

Solar Powered Smart Traffic Control System Using Time Management

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ABSTRACT

An automated Raspberry Pi based traffic control system using sensors updates can be a helpful step in optimizing the traffic flow pattern in busy intersections, and solar based system is used to save electricity. This intuitive design of the transport infrastructure can help alleviate the traffic congestion problem in crowded cities. This system describes a system where photoelectric sensors are integrated with the Raspberry Pi to operate the lanes of an intersection based on the density of traffic. In this system, we will use photoelectric sensors to measure the traffic density. We have to mount four photoelectric sensors for each road; the distance between these sensors will depend on nature of traffic on a particular junction. These sensors will sense the traffic on that particular road. As a result, the improvement in traffic system can be incrementally enhanced, which can lead to eventually significant improvement in the overall traffic system.

The existing Traffic control system is based on the “time” which is already assigned in the system. the existing traffic control systems are failed to reduce traffic congestion problem. This project is de- signed to develop a system which perform execution based on density of vehicles. if the density of vehicles is higher than normal traffic, then time of particular signal increases, which helps to minimize the traffic congestion problem.

Keywords— Solar Panel, Photoelectric sensor, Raspberry Pi, LED (Red, Green, Amber), Power supply, Timer.

1 Introduction

In, today world with all other problems, each country is facing one most serious problem is traffic congestion. There are so many reasons for increasing the traffic congestion like, increase in no. of vehicles on a road inadequate infrastructure like narrow roads, less manpower to control the traffic management etc. Generally, traffic congestion causes slower speed of the vehicles, longer trip time and increased vehicular queuing. When high traffic demand is there the interaction between the vehicles slows the speed of traffic stream which cause traffic congestion. Due to traffic congestion the drives becomes frustrate and gate engage in the road rage. To avoid all these things in traffic environment they have some traffic signs. TSR that is traffic sign recognition is used to regulate traffic sign, warn the drivers and command or prohibit certain actions. This fact real time and robust automatic traffic sign detection and recognition support and disburden the driver because of that its significantly increase the driving safety and comfort. Also there is one advantage of this project is that we are saving the electricity by using solar panels.

For automated intelligent driving vehicle or driver assistant system, traffic signs provide to drivers various information for safe and easy efficient navigation. Real time automatic vision based traffic light control has been recently the internet of many researchers due to frequent traffic jam at major junctions and it is resulting wastage of time. For effective traffic congestion estimation we can use some sensors but as those sensors are costly so available video cameras are more efficient. Due to massive growth in urbanization and traffic congestion intelligent vision based traffic light controller is needed to reduce the traffic delay and travel time especially developing countries. As the current automatic time based control is not realistic and sensor based traffic light controller are not reliable for developing countries. In urban environment one of the biggest problem is traffic jam or traffic congestion many studies and statics from developing countries proved that most of the road accident are because of the very narrow roads and because of the destructive increase in transportation means.

Raspberry Pi microcomputer and multiple photoelectric diode sensors are used in each lane to calculate the density of traffic and operate the lane based on that calculation. This idea of controlling the traffic light efficiently in real time has attracted many researchers to work in this field with the goal of creating automatic tool that can estimate the traffic congestion and based on this Variable, the traffic sign time interval is forecasted.

2. LITERATURE SURVEY

India is the second most crowded Country in the World is a quickly developing economy. It is seeing increased no of road congestion problems in its cities. Framework development is moderate when contrasted with the development in number of vehicles, because of space and cost limitations. Ordinary traffic light framework depends on fixed time idea allocated to each side of the intersection which can't be fluctuated according to differing traffic thickness. Some time it will be not provide sufficient time to pass vehicles because traffic signal time is pre define. Nowadays traffic problem are increasing because of the increasing number of vehicles and the limited resources provided by the current infrastructures. Due to this, there is a need to wait more time in front of the signals.

We propose a system for controlling the traffic light by using Raspberry Pi. The system will detect vehicles at that time this signal goes to system and display show the traffic time on OLED. Then relay will ON and OFF, after that there is a one key if suppose no traffic or less traffic on a road at that time this key will press so time will reduced. Then vehicles can go easily and Solar panel is connected to charge the batteries, which saves the electricity.

3. PROPOSED SYSTEM

Fig.1 shows the overall design of the system. In this intersection, each outgoing lane has four photoelectric diode sensors that calculate and report the traffic conditions of each lane to the Raspberry Pi.

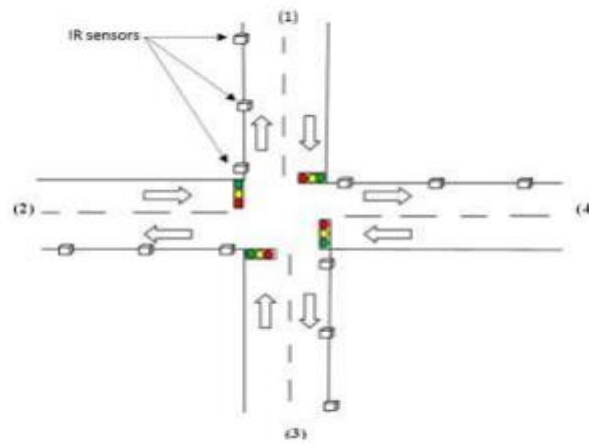


Figure 1: System Design

One of the Renewable energy sources is a Solar system, which generates electricity from the solar light. The aim of our project is to develop a Density Based Traffic Signal System using Raspberry Pi. Nowadays, controlling the traffic becomes more difficult because of rapid increase in the number of automobiles and due to large time delays between traffic signals. In order to reduce this problem, we can choose density based traffic signal system. In this system, we will use photoelectric sensors to measure the traffic density. We have to mount four photoelectric sensors for each road; the distance between these sensors will depend on nature of traffic on a particular junction. These sensors will sense the traffic on that particular road. All these sensors are interfaced to the controller. Based on these sensors, controller detects the traffic and dynamically set up the time delay of signals.

This system will help to reduce the traffic congestion problem. This system helps to measure density of the traffic signal, according to density of traffic, system will change its signal time, which helps to reduce traffic problems occurred in city. Motivation of this project is to save time as well as to reduce traffic congestion problem.

Scope of this project is to decide time, which is based on density of traffic, Raspberry pi is the heart of this system, which sense the density of traffic and calculate the respective time of signals. in this system We use photoelectric sensor which detects the density of the traffic, output of photoelectric signal is given to Raspberry pi, Raspberry pi will calculate the time and using internal timer it changes the time, time of each signal is displayed on Oled display and output of Raspberry pi is given to Green, Red and Yellow LED of each Road.

The components used in this system are listed below.

- A. *Raspberry pi 3*- Raspberry pi is a miniature computer with an operating system that can be used as a development tool for different software and hardware based projects. In this project, the Raspberry Pi

3rd generation was used for its superior processing power compared to other available microcontrollers.

- B. *Solar Panel*- Solar power captures radiant light and heat from the sun and converts it into clean energy that can be used to power homes, businesses and machinery
- C. *Photoelectric sensor*- The most popular type of photoconductive cell is ORP12 Cadmium Sulphide photo conductive cell.
- D. *Power Supply*- Power supply is given to project.
- E. *Light Emmiting Diode (LED)*-LED is used for traffic light operation.
- F. *OLED*--0.96 inch OLED Display Module is a precise small, White OLED module which can be interfaced with any microcontroller using SPI protocol. It is having a resolution of 128x64.

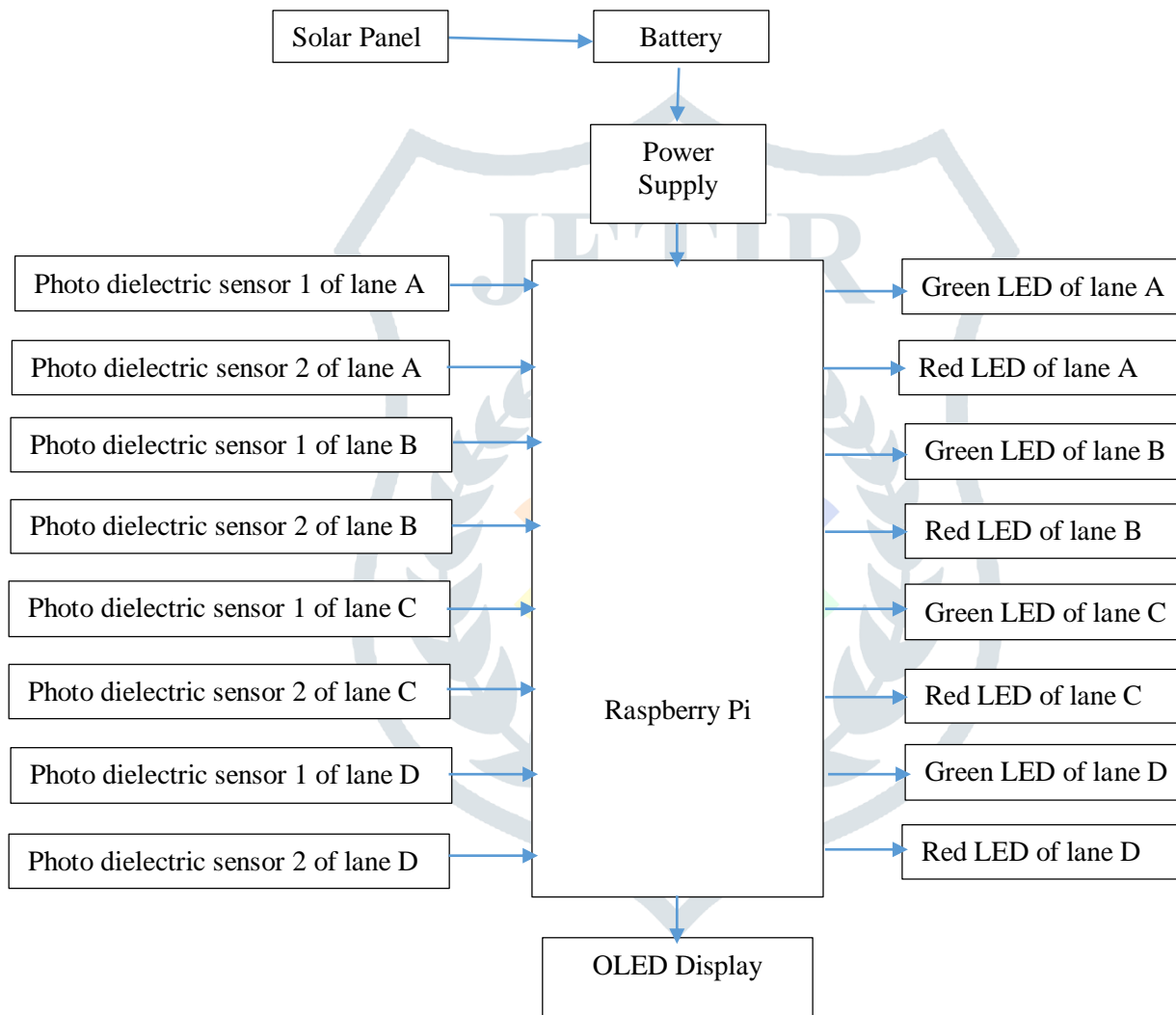


Figure 2: Block Diagram

In this proposed system supply given to the Solar panel. Using solar system which generate the electricity form solar light. This electricity Supply which is given to the whole electronic component of the system OLED display is used which shows the real time information about Traffic signal. Here use to eight sensor when any sensor sense then this signal goes to the Raspberry Pi controller and controller output is low and this signal goes to the relay driver and relay is ON at that time particular LED is ON. There are 4 conditions for density based traffic light controller.

1. If all lane A, B, C and D are no traffic then time for signal light is 3 sec sequentially.
2. If lane A & B are low traffic then time for signal light is 10 sec each and if lane C & D are high density based traffic then time for signal light is 20 sec each.
3. If lane A is high density based traffic then time for signal light is 20 sec and if lane B, C and D are low traffic then time for signal light is 13 sec each.

4. If lane A is no traffic then time for signal light is 3sec and if lane B, C and D are high density based traffic then time for signal light is 19 sec each.

The code for this system was written in a Raspberry Pi 3 using the Python programming language. Figure 3 displays the basic flowchart used in this system. The program runs an endless loop where each lane is activated in a serial order. Data collected from the photoelectric sensors is used to generate the traffic density. The information regarding the level of traffic congestion is stored in a file and it is updated on Oled display. The timer is set for that lane according to the level of traffic. When the timer for a lane is counting down, it continuously monitors if the other lanes, currently with green signals, if there is no vehicle on the road and signal is still green, then pressing key on signal we can minimize the time of signal.

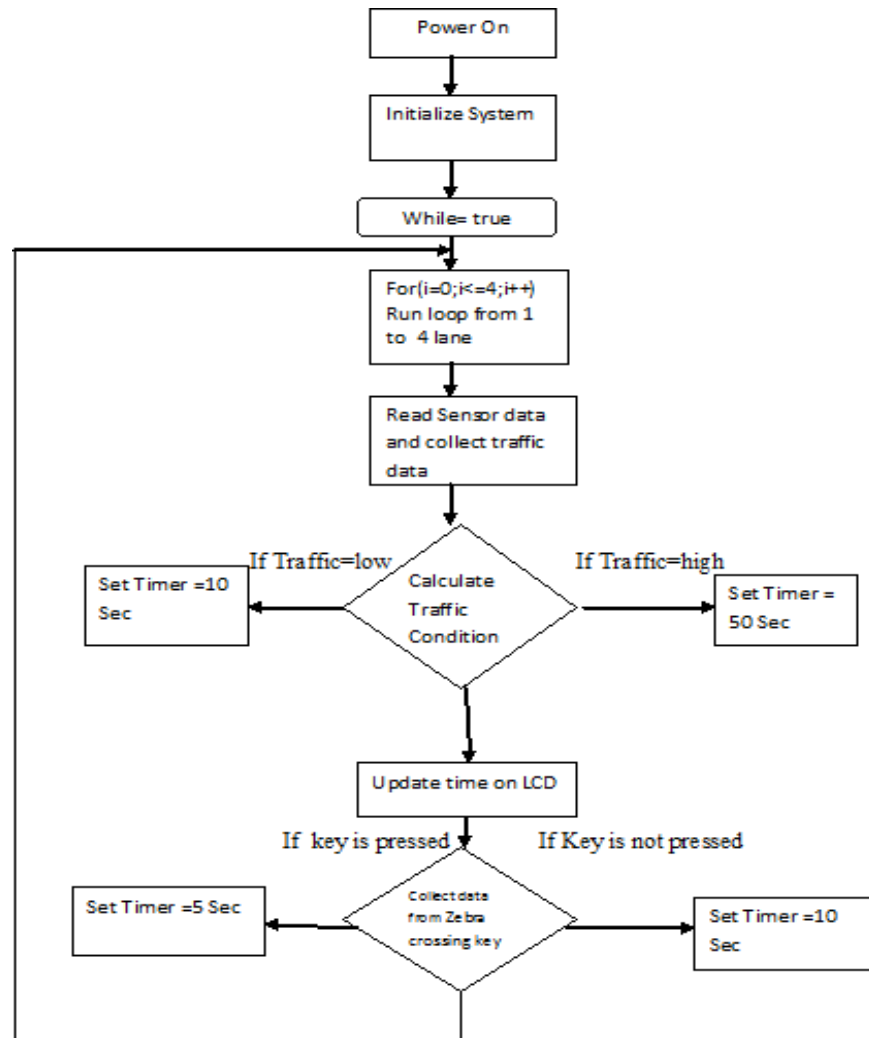


Figure 3: Flowchart of the System Code

4 Results and outcome

This system discussed in this paper is used to control and manage traffic on Road. Raspberry pi will plays very important role in this project. If there is more traffic on road which is detected by photoelectric sensors and time of signal is changed by Raspberry pi and it display it on Display. This system will help to reduce the traffic congestion problem. This system helps to measure density of the traffic signal, according to density of traffic, system will change its signal time, which helps to reduce traffic problems occurred in city. Motivation of this project is to save time as well as to reduce traffic congestion problem. Data collected from the photoelectric sensors is used to generate the traffic density. The information regarding the level of traffic congestion is stored in a file and it is updated on OLED display. The timer is set for that lane according to the level of traffic. When the timer for a lane is counting down, it continuously monitors if the other lanes, currently with green signals, if there is no vehicle on the road and signal is still green, then pressing key on signal we can minimize the time of signal.

Traffic Density	Lane A	Lane B	Lane C	Lane D	Time period
No Traffic	3 sec	3sec	3sec	3sec	12 sec
A&B Low traffic and C&D High traffic	10 sec	10 sec	20 sec	20 sec	60 sec
A High traffic and B, C&D Low traffic	21 sec	13 sec	13 sec	13 sec	60 sec
A no traffic and B, C&D High traffic	3 sec	19 sec	19 sec	19 sec	60 sec

Figure 4: Output Table

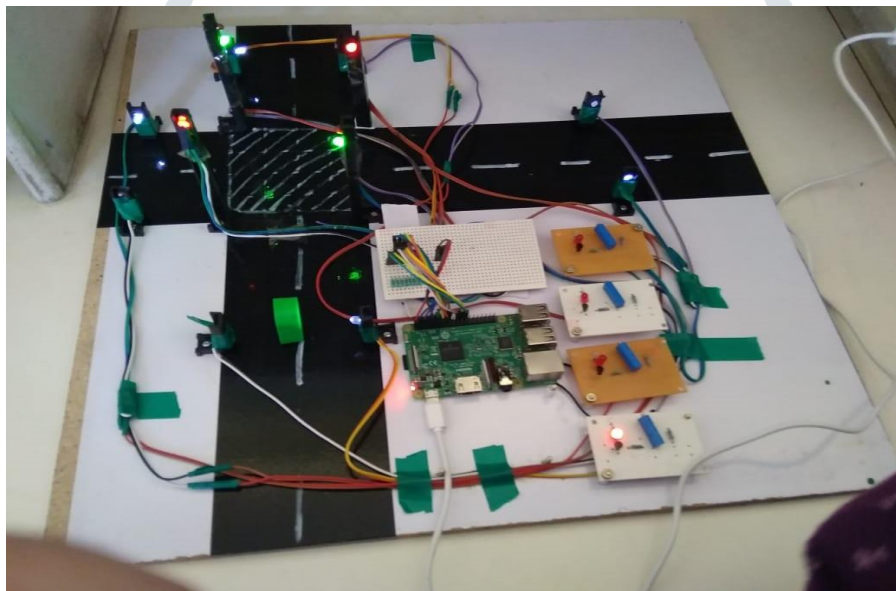


Figure 5: Top view of Model

7 Conclusion and Future Work

This paper tries to introduce a new method for traffic control based on vehicle density, which is found to be very efficient method. Photoelectric sensors used to measure the traffic density. Two sensors is mount on each road. One sensors is used for low density and another used for high density. These sensors will sense the traffic on that particular road. All these sensors are interfaced to the controller. Based on these sensors, controller detects the traffic and dynamically set up time delay of signals

Higher versions of raspberry pi can be used for reducing the processing time. Timer system can also be incorporated. While determining vehicle density if the number of vehicles on any particular side is always less, then each time the lane will be neglected and the waiting time of vehicle on that particular lane will be high. For future expansion this has to be considered.

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