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IR Based Traffic Light System

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ABSTRACT

Conventional traffic light system is based on fixed-time concept allotted to each side of the junction, which cannot be varied as per varying -traffic density. Junction timings allotted are fixed. Sometimes higher-traffic density at one side of the junction demands longer green time as compared to the standard allotted time. The proposed system using Arduino family duly interfaced with sensors changes the junction timing automatically to accommodate movement of vehicles smoothly avoiding unnecessary waiting time at the junction. The sensors used in this project are IR and photodiodes which are in line of sight configuration across the road to detect the density at the traffic signal while interrupted. The density of the vehicles is measured in three zones: lo w, medium, high based on which timings are allotted accordingly.

Keywords : Smart Traffic Light Control System, Traffic Congestion.

I. INTRODUCTION

The world is now equipped with traffic lights, which are also known as traffic signals, traffic lamps, stop & go lights, installed at crossroads in most cities around the world traffic flow control. To guide the traffic three standard colours- Red, Yellow and Green (Stop, Be Alert/Proceed and Go, respectively) are used. The present traffic control framework in the metro areas of India is disorganized because of haphazardness of the traffic density pattern designed for the duration of the day. The signalling timer has a defined time to route traffic in different directions. As a result, the vehicle will have to wait for long, even when the traffic is very low. If the occurrence of the traffic signal timer can be designed such that it can employ or manipulate the regularly varying traffic density, this way the traffic congestion can be reduced accordingly. The traffic congestion consequences leads to loss of productivity, trading issues, delayed delivery and the cost gets increased. Therefore, every individual advises to build new facilities and infrastructure for the problem of traffic congestion. Many traffic lights signals operate on the basis of timing mechanism which is optimized to alter the traffic lights after a given period of time resulting the traffic to wait for long. Most of the traffic light controllers are designed in such a way that they have a fixed-cycle and do not take into account the density of traffic coming from each direction. This paper aims at making a traffic light control system

through simulation in VHDL and a density based sensor is used to get the input from vehicles which guides in decreasing the waiting time.

II. Methodology and System Design

In the design and construction of this system all components work simultaneously. The system works just as a typical traffic light system. The uniqueness of this is in the event that the thickness of vehicles in a specific path of the road is high. At that point, the sensor in that specific path turns out to be low else it is read as a high signal. The signal from the IR is used by the system to control the traffic jamming of the lane. In the event that we get a low signal from any of these sensors, at that point the green LED shines to that specific way and gives a red to every other way. The Arduino IDE is programmed using C language. The block diagram of the density based traffic control system is shown in Figure.1. It is divided into four different sections with each section representing a lane.

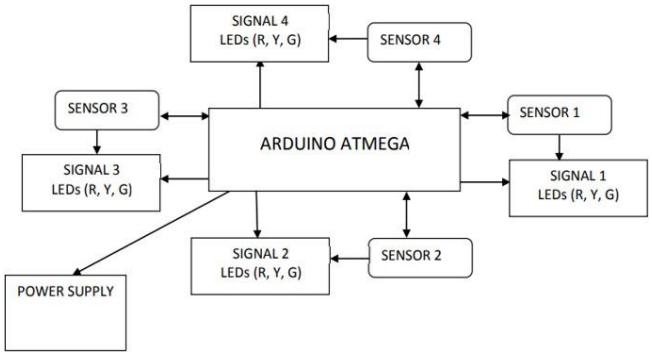

Figure 1: Block diagram of a density based traffic control

2.1 Design of the Project: The construction of the system is divided into three stages as stated: power supply stage, sensor switching stage, and Arduino connection stage. The power supply for this system is 9 V DC battery as shown in Figure 2. It has a nominal voltage of 9 V, a discharge resistance of 620 Ω s and a cut off voltage of 5.4 V. According to the power needed for the components of the thickness based traffic light control framework, supply of +5 V regarding GND is created. The total hardware worked with TTL (Transistor-Transistor Logic) rationale dimension of 0 V to 5 V. Power applied to the Vin pin is stepped down to 5 V by the on-board regulator on the Mega. The minimum voltage is about 6.2 V because of the regulator dropout (that is, the regulator needs at least 1.2 V above its 5 V output in order to operate) 9 -12 V is recommended. Applying a higher voltage to the system will not provide any more power to the Mega and its peripherals/shields. Instead, the excess power is dissipated in the regulator as heat.

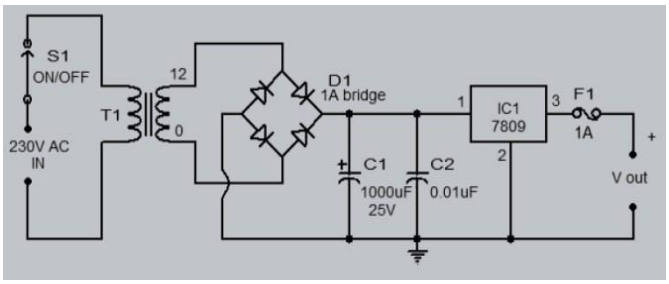

Figure 2: 9V power supply for the Arduino Atmega

The infrared sensors (IR) are the most important components of this project. The sensors act like a switch as it controls the switching of the LEDs. The IR sensors have been applied to several traffic systems [6-9]. Other uses of electronic device for environmental factors have been listed in . The IR system is designed in such a way that its receiver and transmitter are mounted on either side of the road such that it gets activated whenever automobile passes between the two sensors. The sensors enable this system to be automated unless it is a regular traffic control system which has been rendered ineffective in densely populated areas. The infrared sensors have a detection range of 2 cm – 30 cm. They determine if there is a heavy traffic on one lane and allow the flow of traffic in preference to other less dense lanes. Figure 3 shows the connection of the sensor and Arduino.

III. Flow Chart and Implementation

The approach of implementing a traffic light con- trol signal starts with a flow chart. A flow chart is needed for representing and visualizing several progressions of

traffic management system which will be helpful in the recognition of a traffic light control system.

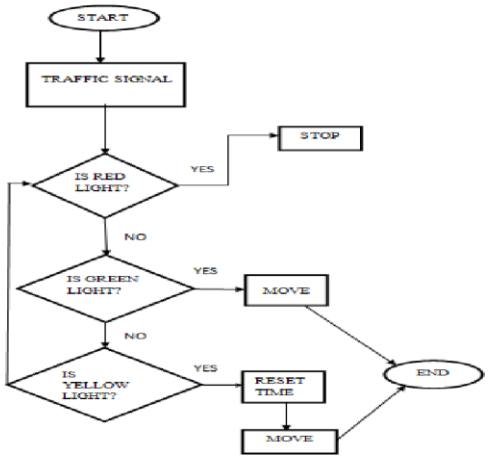

Figure2: Flow Chart representing simple traffic control signals

The above given flow chart is the general representation of a traffic light control signal that how the system actually works. To reduce the waiting of the vehicles the code is synthesized in VHDL.

There are 4 directions, and works in pairs as East-West; North-South, each intersection will have the IR sensors to detect the presence of vehicle.

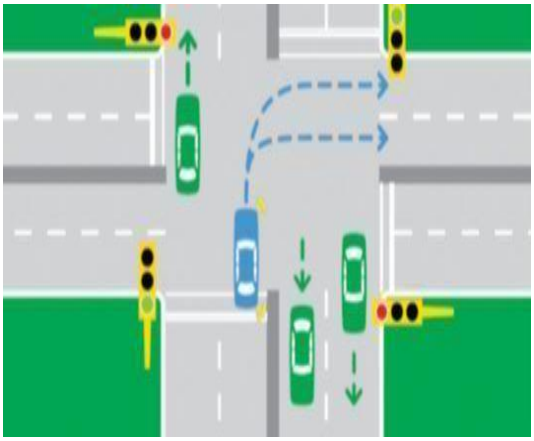

Figure 3: Briefing of sensors applied opposite to each other

The figure 3 works according to the density based IR sensor which will sense the presence of heavy traffic and will work accordingly. The traffic light signal has three different colors of indicators RED, YELLOW and GREEN shown below in figure 4.

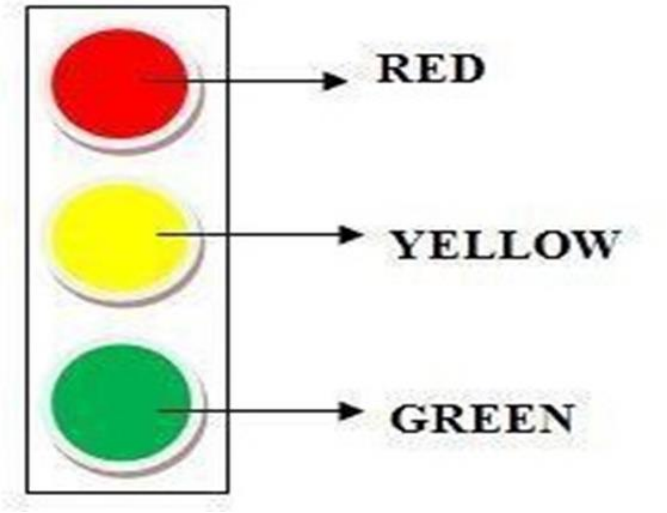

Figure 4: Traffic Light Signals

The intersection is equipped with IR (Infrared) sensor transmitter & receiver. It is a '+' type of road. Each lane has the same set up, this will be helpful in detecting the vehicles and reduce the waiting time causalities.

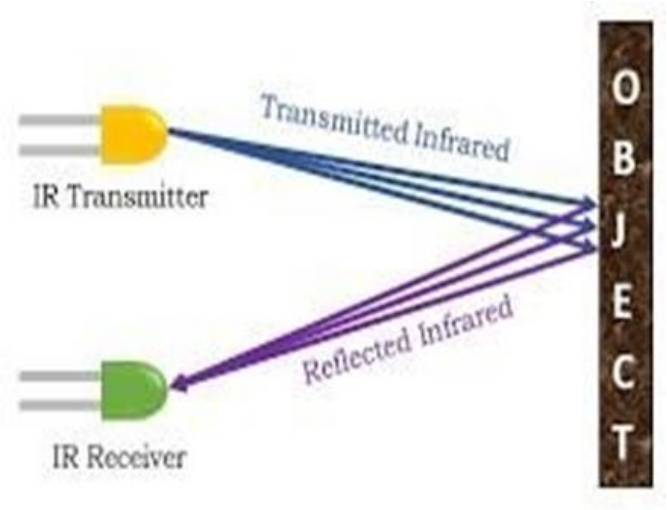

Figure 5: Working of IR Sensor

An IR (Infrared) sensor is an electronic gadget which can be utilized to detect certain parameters of its surroundings by either producing or ident- ifying radiations. It can likewise quantify warmth of an item and recognize movement. It utilizes the infrared light to detect protests before them and guide or theory their separation. This framework comprises of 6 IR sensors as a locator of intersections.IR transmitter resembles a LED.

This IR transmitter dependably produces IR beams from it. The working voltage of this IR transmitter is 2 to 3v. These IR (infrared) beams are undetectable to the human eye. Be that as it may, we can see these IR radiations through cam- era. IR transmitter transmits IR beams that are gotten by IR collector. By and large IR recipient has high opposition in the request of mega ohms however when it is getting IR beams the obstruct- tion is low. The working voltage of IR collector likewise 2 to 3V. We need to put these IR pair so that when we place an impediment before this IR pair, IR collector ought to most likely get the IR beams. At the point when control is provided, the transmitted IR beams hit the article and reflect back to the IR recipient.

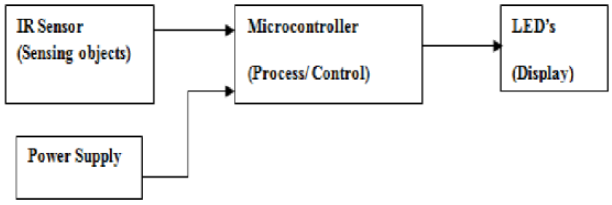

Figure 6 : Input/Output Block Diagram for Traffic lights in accordance with the sensor

In the above figure 6 microcontroller AT89C51 will be used as it can be erased and can be also be programmed 1000 times once it is deployed. The above study and implementation shows the working of traffic light control signal in an adaptive or flexible aspect. This approach ai- ms at decreasing the waiting time for the vehicles and also solves the traffic congestion issue.

IV. Conclusion

The traffic congestion has been a problem since many decades. New modifications and changes are made with invention of new technologies. The traffic light control system used nowadays is not adaptive, it has a fixed time cycle which repeats according to the time attributed. By using the sensor, the presence of heavy traffic in each direction can be determined and the traffic light signals will alter subsequently. The Four-way traffic light controller designing with VHDL is the research paper which solely matters in the implementation of this review paper.

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