Traffic Signal control system in Emergency by Using Solar and Wind Energy

G.Prasanna Rani¹, N.Bhagya Laxmi²
Department of ECE
CMR College of Engineering and Technology, India

Abstract:
This paper is to use the solar and wind energy in powering density based traffic control system. Since solar energy is one of the major renewable sources and is non-polluted an attempt is made to utilize this energy in the traffic control system. During normal time the signal timing changes automatically on sensing the traffic density at the junction but in the event of any emergency vehicle like ambulance, fire brigade etc requiring priority are built in with RF (Tx and Rx) remote control to override the set timing by providing instantaneous green signal in the desired direction while blocking the other lanes by red signal for some time. Traffic congestion is a severe problem in many major cities across the world thus it is felt imperative to provide such facilities to important vehicles.

Key words: ARM7, LEDs, Voltage Regulator, Resistors, Capacitors, Crystal, Diodes, Transformer, IR-LED & Photodiodes, Transistor, RF modules, encoder and decoder ICs, Wind Turbines

I. INTRODUCTION

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 standard allotted time. The proposed system using a microcontroller of 8051 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 are in line of sight configuration across the roads. The emergency vehicle alert is triggered by RF transmitters in the emergency vehicle and the RF receiver is placed in the junction.

Further the project can be enhanced by synchronizing all the traffic junctions in the city by establishing a network among them. The network can be wired or wireless. This synchronization will greatly help in reducing traffic congestion. The traffic junctions are fixed also proposes similar wireless sensors based system that type which uses constant timings for each cycle. Even uses photo-sensors for traffic sensing. The basic concept though they are simple, the efficiency is very poor in high traffic conditions. In order to avoid problems in it uses the IR interruption concept for generating conventional traffic control system, the proposed method is designed. To detect the traffic density in the signals, this project uses photodiodes and IR sensors which are in line of sight configuration across the roads. The emergency vehicle alert is triggered by RF transmitters in the emergency vehicle and the RF receiver is placed in the junction.

Previous approaches uses camera based or loop detection methods which are inaccurate and time consuming. Video based monitoring needs more maintenance while loop detection reliability is very low. In this project the circuit has two voltage sources, the battery and solar cell, battery and wind fans, in order to keep the traffic signal. Operating at all times even if there is a lack of the electricity. The purpose of the solar panel in the circuit is to provide a clean source of energy to run the traffic light signal and to charge the battery during the day time. The second energy source is the lead acid battery which charges by solar cell during the day time and supplies electricity to the circuit, when solar cells can’t generate enough voltage to run the circuit (During night or cloudy days), for cloudy days we are using wind based electricity. The signal for any emergency vehicles like ambulance, fire brigade. This unit has two components. One is a RF encoder and transmitter circuit which will be placed in the emergency vehicle. The second component is the RF decoder and receiver which will be placed in the junction.

II. Implementation of Density Based Traffic Control Unit:

The block diagram of proposed density based traffic control unit is show in Fig.2. The project uses AT89S52 microcontroller and IR sensors for deciding the signal timings based on the traffic density in each lane.
2.1. Block Diagram

Transmitter:

![Block Diagram of Transmitter](image1)

Receiver:

![Block Diagram of Receiver](image2)

FIGURE 1

BLOCK DIAGRAM OF TRANSMITTER, RECEIVER.

It uses the IR interruption concept for generating logic states to the input of the microcontroller. To achieve the same a number of IR diodes are used facing photodiodes. While the IR light falls on the photodiode the resistance of the photodiode falls increasing the bias voltage. Logic high sensed by the microcontroller input changes the green ON time to a higher value for allowing more number of vehicles to pass through. In case any other way gets more logic high, the sequential timing gets automatically increased for that way. Based on the IR interruption the green ON time increases, thus more the vehicle longer will be the green signal time. Thus dynamic time control is achieved based on the traffic density. The RF module will trigger emergency alert whenever there is any emergency vehicles such as ambulance, fire brigade, etc… This unit is powered by solar panels and a battery unit.

III. SYSTEM IMPLEMENTATION

The proposed system consists of following three main units, which coordinates with each other and manages the traffic flow in the junctions efficiently and also prioritize the emergency vehicles in each traffic zone. The below are the three units of the proposed system.

- Density Detection System
- Emergency Vehicle Alert System
- Solar Power Supply

3.1. Density Detection System:

The density detection system consists of an IR LED and a Photodiode which acts as an IR transmitter and receiver respectively. The system uses Microcontroller arm7. Each zone in the traffic junction is monitored by the IR photo sensors. These sensors monitor the density in the zone and provide input to the Microcontroller unit. Microcontroller in turn will change the signal timings as per the input provided by the sensors. If the density in a specific zone is high, then IR sensors indicate the same to microcontroller unit which has been programmed to increase the green light timings on that specific zone.

3.2. Emergency Vehicle Alert System:

The purpose of emergency vehicle alert system is to prioritize the signal for any emergency vehicles like ambulance, fire brigade. This unit has two components. One is a RF encoder and transmitter circuit which will be placed in the emergency vehicle. The second component is the RF decoder and receiver which will be placed in the junction.

Whenever the emergency vehicle arrives at the junction, the driver can initiate a signal using the RF transmitter. This signal will be received in the junction RF receiver and the microcontroller unit will set the green light for the zone in which emergency vehicle is present. Rest all other zones will be set to red signal allowing the emergency vehicle to reach the destination as soon as possible.

3.3. Solar Power Supply:

The solar power supply unit consists of an array of solar cells connected in parallel or series to produce DC electricity with desired parameters. The charge controller/DC-DC converter device is a two in one component which does two main functions. This device protects the battery from overcharging and deep discharging, which is very important to protect the battery and to increase its life span. It basically takes voltage supplied by solar panel and drops it down to 12 Volts and supplies both battery and the light panel. This is mainly because the solar panel output may vary up to 25V which can result in damage of the circuit components

IV. Design and Simulation of a Charge Controller

A charge controller or charge regulator is basically an voltage and/or current regulator to keep batteries from overcharging. A charge controller or charge regulator is basically a voltage and/or current regulator to keep batteries from overcharging. It regulates the voltage (V) and current (A) coming from the solar panels going to the battery. Most "12 volt" panels put out about 20-25 volts, so if there is no regulation the batteries will be damaged from overcharging. Most of the batteries need around 14 to 14.5 volts to get fully charged. The simple charge controller will be implemented using the Multisim program.
The IR sensors at the junctions calculate the density of traffic in each junction and provide input to the microcontroller. If there is any emergency vehicle alert generated, then that specific signal will be made green else the signal with high density will be made green. Once the time on any green signal reaches the threshold, the corresponding next signal will be made green.

4.1. WIND TURBINES:
Because wind velocity increases at higher altitudes, the backward force and torque on a horizontal axis wind turbine (HAWT) blade peaks as it turns through the highest point in its circle. The tower hinders the airflow at the lowest point in the circle, which produces a local dip in force and torque. These two effects combine to produce a cyclic twist on the main bearings of a HAWT. The combined twist is worst in machines with an even number of blades, where one is straight up when another is straight down. To improve reliability, teetering hubs are used which allow the main shaft to rock through a few degrees, so that the main bearings do not have to resist the torque peaks.

Rotatable shutters mounted on a circular disk automatically open when directed into the wind, regardless of the wind's direction. Pairs of upper and lower shutters are geared together. The lower shutter acts as a counterweight to the upper shutter. The bottom shutter opens in the downward direction and its weight helps to lift the upper shutter in the upward direction, as the wind applies an opening force against both shutters. When the shutters reach the vertical position, stops prevent them from opening further and the force of the wind is transferred from the open shutters to the circular disk. And the circular disk is attached to the vertical axis for power output. The circular disk, shutters, and outer vertical axis rotate together. The outer vertical axis is mounted via bearings over an inner vertical axis that is stationery. The shutters are blown closed by the wind (no stops in the opposite direction) as they reverse direction during their rotation and move into the wind on the opposite side of the wind turbine. When the wind is not blowing, the shutters open by gravity because the lower shutter is weighted to be slightly heavier than the upper shutter and it therefore can cause the upper shutter to open via the force of gravity as the two shutters are geared together. Wind blows against the open shutters and the open shutters with stops apply a force against the disk, but the open shutters with no stops (opposite side going into the wind) merely close due to the force of the wind (not applying a force against the disk) and the wind turbine begins spinning no matter what direction the wind comes from. Operation of the turbine is remarkably quiet as compared to the appearance of the video due to biasing members that absorb the shock of the opening and closing and provide useful energy output.

Conventional turbines must be very tall in order to create leverage by having very long blades to sweep a very large area. Hunt's vertical axis creates leverage by increasing its width instead of height. This allows the vertical turbine to be used in many applications, in which horizontal axis turbines cannot be used, such as flat building rooftops or just above the rooftop of a house or portable office building, as a sailboat wind turbine over a cabin area, attached to cellular telephone towers, on top of advertisement billboards, on the top of water towers, at the top of power line towers, etc.

V. RESULTS AND DISCUSSIONS

The proposed system overcomes the problem of traffic jam on intersection at the traffic signal system is introduced. Here the first objective is developing priority based signaling which helps to give priority to emergency vehicles in the road by using solar and wind energies.
VI. CONCLUSION

This project proposes a traffic control system that resolves the problems faced in conventional traffic signal systems. It provides effective time consumption on traffic signals. This also reduces man power involved in the management of traffic signals and thus reduces cost and increases safety on road. Usage of solar power and wind power makes this project more energy efficient. Also emergency vehicle override system reduces the time taken for emergency vehicles like ambulance, fire brigade and police vehicles to reach destination on time avoiding wastage of time in many traffic signals and thus reduces life risks and property damage. Overall it gives an economic consumption of fuel and man power. Proposed method also reduces the chance of traffic light violations in the junction. Reduced pollution on in vehicles at junctions.

VII. REFERENCES


Author’s Profile:

G.Prasanna Rani Received her post graduation degree from ANURAG engineering college, Telangana, India and currently working as assistant professor in Department of Electronics and communication Engineering in CMR college of engineering and technology, Telangana, India.

N.Bhagya Laxmi Received her post graduation degree from Nova engineering college, Telangana, India and currently working as assistant professor in Department of Electronics and communication Engineering in CMR college of engineering and technology, Telangana, India.