Acknowledgement

We would like to express our deepest gratitude to Department of Electronics and Computer Engineering for providing us with the opportunity to involve in this project which has helped us understand VHDL, microcontroller programming and widen our knowledge in the realm of electronics. We would also like to thank Dr. Surendra Shakya, Anand Kumar Shah and Suresh Kumar Jha for providing us with enough guidelines and mentoring us regarding VHDL.

Table of Contents

1. Introduction

1.1 Background

Traffic lights are signaling device positioned at pedestrian crossings, road intersections and other locations to control competing flows of traffic. The green light allows traffic to proceed in the direction denoted, if it is safe to do so and there is room on the other side of the intersection. The amber (yellow) light warn that the signal is about to switch to red. The red signal prohibits any traffic from proceeding.
In this project, traffic management system has been implemented using VHDL.

1.2 Problem Statement

Traffic congestion is a condition on transport networks that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queue. When traffic demand is high, the interaction between vehicles slow down the speed of the traffic stream and hence results in congestion. Traffic congestion has been a major issue in the several cities all over the world. The absence of proper traffic management system has caused following problems-

- Waste of time of motorists and passengers ("opportunity cost"). As a non-productive activity for most people, congestion reduces regional economic health.
- Delays, which may result in late arrival for job, meetings, and education, resulting in several losses.
- Incapability of prediction of approximate time has caused drivers to allocate more time to travel "just in case", and less time on productive activities.
- Wasted fuel increasing air pollution and carbon dioxide emissions owing to increased idling, acceleration and braking.

To solve these problems, automatic traffic controller must be implemented . This system is smart and this problem is addressed by this project.

1.3 Objectives:

1) To solve the problem of traffic congestation using smart traffic light system.
2) To use VHDL to generate its waveform.

2. Theory

2.1 VHDL

VHDL stands for very high-speed integrated circuit hardware description language. It is a programming language used to model a digital system by dataflow, behavioral and structural style of modeling. This language was first introduced in 1981 for the department of Defense (DoD) under the VHSIC program. It can describe the behavior and structure of electronic systems .The benefits of VHDL are:

1) Quick-Time-to-Market • Allows designers to quickly develop designs requiring tens of thousands of logic gates • Provides powerful high-level constructs for describing complex logic • Supports modular design methodology and multiple levels of hierarchy § One language for design and simulation

2) Allows creation of device-independent designs that are portable to multiple vendors.

3) Allows user to pick any synthesis tool, vendor, or devices.

The features of VHDL are

- Support for concurrency
- Support sequential statements.
- Support for test & simulation.
- Support typed language.
- Support hierarchies.
- Support for vendor defined libraries.
- Support multivalued logic.

There are three types of model in Architecture body in VHDL. They are-

- Data flow model - It is the highest level of abstraction available in market today. Here circuit is defined as how data flows in the system.

- Behavioral model: Here behavior of the system is described with respect to time.

- Structural model: Here, low level of the description of circuit such as gates and flip flops are developed and they are combined to form larger structure.

2.2 Proteus

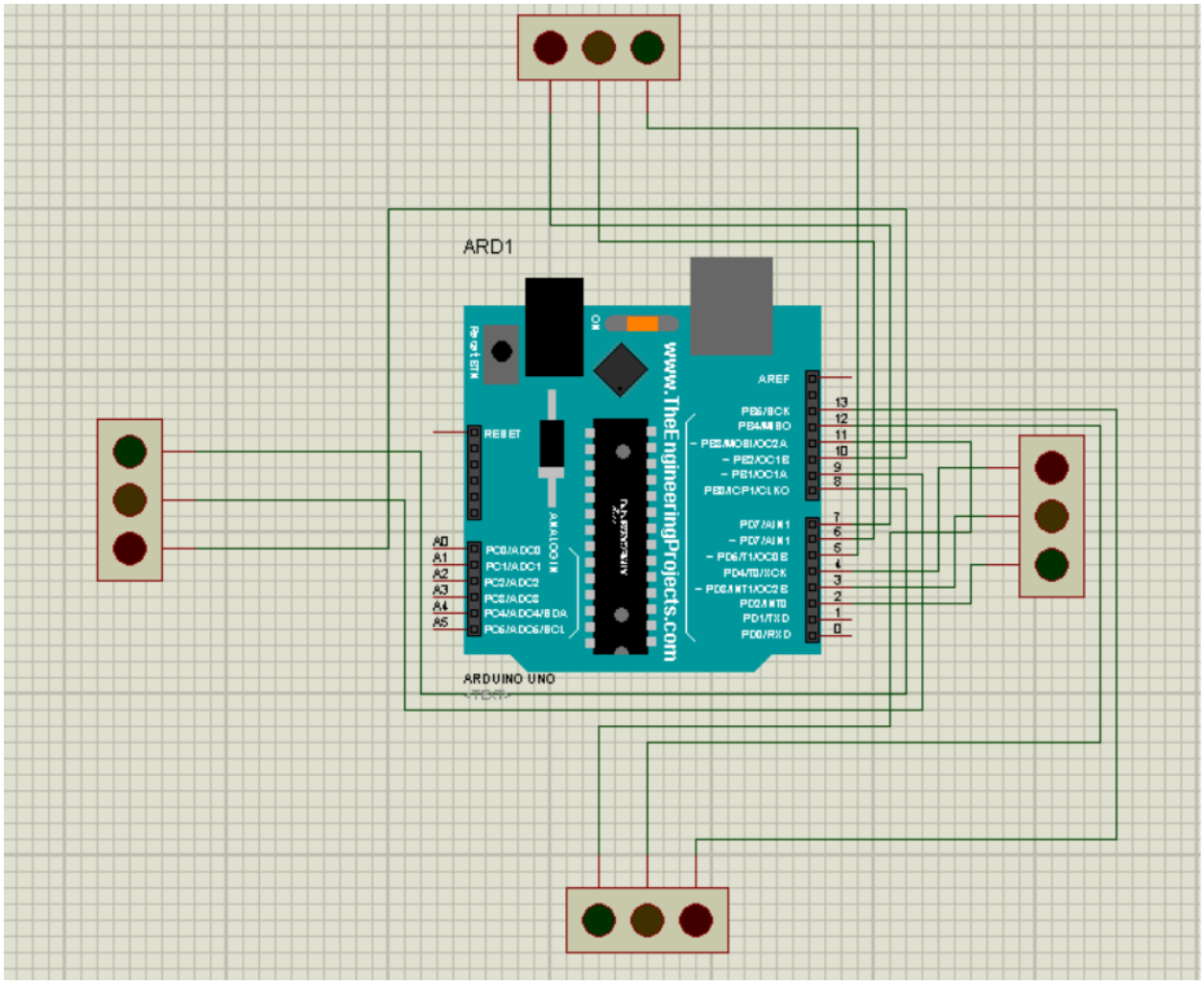
The **Proteus Design Suite** is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

It was developed in Yorkshire, England by Labcenter Electronics Ltd and is available in English, French, Spanish and Chinese languages.

The Proteus Design Suite is a Windows application for schematic capture, simulation, and PCB layout design. It can be purchased in many configurations, depending on the size of designs being produced and the requirements for microcontroller simulation. All PCB Design products include an auto router and basic mixed mode SPICE simulation capabilities.

3. Methodology

The traffic light controller is implemented using proteus. For this circuit is built using Arduino, and TRAFFIC LIGHTS module. The code is written on the arduino for the traffic management and circuit is built as shown in the figure-



For the waveform simulation, code is written in VHDL . The circuit is implemented so as to fulfill the following state diagram-

FINITE STATE MACHINE (STATE DIAGRAM)

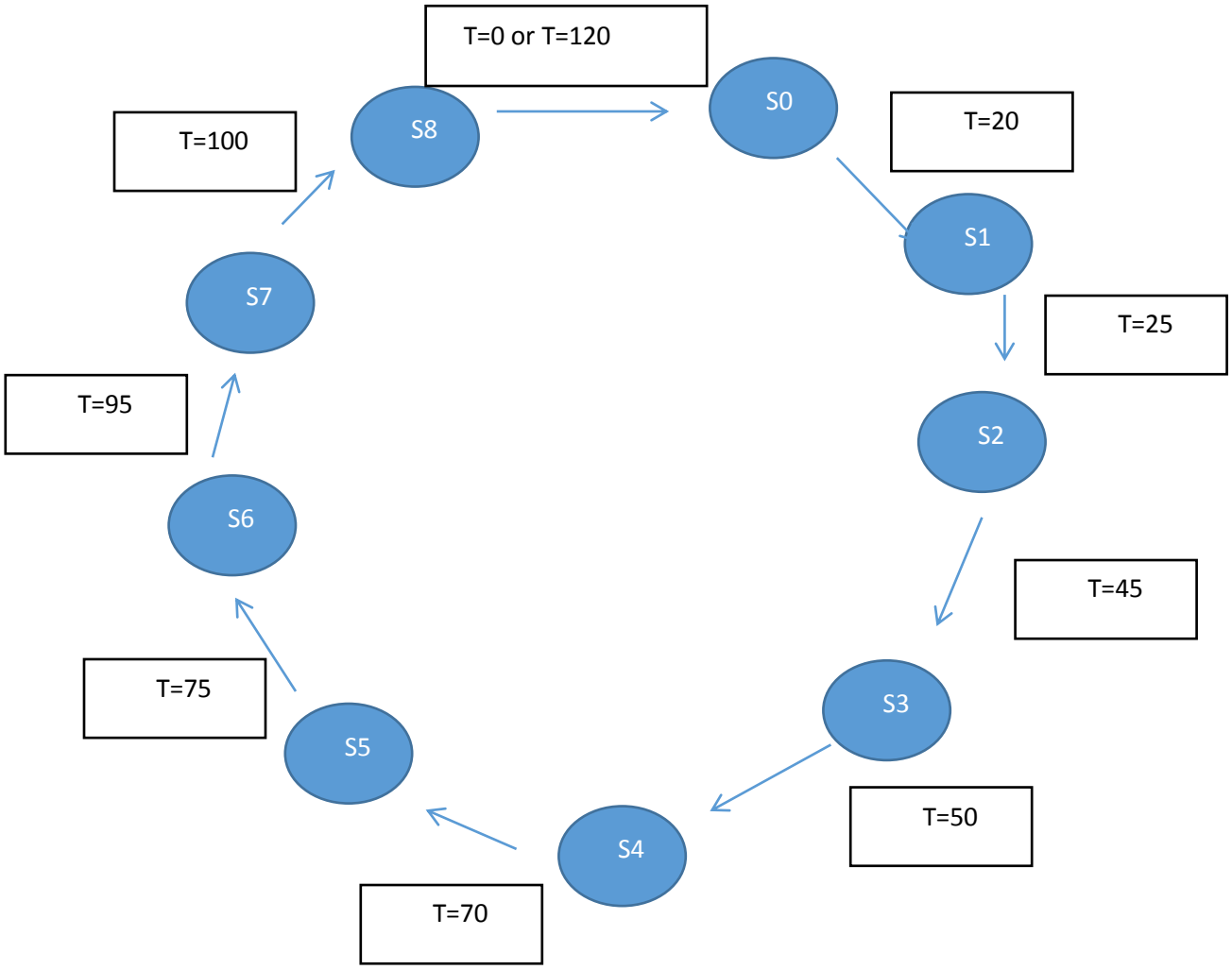


Figure 1: State diagram

The state table for the implemented circuit is as follows:

Table1: Table showing the state diagram of traffic lights

Time (input)	**Current state**	**Next state**	**Output**
0	S0	S0	**1**234
20	S0	S1	*1*234
25	S1	S2	1*2*34
45	S2	S3	1*2*34
50	S3	S4	12**3**4
70	S4	S5	12*3*4
75	S5	S6	123**4**
95	S6	S7	123*4*
100	S7	S8	1234
120	S8	S0	**1**234

Where, Bold =Green , Italic=Orange, Normal=Red

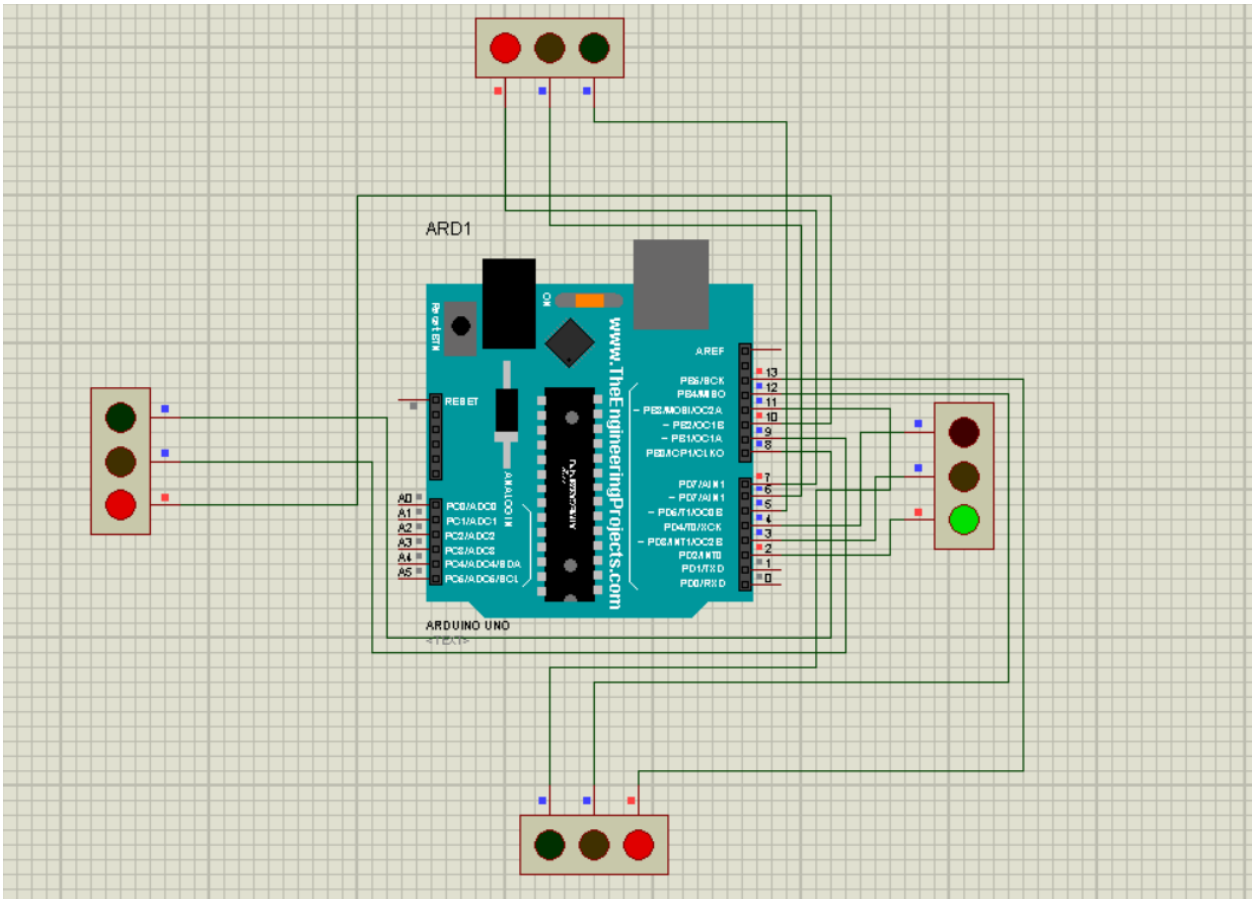
1234 represent traffic lights in four corners

4. Result and Analysis

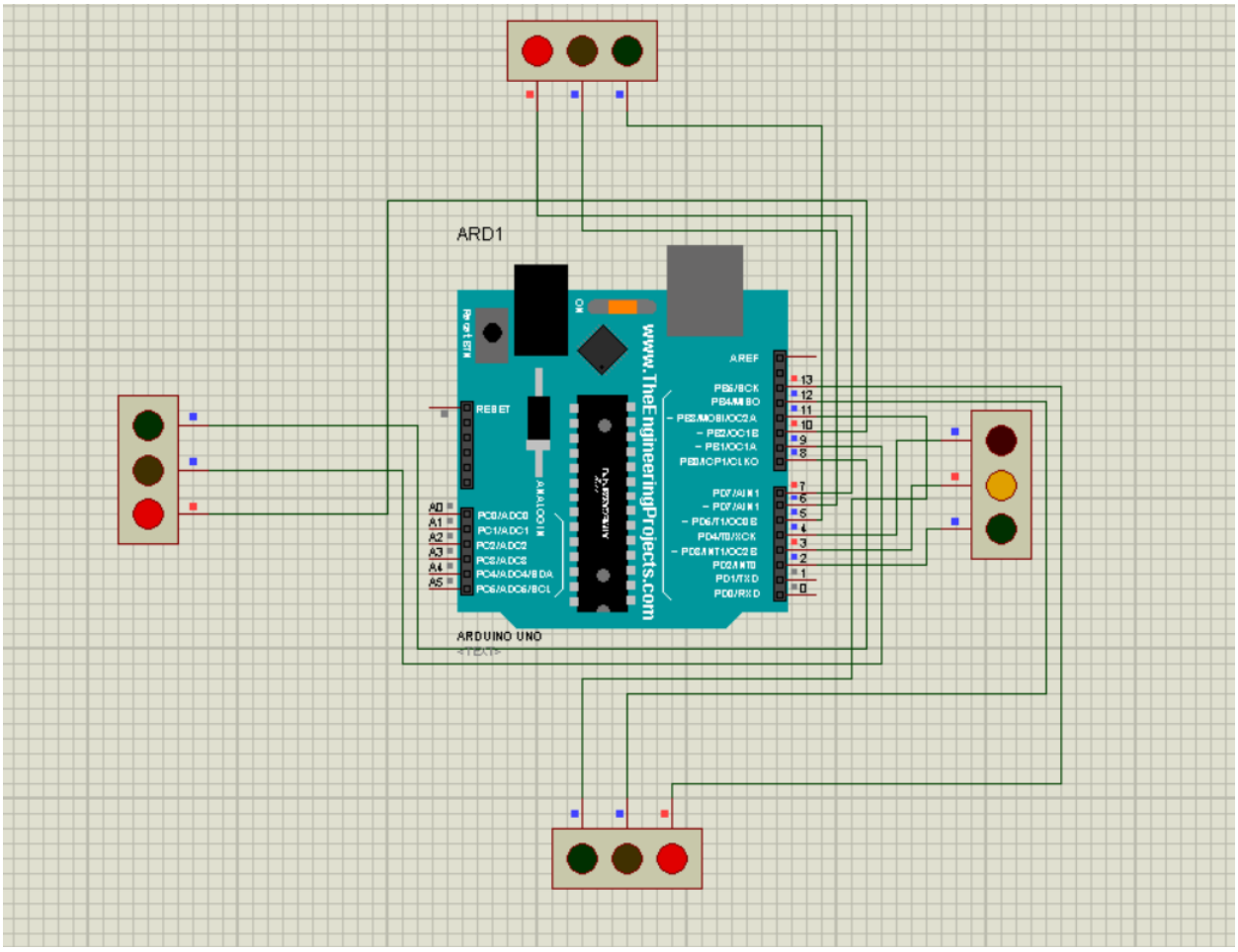
4.1 Output

The output obtained on proteus simulation are as follows-

Green light for Traffic1 which stays for 20 seconds



Yellow light for Traffic1 which stays for 5 seconds-



Similarly green and yellow light are successively obtained for traffic2 , traffic3, traffic4 then back to traffic1.

5. Limitations

Despite our immense effort, our project has some limitations-

1) It is based on equal allocation of time rather than density based allocation
2) It is not suitable for emergency situation such as ambulance passing.
3) It may cause accident in the case of emergency.

6. Future enhancement

This project can be enhanced in the future in the following ways-

1) It can be implemented on density based allocation rather than time based allocation.
2) It can be further enhanced to include sensor suitable for emergency conditions.