VEHICLE DENSITY BASED TRAFFIC SIGNAL CONTROL SYSTEM.

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Abstract :

This paper contains infrared sensor based prototype of self-adaptive traffic signal control system. It is an autonomous traffic control system, which can be effective measure to help congestion of urban traffic. This system improves the efficiency of traffic operation on urban road networks. The self-adaptive traffic signal system is a closed loop control system. This system adjusts the traffic signal parameters by measuring the intensity of vehicles in a respective and gives a priority to that lane (green signal to the highest intensity of vehicles) and red signal other remaining lane.

It is self-adaptive system that uses infrared sensors at each road at intersection to measure the density of vehicles. It uses a Node MCU mega microcontroller that stores all the data and accordingly gives priority to the lane that has majority of vehicles. This paper has provided detailed description of each of the components with its pin diagram along with technical detail.

INTRODUCTION :

On a daily basis traffic congestion has become a major problem in most of the urban cities. Here the problem in not only increase in waiting time but also leads to increase in emission of carbon dioxide due to vehicles being stuck in traffic. This not only makes live of people easier but also has an positive effect on climate. Present traffic system is an open loop control system consisting of red, yellow, green coloured lights. This operation is time based, where the time for each light is fixed which in turns creates issue of inappropriate operation of traffic system that leads to increase in waiting time and loss of fuel. This literature solves the issue by making traffic signal automatic and behaves as per traffic density rather than fixed time and based on Node MCU microcontroller, IR sensor, IOT based and other methods. This is a smart traffic system that senses traffic density and gives green signal to the highest density lane. The traffic density is sensed by Infrared sensor (IR). The prototype has 2 IR sensors for each lane. The sensors can be increased as it is a real life application. Number of IR sensor is responsible to measure the density and to detect the traffic. The output of IR sensor is measured by detecting vehicle density and the traffic lights are controlled by Node MCU microcontroller board which generates control signal.

COMPONENTS AND THEIR DESCRIPTTION:

- Node MCU-The Node MCU is an open source software and hardware development environment built around an inexpensive system on a chip (SoC) called the ESP8266.
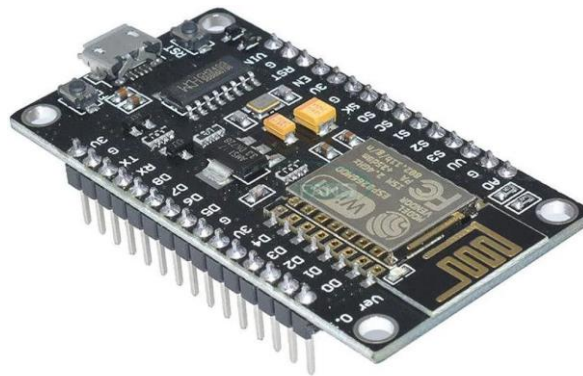
- IR Sensor – A infrared detection system consists of basic components:
    1. Infrared source
    2. Contact medium
    3. Optical component
    4. Infrared detector
    5. Infrared receiver
    6. Signal processing

- LED-It is a mini traffic light display module with high brightness and suitable for production of a traffic light system model. It is connected to Node MCU microcontroller.

- LCD Display-It is a 16×2 LCD Green display with a black font and yellow back light. It consist of many library for interfacing LCD with Arduino , Raspberry Pi ,Node MCU.

- I2C(Inter integrated circuit) module-I2C module is used to reduce the number of pins needed for the display which enables the display to work on four pins.

THE TRAFFIC LIGHT SYSTEM:

A four way road intersection with IR sensor having A ,B ,C ,D represented as roads and the arrows represents the movement of traffic on that road is shown in fig. IR1 and IR2 are the IR sensors facing road D i.e. IR transmitter and IR receiver are facing towards road D. Similarly for road A (IR3,IR4) and for road B (IR5,IR6) and for road C (IR7,IR8) respectively . When a density of vehicles reaches in front of IR sensor then the output signal from the sensor is considered as traffic density. The more the no. of IR sensors in a lane detects traffic the more the density of traffic in that road, to give a green signal to that road. Following rules are executed.
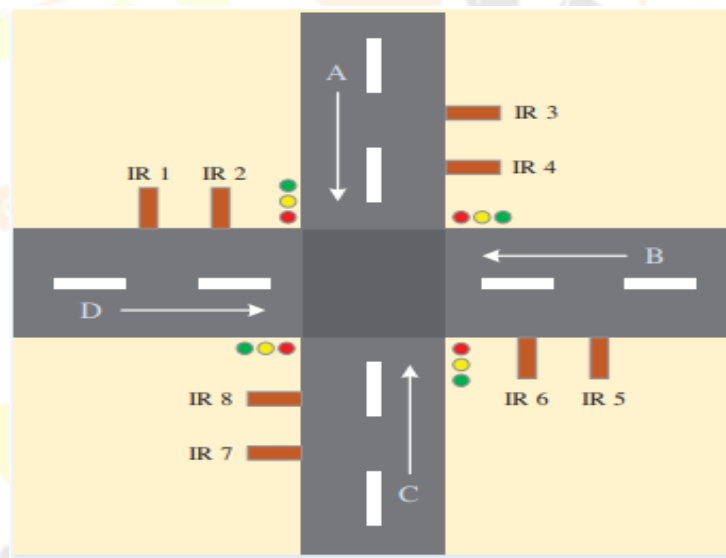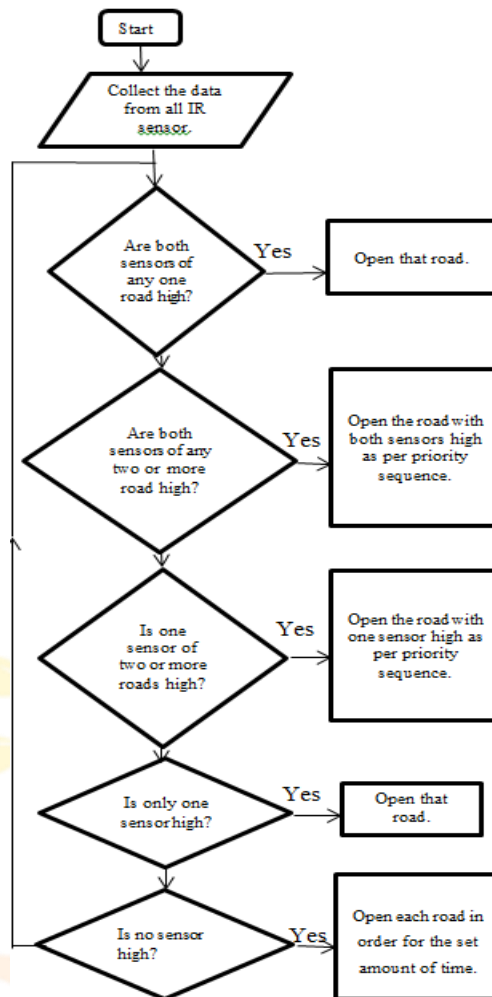
Literature review:

Vehicle Density based traffic signal control system is a type of intelligent transportation system (ITS) which uses sensors to detect the density on road and adjust the timing of traffic signal accordingly.it creates a advanced traffic control system which improves traffic flow and reduce its congestion.

The IR sensors are popularly used in vehicle density based traffic signal control system because they are easy to install and also inexpensive. IR sensor emits infrared light so when a vehicle passes through this beam of light the sensor detects change in the intensity of reflected light which in turn indicates the presence of vehicle.

RESULT:

After learning about the component and using sufficient microcontroller programming we obtained following results. When there is normal traffic at intersection the traffic light begins to flash at a particular time delay. When there are more vehicle in one lane than the other lane is given priority and the signal turns green as soon as the lane is not clear.
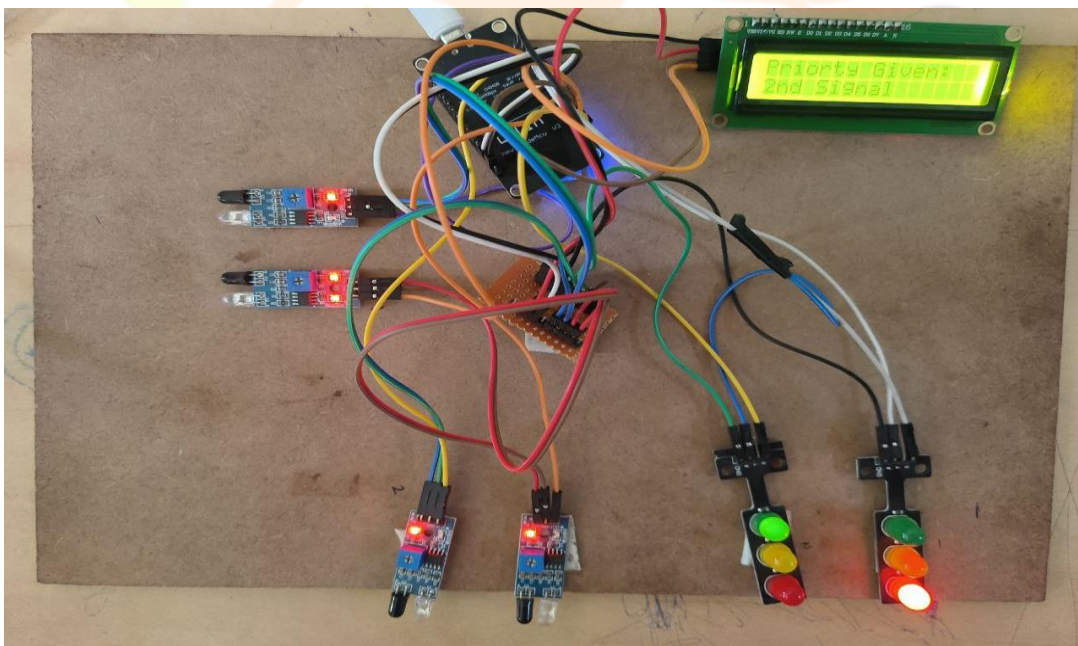
CONCLUSION:

This paper has successfully presented an approach for the optimization controlled traffic light in a city using microcontrollers and IR sensors. By using this system we have tried tom reduce traffic jams due to traffic lights to an extent and we have successfully got the results. The number of vehicles passing through a particular lane at a fixed time slot decides the traffic density range and based on density of vehicle microcontroller controls the traffic light delay for next recording.