CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

There are 2 parts that involves in accomplishing this project which through, software approach for simulation and schematic design using gate logic for hardware implementation. This simulation part becomes the supporter where it will support the data that had been obtained through the hardware implement to prove that whatever the findings in simulation are same with implement in hardware using gate logic.

2.2 Traffic Light Systems

A traffic light system is an electronic device that assigns right of way at an intersection or crossing or street crossing by means of displaying the standard red, yellow and green colored indications. An addition, it also works in conjunction with pedestrian displays to assign pedestrian crossing right of way [1]. A traffic light, also known as traffic signal, stop light, stop-and-go lights, is a signaling device positioned at a road intersection, pedestrian crossing, or other location in order to indicate when it is safe to drive, ride, or walk using a universal colour code (and a precise sequence, for that are colors blind)[2].

Nowadays, a red light meant traffic in all directions had to stop. A yellow light meant cross-town traffic would have to slow and a green light would to go or proceed.

The difficulty in understanding this confusing color sequence was compounded by neighboring towns using another system. The development of an intelligent control structure ensures an optimal solution for all participants in the transportation and road traffic system [1].

There are different ways controlling road intersections. In the simplest cases the right-hand rule or, if the traffic is higher, a roundabout or the signal of a policeman can help steer the traffic. However, especially in big cities, in the complicated cases when the roads in the intersection have several lanes, the use of traffic lights cannot be avoided. An additional issue arises when in the intersection not only roads but also railroad tracks take part, what often occurs in suburban traffic situations. The most common way to handle this type of intersection is the conventional cyclic lights control. In more enhanced control, the traffic in different directions is monitored by sensors and the signals thus obtained control the traffic lights. In this method the control is adapting to the traffic [3, 4].

The general problem is the huge number of variables and the need for large computing efforts. To simplify this problem a possible way is the use of fuzzy techniques. In the last couple of years a lot of simulations were done and also practical control systems were built based on simple fuzzy rules [5,6,7,8,9,10,11,12,13,14]. However in the most complicated cases where the numbers of lanes are large and maybe not only one but more road intersections and railroad take part, it does make sense to use fuzzy methods containing hierarchy and apply interpolation to decrease the complexity [13, 14].

2.3 Benefit of Traffic Light Controller

When properly used, traffic control signals are important devices for the control of vehicular in road. They assign the right-of-way to a choice of traffic movements and thereby deeply influence traffic flow. Traffic control signals that are properly designed, located, operated, and maintained will have one or more of the following advantages:

I. Provide orderly movement of traffic
II. Minimize completing movement
III. Coordinated for continuous movement
IV. Provide driver confidence by assigning right way

Traffic control signals are often considered a cure for all traffic problems at intersections. This belief has led to traffic control signals being installed at many locations where they are not needed, adversely affecting the safety and efficiency of vehicular, bicycle, and pedestrian traffic. Traffic control signals, even when justified by traffic and roadway conditions, can be ill-designed, ineffectively placed, improperly operated, or poorly maintained. While traffic signals can help in locations where they are justified and installed properly, they also have disadvantages. There will always be some disadvantages even if the signal is justified.

2.4 Types of Traffic Signals Components and Operations

Most traffic signals will have the following components or part:

I. Main display with red, yellow and green lights.
II. Traffic signal cabinet containing the traffic signal controller and Vehicle Detection Systems, either
III. Inductive loops or sensors

In the many cities, traffic signals mainly operate in three modes:

I **Fixed-time mode:** Under this mode, there are no detections for any approach. The signal continuously cycles regardless of actual traffic demand. Pedestrian walk signals are automatic and will cycle concurrently with the vehicular signal indication.

II **Semi-Actuated mode:** Under this mode, the detection system is present only on a minor cross street. When detection is activated, the green light on a major street is interrupted to allow the minor street traffic and

pedestrians to safely enter the intersection. Pedestrian walk signals for crossing a minor street are automatic, while those for crossing a major street are not. Pedestrians crossing a major street must push the "pedestrian push button" to get the walk signal.

III **Actuated mode:** Under this mode, there are detections for all approaches. The traffic signal is set to provide the green light "on-demand" or only in the presence of vehicles [1].

2.5 State Machine Design

A frequency design found in almost all types of digital design is a state machine. It is easy to design and gives the designer great flexibility when the designer needs to weak the design either for speed or area optimization. Most synthesis tools in the market have special option to allow a designer to synthesize a state machine design. A state machine format is the good examples of a design that can be coded of an intelligent traffic control systems. A traffic control system has only certain fixed conditions to fulfill in order to control the traffic lights that control traffic flow [15].

2.6 Explanation about Software and Hardware

This project is dividing by two parts, which are software for simulation and hardware for implementation. In this project, Verilog HDL (Hardware Description Language) is used for write a coding using Quartus11 Software. After finished design gate logic and writing the coding, this project can proceed to another part; implement gate logic in breadboard.

2.6.1 Quartus 11 Software

The Altera® Quartus® II design software provides a complete, multiplatform design environment that easily adapts to your specific design

needs. It is a comprehensive environment for system-on-a-programmable-chip (SOPC) design. The QuartusII software includes solutions for all phases of FPGA and CPLD design (Figure 2.0) [16].

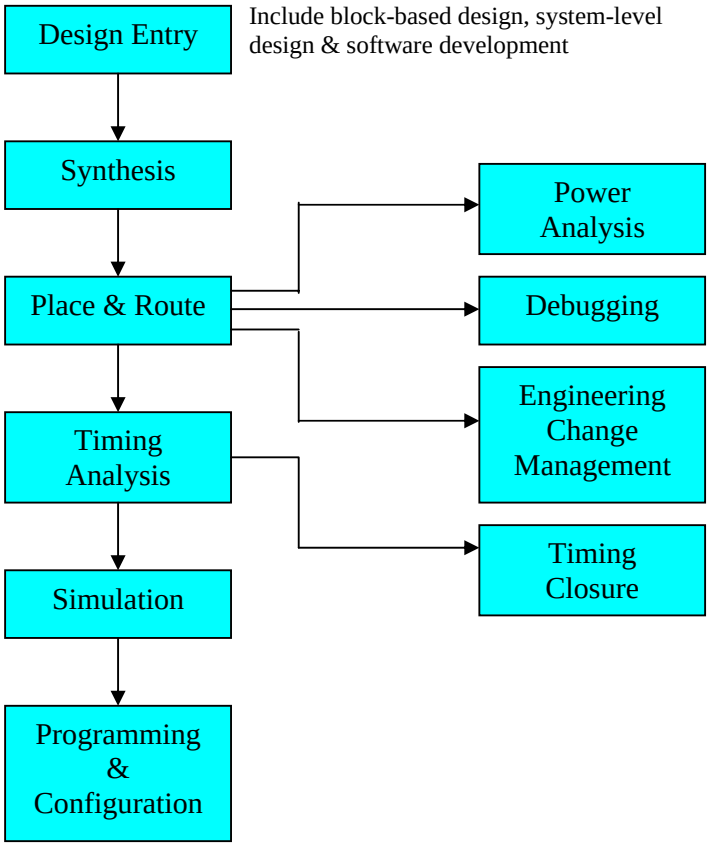

Figure 2.0: Quartus 11 Design Flow [16]

In this software, we can use the Text Editor to create a Verilog HDL, VHDL, or Altera Hardware Description Language (AHDL) design. Use the Block Editor to create a block diagram with symbols that represent other design files, or to create a schematic. A Verilog HDL are used in this project for write a coding and the Block Editor is use to create a block diagrams with symbols that present the block of traffic light controller.

2.6.2 Benefit of Using Verilog HDL (Hardware Description Language)

Verilog is a widely used Hardware Description Language (HDL) for design digital circuits. It can also be used for modeling analog circuits. Verilog is a descriptive language that describes a relationship between signals in a circuit [17]. A Verilog model describes a unit of digital hardware in terms of

I. Interconnections of other hardware unit whose models prescribe their behavior in a simulation and
II. Behavioral / procedural algorithms that abstractly describe input/output behavior that could be personified in a hardware unit.

Hardware description language (HDL) is divided by two types, Verilog and VHDL (VHSIC – Very High Speed Integrated Circuit Hardware Description Language). Both have its advantages and its disadvantage. In this project, Verilog HDL was chosen because it's used for synthesis of logic circuits (synthesizable code), used for verification purposes of a circuit (can be analog or digital or mixed signal), can be used by combining synthesis & verification (synthesizable & behavioral code) and it used for netlist representation of a synthesizable circuit (structural code). The advantages using Verilog HDL are shown below:

I. Easy to write
II. Easy to understand as it similar to C program
III. Easier to learn compared with VHDL