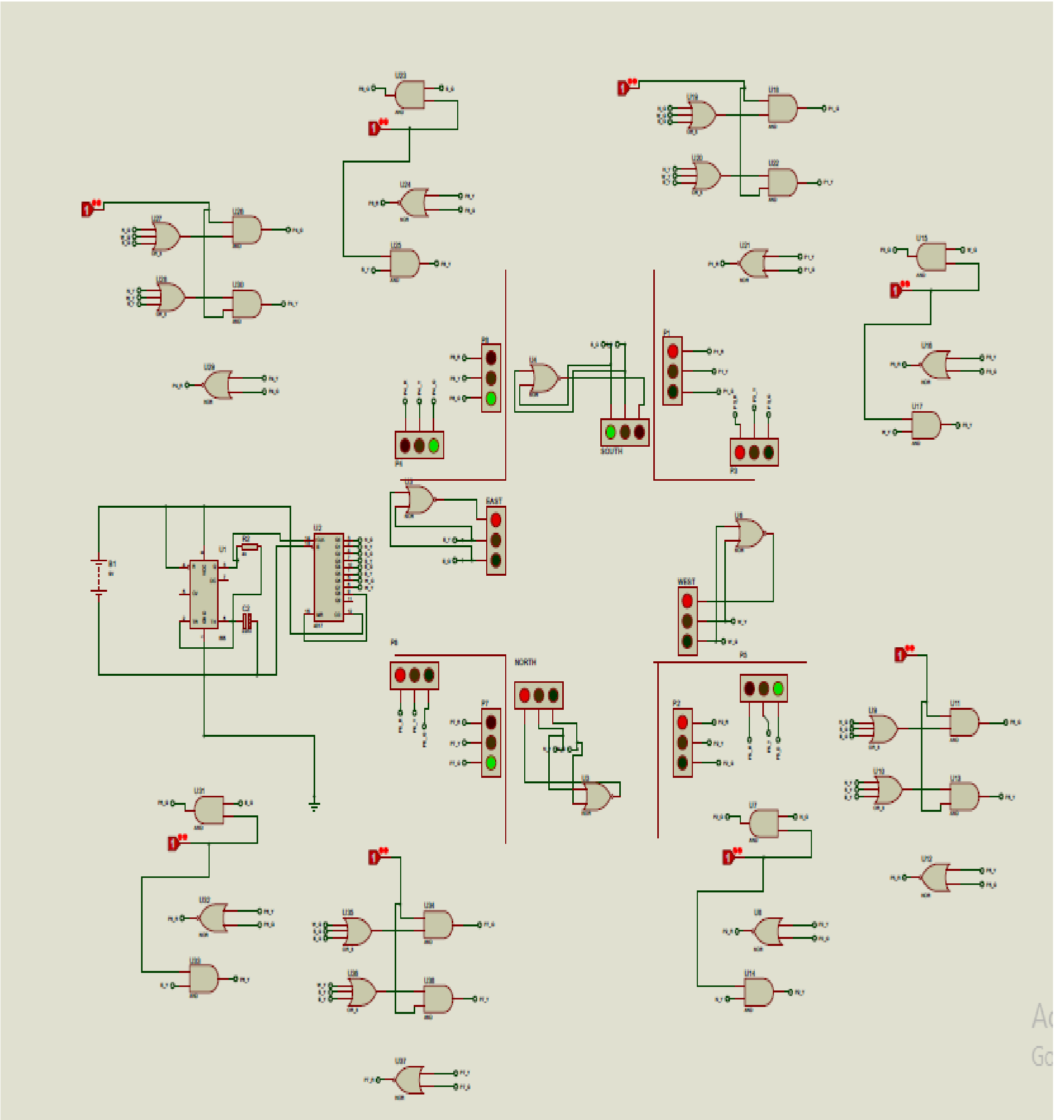


Figure 4: Circuit Diagram of our project

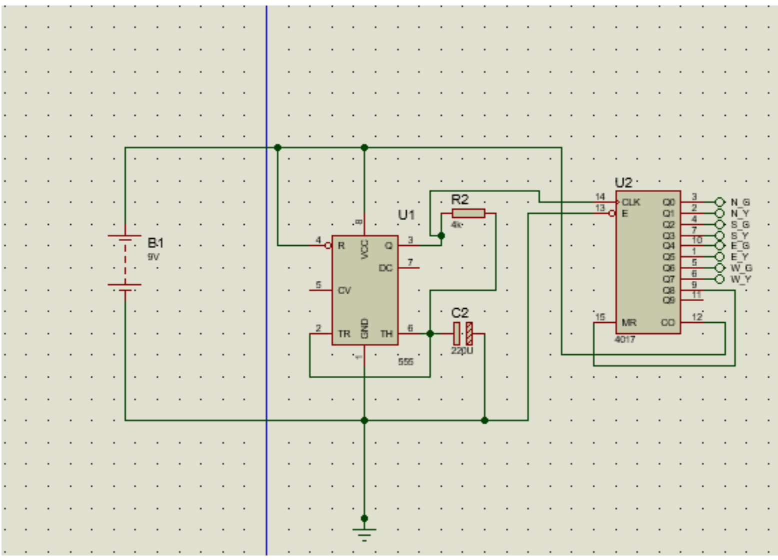


Figure 5: Circuit for clock generation to decade counter

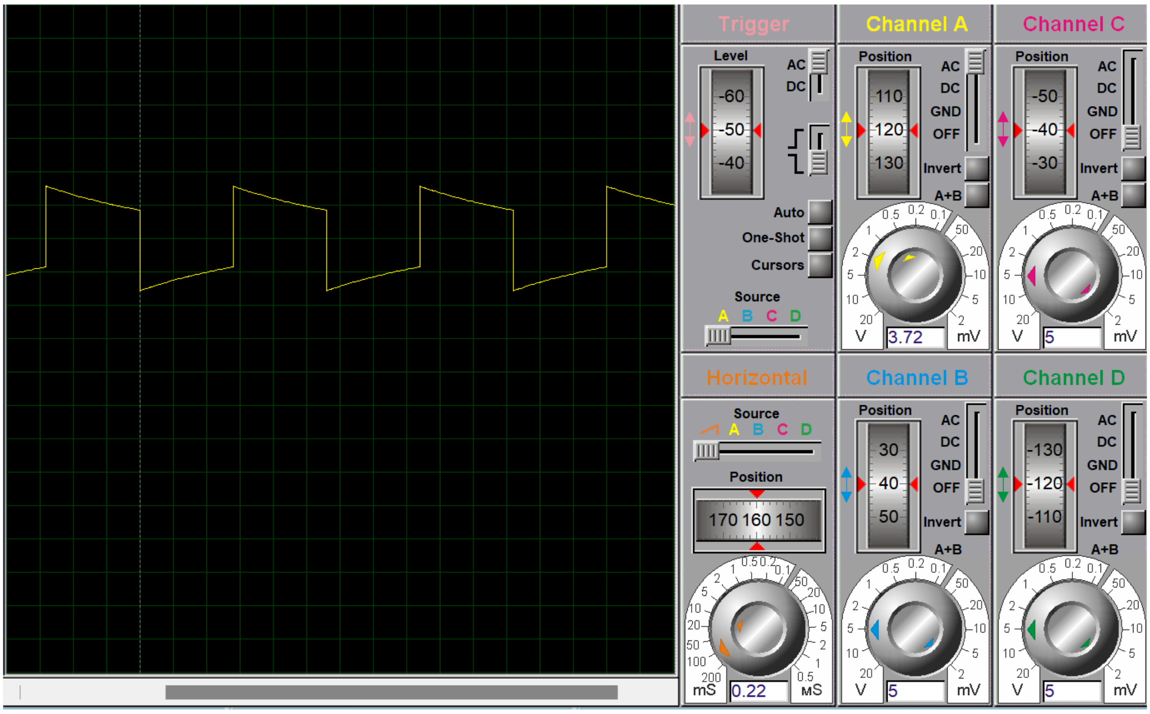


Figure 6: Output from 555 timer IC

3.5 Full Source Code of Firmware

The whole project was implemented in Verilog via Hardware Description Language. The code is given below:

Table: Source Code for the main program

```
module
traffic_light(Clk,Reset,w,N_G,N_Y,N_R,S_G,S_Y,S_R,E_G,E_Y,E
_R,W_G,W_Y,W_R,P1_G,P1_Y,P1_R,P2_G,P2_Y,P2_R,P3_G,P3_Y,P3_R
,

P4_G,P4_Y,P4_R,P5_G,P5_Y,P5_R,P6_G,P6_Y,P6_R,P7_G,P7_Y,P7_R
,P8_G,P8_Y,P8_R);

          input Clk,Reset,w;
          output                                        reg
N_G,N_Y,N_R,S_G,S_Y,S_R,E_G,E_Y,E_R,W_G,W_Y,W_R;

          output                                        reg
P1_G,P1_Y,P1_R,P2_G,P2_Y,P2_R,P3_G,P3_Y,P3_R,P4_G,P4_Y,P4_R
,P5_G,P5_Y,P5_R,P6_G,P6_Y,P6_R,P7_G,P7_Y,P7_R,P8_G,P8_Y,P8_
R;

          reg [3:1] y,Y;
          parameter                                   [3:1]
A=3'b000,B=3'b001,C=3'b010,D=3'b011,E=3'b100,F=3'b101,G=3'b
110,H=3'b111;

          always @(w,y)
          begin
              case(y)
                A: if(w)
                   begin
```

```
P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=1;P6_R=0;P7_G=0;P7
_Y=1;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=E;
                   end
 E:   if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=1;S_Y=0;S_R=0;E_G=0;E_Y=0;E_R
=1;W_G=0;W_Y=0;W_R=1;

P1_G=0;P1_Y=0;P1_R=1;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3
_Y=0;P3_R=1;P4_G=1;P4_Y=0;P4_R=0;

P5_G=1;P5_Y=0;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=1;P7
_Y=0;P7_R=0;P8_G=1;P8_Y=0;P8_R=0;

                       Y=F;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=1;S_Y=0;S_R=0;E_G=0;E_Y=0;E_R
=1;W_G=0;W_Y=0;W_R=1;
```

```
N_G=1;N_Y=0;N_R=0;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R=1;W_G=0
;W_Y=0;W_R=1;


P1_G=1;P1_Y=0;P1_R=0;P2_G=1;P2_Y=0;P2_R=0;P3_G=0;P3_Y=0;P3_
R=1;P4_G=1;P4_Y=0;P4_R=0;

P5_G=1;P5_Y=0;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7_Y=0;P7_
R=1;P8_G=0;P8_Y=0;P8_R=1;

                      Y=B;

                   end
                   else
                   begin

N_G=1;N_Y=0;N_R=0;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R=1;W_G=0
;W_Y=0;W_R=1;


P1_G=1;P1_Y=0;P1_R=0;P2_G=1;P2_Y=0;P2_R=0;P3_G=0;P3_Y=0;P3_
R=1;P4_G=1;P4_Y=0;P4_R=0;

P5_G=1;P5_Y=0;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7_Y=0;P7_
R=1;P8_G=0;P8_Y=0;P8_R=1;

                      Y=A;
                   end
                B: if(w)
                   begin

N_G=0;N_Y=1;N_R=0;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R=1;W_G=0
;W_Y=0;W_R=1;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=1;P2_R=0;P3_G=0;P3_Y=0;P3_
R=1;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7_Y=0;P7_
R=1;P8_G=0;P8_Y=0;P8_R=1;

                       Y=B;

                   end
                   else
                   begin

N_G=0;N_Y=1;N_R=0;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R=1;W_G=0
;W_Y=0;W_R=1;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=1;P2_R=0;P3_G=0;P3_Y=0;P3_
R=1;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7_Y=0;P7_
R=1;P8_G=0;P8_Y=0;P8_R=1;


                     Y=C;
                   end
                C:  if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=1;E_Y=0;E_R=0;W_G=0
;W_Y=0;W_R=1;


P1_G=1;P1_Y=0;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3_Y=0;P3_
R=1;P4_G=0;P4_Y=0;P4_R=1;

P5_G=1;P5_Y=0;P5_R=0;P6_G=1;P6_Y=0;P6_R=0;P7_G=1;P7_Y=0;P7_
R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=D;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=1;E_Y=0;E_R=0;W_G=0
;W_Y=0;W_R=1;
```

```
P1_G=0;P1_Y=0;P1_R=1;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3
_Y=0;P3_R=1;P4_G=1;P4_Y=0;P4_R=0;

P5_G=1;P5_Y=0;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=1;P7
_Y=0;P7_R=0;P8_G=1;P8_Y=0;P8_R=0;

                       Y=E;
                   end
                F:   if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=1;S_R=0;E_G=0;E_Y=0;E_R
=1;W_G=0;W_Y=0;W_R=1;


P1_G=0;P1_Y=0;P1_R=1;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3
_Y=0;P3_R=1;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7
_Y=1;P7_R=0;P8_G=0;P8_Y=1;P8_R=0;

                       Y=F;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=1;S_R=0;E_G=0;E_Y=0;E_R
=1;W_G=0;W_Y=0;W_R=1;


P1_G=0;P1_Y=0;P1_R=1;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3
_Y=0;P3_R=1;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7
_Y=1;P7_R=0;P8_G=0;P8_Y=1;P8_R=0;

                       Y=G;
                   end
               G:   if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R
=1;W_G=1;W_Y=0;W_R=0;


P1_G=1;P1_Y=0;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=1;P3
_Y=0;P3_R=0;P4_G=1;P4_Y=0;P4_R=0;

P5_G=0;P5_Y=0;P5_R=1;P6_G=0;P6_Y=0;P6_R=1;P7_G=1;P7
_Y=0;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=H;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R
=1;W_G=1;W_Y=0;W_R=0;



P1_G=1;P1_Y=0;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=1;P3
_Y=0;P3_R=0;P4_G=1;P4_Y=0;P4_R=0;

P5_G=0;P5_Y=0;P5_R=1;P6_G=0;P6_Y=0;P6_R=1;P7_G=1;P7
_Y=0;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=G;
                   end
               H:   if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R
=1;W_G=0;W_Y=1;W_R=0;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3
_Y=1;P3_R=0;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=0;P5_R=1;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7
_Y=1;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;
```

```
P1_G=1;P1_Y=0;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3_Y=0;P3_R=1;P4_G=0;P4_Y=0;P4_R=1;

P5_G=1;P5_Y=0;P5_R=0;P6_G=1;P6_Y=0;P6_R=0;P7_G=1;P7_Y=0;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                      Y=C;
                   end
                D:   if(w)
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=1;E_R=0;W_G=0;W_Y=0;W_R=1;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3_Y=0;P3_R=1;P4_G=0;P4_Y=0;P4_R=1;

P5_G=0;P5_Y=1;P5_R=0;P6_G=0;P6_Y=1;P6_R=0;P7_G=0;P7_Y=1;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=D;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=1;E_R=0;W_G=0;W_Y=0;W_R=1;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3_Y=0;P3_R=1;P4_G=0;P4_Y=0;P4_R=1;
                       Y=H;

                   end
                   else
                   begin

N_G=0;N_Y=0;N_R=1;S_G=0;S_Y=0;S_R=1;E_G=0;E_Y=0;E_R=1;W_G=0;W_Y=1;W_R=0;


P1_G=0;P1_Y=1;P1_R=0;P2_G=0;P2_Y=0;P2_R=1;P3_G=0;P3_Y=1;P3_R=0;P4_G=0;P4_Y=1;P4_R=0;

P5_G=0;P5_Y=0;P5_R=1;P6_G=0;P6_Y=0;P6_R=1;P7_G=0;P7_Y=1;P7_R=0;P8_G=0;P8_Y=0;P8_R=1;

                       Y=A;
                   end
              endcase

          end

          always @(posedge Reset or posedge Clk)
          begin

              if(Reset==1) y<=A;
              else y<=Y;

          end


endmodule
```

The output waveform is attached here

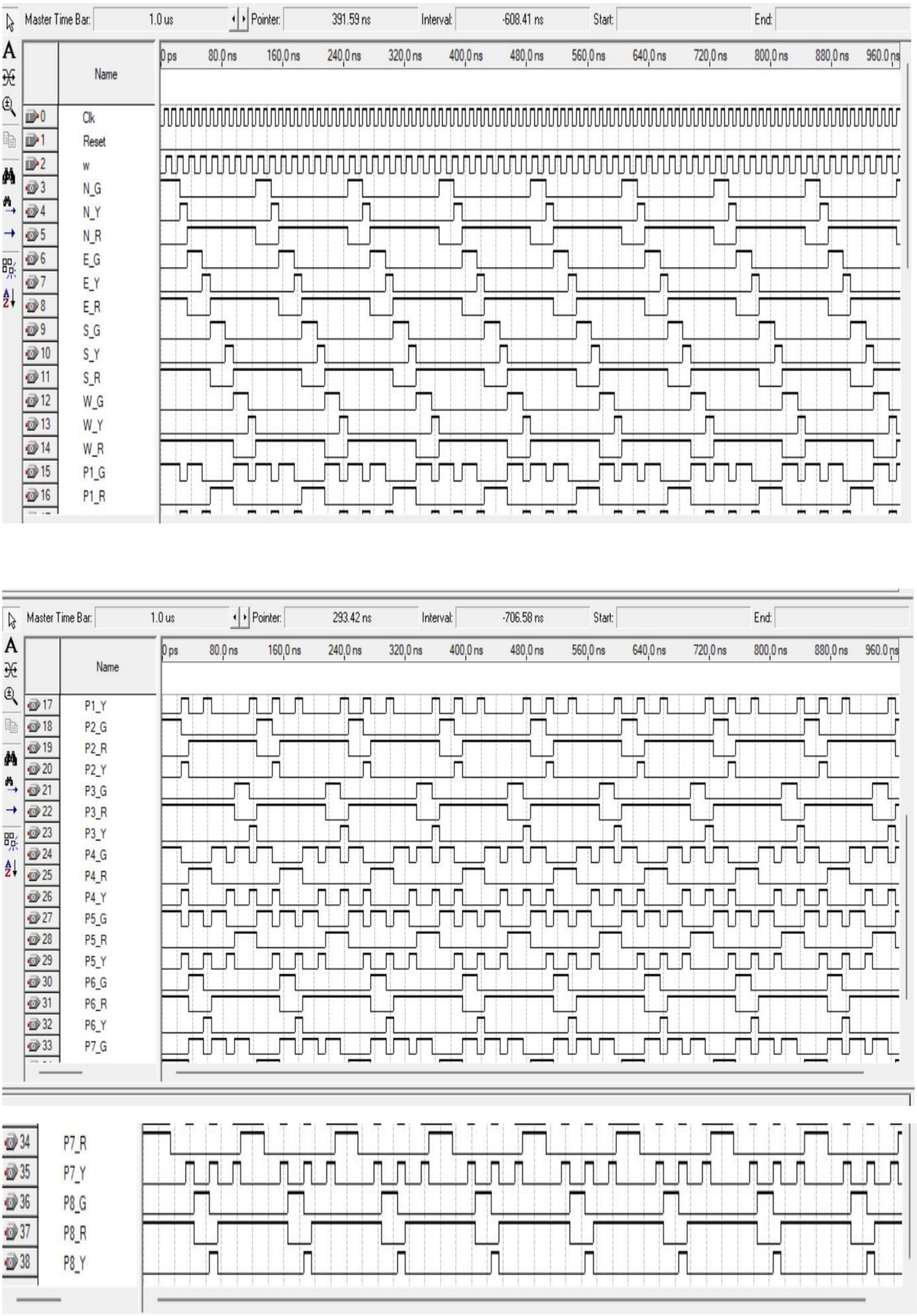


Figure 7: Simulation Timing Diagram (Vector Waveform)

4 Implementation

4.1 Description

In this project, we used **Proteus software** and **Verilog code** to design and implement a traffic light control system with pedestrian movement. We used these tools to design the logic and functionality of our traffic light control system, which consists of four main components: the traffic light controller, the pedestrian controller, the traffic sensor, and the pedestrian sensor.

The traffic light controller is responsible for controlling the sequence and timing of the traffic lights at the intersection. It has four states: green, yellow, red, and all-red. The transition between these states depends on the input from the traffic sensor and the pedestrian sensor. The traffic light controller outputs four signals: R (red), Y (yellow), G (green), and AR (all-red) to control the traffic lights.

The pedestrian controller is responsible for controlling the pedestrian crossing signal at the intersection. It has two states: walk and don't walk. The transition between these states depends on the output from the traffic light controller.

The pedestrian is allowed when the red light of his part is on.We implemented this project in hardware format using breadboards and ICS. We checked the LEDs and found them working properly.

4.2 Data Analysis

In our project, our goal was to control the movement of eight pedestrian. But due to hardware limitations, we could not implement it successfully.

4.3 Results

We could implement four way traffic signal and four pedestrian traffic lanes only.

5 Design Analysis and Evaluation

5.1 Novelty

The concept of making traffic light control system using logic ICs is not a new thing. The parts that differentiate our project from other projects are implementation of circuit and adding new features. Here, we used 555 IC timer to generate clock signal. Also, for pedestrian movement, we used push button as pressure sensor. These features make our project unique to others.

5.2 Design Considerations

5.2.1 Considerations to public health and safety

We made a miniature traffic light model which can be implemented in big scale. Improper traffic management leads to traffic congestion. Everyday, our valuable working hours are wasted due to traffic jam. Lack of traffic management also leads to various accidents. Our project aims to alleviate these kinds of problems. Proper implementation of traffic light control system can ensure public safety in busy roads. Pedestrians can cross roads without fear of getting hit by vehicle by proper implementation of traffic management.

5.2.2 Considerations to environment

Most of the apparatuses that are used in this project are recyclable. The equipment can be re used in other projects after the demonstration is finished. So, nothing goes wasted in our project. No element was disposed to the environment during project construction.

5.2.3 Considerations to cultural and societal needs

When creating a miniature traffic light control system with a pedestrian crossing utilizing logic integrated circuits, it is essential to take cultural and social concerns into account. The design should adhere to regional norms and practices regarding pedestrian safety and driving behavior in order to ensure cultural relevance. The promotion of accessibility for a wide audience is achieved by designing a user-friendly interface with universal symbols and signage. The educational component of this project should increase understanding of social responsibility and traffic safety while incorporating the neighborhood and stakeholders in its development. Sustainability ought to be a top concern, in line with cultural and environmental values. The project's societal impact is further increased by ensuring accessibility for people with impairments and abiding with local traffic laws, making it a thorough and culturally aware educational tool.

5.3 Investigations

5.3.1 Literature Review

Long-standing key challenges in urban planning and transportation engineering are traffic management and safety. Due to the growing emphasis on pedestrian safety and urban mobility, the integration of pedestrian crossings into traffic light control systems has gained prominence in recent years. According to published research, using logic integrated circuits (ICs) to mimic traffic control systems has proven to be a successful instructional strategy for teaching traffic engineering principles. These little systems give students hands-on experience and are frequently used in educational institutions all around the world.

Research also emphasizes how crucial it is to take cultural and social demands into account when planning programs for traffic management. Designing traffic control systems with a cultural awareness guarantees that the symbols and signals used by the system are understood by the community. The project's relevance to real-world settings is demonstrated by the inclusion of pedestrian crossings, which address pedestrian safety, a major concern in urban areas. The material emphasizes the project's contribution to education by highlighting how it advances knowledge of traffic safety concepts and responsible driving.

The literature frequently returns to the issues of sustainability and community involvement. Participating in the project's development with local stakeholders and communities generates a sense of ownership and guarantees that the system will meet the unique requirements and expectations of the region where it will be used. The use of eco-friendly materials and energy-efficient components is also emphasized by sustainability considerations, in line with cultural and social ideals of resource stewardship and environmental preservation.

In conclusion, the research highlights the importance of incorporating pedestrian crossings into tiny traffic light control systems employing logic integrated circuits. These initiatives contribute to a thorough and socially relevant approach to traffic management and safety education by acting as beneficial educational tools, fostering cultural sensitivity, improving pedestrian safety, and involving local communities.

5.3.2 Experiment Design

This part is briefly described in section: Design.

5.3.3 Data Analysis and Interpretation

This part is briefly described in section: Design.

5.4 Limitations of Tools

- **Faulty NOR ICs:** We faced a lot of trouble due to faulty “7402” ICs. According to the salesman, these ICs are poorly made and they do not last very long. Also, they cannot sustain the voltage level which was mentioned in their datasheet. During the working process, we found almost 27 NOR ICs unusable due to internal fault.
- **Limitation of Supply Current:** We used an AC to DC converter to power up the whole project. As only one power source was used, current was divided into the components, which led to less power than required. That’s why, we could implement only four pedestrian movement.
- **Lack of Synchronization:** As the traffic way movement and pedestrian movement introduced, traffic lights get gradually unsynchronized due to current limitation.
- **FPGA:** We have already written the Verilog code for the whole project. The vector waveform

or timing diagram was also generated. However, we could not manage an FPGA board to implement it via our code.

5.5 Impact Assessment

5.5.1 Assessment on Social and Cultural Issues

For poor traffic management system, we have to spend a lot of time in the road sitting in a car or public transport wasting our much valuable time. It has a negative impact in our social and cultural life. We cannot manage enough time to interact with our family and our children are being unsocialised. This problem can partly be solved by ensuring a better traffic management system which will save our time.

5.5.2 Assessment of Health and Safety Issues

Not ensuring proper traffic management system not only cost our time but it has also an impact in our health and safety. Traffic jam can be very suffocating which can cause headache or high blood pressure. According to World Health Organization (WHO), the traffic accidents which the children are subject to are the most serious epidemic problem in the industrial world. Between %50 and %25 percentages of causes of death among 0-14-year-old children is composed of accidents and approximately half of these deaths are caused by traffic accidents. The bicycle and pedestrian accidents are the main types of traffic accidents which children are subject to. If we work on the betterment of traffic management system we will certainly be able to reduce the traffic jam and road accident. So our project has a positive effect on health and safety issues.

5.6 Sustainability and Environmental Impact Evaluation

Our project does not seem to be hazardous for environment. The electrical components we used does not affect the environment badly. Rather it can be useful by reducing traffic jam and road accident. When the question of sustainability arises, we have to say that our project is not so sustainable as we expected at first. This is solely due to the limitations in hardware implementation. We tried our best to make it sustainable as more as possible but still there are a lot of scope to make it more sustainable and better. We used eco-friendly materials. It is very energy efficient. The maintenance is also easy.

5.7 Ethical Issues

We don’t really have any ethical issues in this project. We designed our simulation circuit very own and verify the simulation using Verilog code by ourselves. We implemented the circuit in hardware. We didn’t take help from any internet source. However, during this project, we faced some problem while hardware implantation as the IC and other electrical component like resistance, capacitance, LED and power supply was not functioning properly. That’s why we discussed with some of our friends on how to overcome these problems.

6 Reflection on Individual and Team work

6.1 Individual Contribution of Each Member

ID	Name	Contribution
1906078	Asif Aftab Ronggon	Designing simulation circuit, Verilog implementation
1906073	Navid Newaz	Hardware implementation and debugging
1906079	Md. Faiyaz Abid	Hardware implementation and debugging
1906088	Md. Shahin Ferdous	Hardware implementation and debugging

6.2 Mode of TeamWork

Our whole project can be divided into two parts: software simulation and hardware implementation. We divided ourselves according to these two parts. The software simulation was wholeheartedly and perfectly done by our teammate Asif Aftab Ronggon. The hardware implementation and meticulous debugging was done by rest of us.

6.3 Diversity Statement of Team

Our group consists three male undergraduate students who are hall resident, and one male undergraduate student who is attached to hall. There is not much diversity in our team.

6.4 Log Book of Project Implementation

Date	**Milestone achieved**	**Individual Role**	**Team Role**	**Comments**
21.6.23	Truth Table Design	Asif Aftab Ronggon		Successful
22.6.23	FSM Design	Asif Aftab Ronggon		Successful
12.7.23	Circuit Simulation in Proteus	Asif Aftab Ronggon		Successful
19.7.23	Verilog Implementation and generating timing diagram	Asif Aftab Ronggon		Successful
2.8.23	Shopping for project	Md. Shahin Ferdaus, Navid Newaz		Successful

5.8.23	Hardware circuit build up Part 1	Md. Shahin Ferdaus, Navid Newaz, Md. Faiyaz Abid		Unsuccessful
12.8.23	Hardware debugging Part 1	Md. Shahin Ferdaus, Navid Newaz, Md. Faiyaz Abid		Unsuccessful
17.8.23	Hardware debugging Part 2	Md. Shahin Ferdaus, Navid Newaz, Md. Faiyaz Abid		Unsuccessful
19.8.23	Shopping for project for additional resources	Faiyaz Abid		Successful
23.8.23	Went to buy items which were destroyed during working	Faiyaz Abid, Shahin Ferdaus		Successful
27.8.23	Hardware Implementation Part 2	Md. Shahin Ferdaus, Navid Newaz, Md. Faiyaz Abid		Unsuccessful
3.9.23	Final Hardware implementation and project completion	Md. Shahin Ferdaus, Navid Newaz, Md. Faiyaz Abid		Successful

7 Communication

7.1 Executive Summary

A fascinating project called "Traffic Light Control System with Pedestrian Crossing" scales down a whole traffic management ecosystem. It simulates typical traffic signal operations and also incorporates a pedestrian crossing feature thanks to the use of logic integrated circuits, which increases realism and instructional value. This model is a priceless teaching tool that emphasizes the value of pedestrian safety in urban planning while introducing students and hobbyists to the fundamentals of traffic engineering. It encourages a better appreciation for comprehensive and safe transportation systems while empowering people to understand the complex mechanics of traffic control.

7.2 User Manual

7.2.1. Introduction

Purpose: This user manual provides detailed instructions for assembling, operating, and maintaining the “Traffic Light Control System with Pedestrian Crossing" The project aims to educate users about traffic management and pedestrian safety principles.

Scope: This manual covers the assembly process, system operation, safety precautions, and maintenance guidelines for the project.

Project Overview: The miniature traffic light control system mimics real-world traffic management and includes a pedestrian crossing feature. It uses logic integrated circuits (ICs) to create a realistic and educational experience.

7.2.2. Safety Precautions

General Safety Guidelines:

- Always work in a well-ventilated area.
- Wear appropriate safety gear, including safety glasses and static discharge protection if necessary.
- Keep small components and wires away from children and pets.
- Avoid loose clothing that could get caught in moving parts.
- Do not touch exposed electrical connections when the system is powered.

Electrical Safety:

- Disconnect the power source when making electrical connections.
- Use insulated tools to prevent electrical shocks.
- Avoid water or moisture contact with the project while it's operational.

7.2.3. Components and Materials

List of Components: 100µF capacitors, 220***Ω*** resistors, red, green, blue LEDs, CD4017 decade counter, jumper wires, 555 timer, ICs: 7402(NOR), 7408(AND), 7432(OR), power source (AC to DC converter).

7.2.4. Assembly Instructions

Step 1: Assemble the Base: Use breadboard as base. Make sure all sources of breadboard are shorted. Ensure that for ground also.

Step 2: Construct the timer and counter circuit: Build up the timer and 4017 Counter circuit according to the circuit diagram.

Step 3: Install Traffic Lights (LEDs): Connect the red, green and blue LEDs by following the circuit diagram.

Step 4: Place Pedestrian Crossing Lights: Repeat step 3 for this part

Step 5: Connect Logic ICs: Connect the logic ICs carefully with the LEDs according to the circuit diagram

Step 6: Power Supply: Connect the DC power supply's positive and negative with all the IC's V_{cc} and ground. **Do not connect over 5V with the circuit. Make sure the supply is within operation range of the used ICs by checking their datasheet.**

7.2.5. Operation

5.1 Turning on the System: By turning on the power supply, the LEDs should start to blink according to their sequence.

8 Project Management and Cost Analysis

In this project we wanted to develop a real life traffic signal with pedestrian movement.
We have set few milestones. The milestones are as followed

M1: To establish the FSM	Completed before June
M2: To simulate the circuit with the software	Completed within July
M3: Complete the Verilog code	Completed within July
M4: To implement the circuit in hadware	Completed within august

We have achieved all our milestones. But achieving these milestones we faced many problems.
They are:

Issue 1	We have problems while building the logic
Issue 2	Once the logic was developed than the problem was faced to build a minimized version of the FSM
Issue 3	Verilog is not a famous tool for coding. While coding it was tough enough to do coding perfectly.
Issue 4	Hardware problems were the main problem we faced while doing this project. ICs needed to be changed frequently. Needed to debug the circuits very frequently.
Issue 5	Merging all hardware parts was another big challenge we have faced

8.1 Bill of Materials

Materials	Quantity	Per Unit Cost	Cost (tk)
Adapter	1	475	475
Power Source	1	1390	1390
Bredboard	12	130	1560
Jumper Wire	8 set	80	640
LEDs	120	2	240
7402 IC	40	25	1000
4001 IC	20	25	500
CD4017 IC	5	20	100
555 Timer	10	10	100
Resistors	5	1	5
Capacitors	6	5	30
9V Battery	5	40	200
7432 IC	20	25	500
7408 IC	20	25	500
4075	20	40	800
		Grand Total:	8040

9 Future Work

- Implementing complete 8-way pedestrian movement
- Adding sensors for pedestrian detection
- Integrating emergency lane to the system
- Implementing the whole project using FPGA board