DYNAMIC TRAFFIC LIGHT SWITCHING THROUGH SENSORS

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Abstract:

In recent decennary, traffic junctions are generally controlled by traffic policemen or fixed time traffic light signal. Traffic congestions and accidents can be avoided by providing traffic junctions. Because of fixed time traffic light signal,there is a huge loss of time,loss of opportunities and loss of fuel.It also results other problems like pollution and increased stress levels of human. In this paper, we are focusing on these particular problems which arises on traffic junction by fixed time switching of traffic lights. So to solve these problems we will go density based Dynamic traffic light switching. This new approach of traffic light switching will be beneficial for people who stuck in traffic. This approach changes a traffic light based on density of vehicle in each lane of a junction. The combination of existing technology and Artificial intelligence by thinking themselves can reduce time and complexity of traffic system. This paper represents implementation and development of smart dynamic traffic light switching through sensors. This system having dynamic control which reduces Average Waiting Time (AWT). This system prototype is made up of Arduino AT Mega, IR sensors, AD converter, and Power supply.

Keywords: **Dynamic control, Density, Traffic Junction, Time shift**.

I. INTRODUCTION:

Now a day, population of a metro city is increasing day by day that's why number of vehicles also increasing rapidly because of that people are facing, traffic jam problem. Number of vehicles also increased in the city and delay in the traffic signal becomes the reason for the traffic. So to solve this problem we will change the traffic signal according to density of vehicles. This paper justifies you how to manage the traffic based on vehicle density. IR sensors(transmitter and receiver) will be used to sense the traffic density at the junction. We are using three pair of IR sensor for each lane. Sensors are used to analyse traffic on particular lane. Microcontroller will work according to the sensors output. Using those sensors, we are detecting and controlling the traffic system.

With new wings of hopes, people are coming out from their houses for developing the standard of living. That's why day by day traffic congestion is increased. As a outcome of this two main problems are arises. No traffic but still need to wait, Heavy traffic jams. These problems occur due to Fixed Control on Traffic. The meaning of Fixed Control on Traffic is that we are not controlling the traffic according to the density, but in manner of programming which is already fixed in the system.

To solve this problem of a fixed traffic light control system, we are introducing a traffic control system which is based on the density, for keeping control on the traffic. It is named 'dynamic traffic light switching through sensors' means a system which can change itself according to number of vehicles or can say density.

IR sensors are used for making a conventional traffic control system. Pair of IR sensors includes IR transmitter and IR receiver. These IR transmitter and IR receiver will be placed in line of sight manner on the road at a particular distance. IR sensors detect the vehicle and send the information to the microcontroller when vehicle is passing in front of the IR sensors. According to the density of vehicle on the road microcontroller provide the glowing time to LED. If the density is lower, LED will glow for less time than average or vice versa.

The main advantage of this system is that it reduces the waiting time for vehicles. Now-a-days' time is most valuable thing, so because of that reason many people breaks the traffic rules just to reached at time to their destination. The reason behind breaking the traffic rules is to wait for more time whether the traffic is present or not. So, the proposed system is able to minimize the number of accidents happening on the road every day. IR sensors are connected to the microcontroller and traffic lights are also connected to the microcontroller. There will be low if traffic occurs on that lane otherwise it will be high.

II. LITERATURE SURVEY:

According to traffic density, RSU will provide available route to driver to reach hisdestination. The values which are generated using density of vehicle and that data is given to all vehicles. Algorithm is created to inform the available routes and control traffic. Because of this people will reach to their destination on time, they will not miss opportunity. [1]. This system involves detection of vehicles which are breaking traffic signal. Vehicles are detected with the help of central controller i.e. Arduino which is placed at every road of junction.Even if RED light is ON then also vehicle passes by that way that means signal is broken. The breaking traffic signal vehicles image is capture by cameras and actions will be taken against them[2].In this proposed

system, they have created a framework for making a traffic flow more effectively. They have placed sensor at road side which analyse road conditions. They proposed new algorithm to decide when to change the traffic light to control congestion. This system is fully depending on the input data which is received from sensor and given to controller, this means low overhead in processing and communication[3].In this paper they have focused on achieving a traffic control in developing countries such as India, where road quality is one of the most concern parameter which needs to be consider. The objective is vehicle should not be wait for more than its average waiting time. It also focuses on giving priority to emergency vehicles such as ambulance, fire brigade. And also detects the unexpected events such as road accident and breaking signal [4].Wireless Sensor Network (WSN) technology is used to detect vehicle. Using this method vehicle monitored dynamically and also to control the state of the signal light in a road intersection new algorithm to control the signal is developed. Simulation is also done for controlling traffic which results in proposed system is more effective than real time traffic control light switching system [5].

III. PROPOSEDSYSTEM:

According to traffic density the signal timing changes automaticallyat the junction. The automatic time switching function are used to accommodate movement of vehicles smoothly by avoiding the unnecessary waiting time at the junction.

In our system,Arduinofamily duly interfaces with sensors and LED signals.We are using 12 pairs of IR sensors i.e. IR transmitter and IR receiver. Three pairs of IR sensor are place in one lane which is connected together in a light of sight configuration. Suppose fixed time slot is 120 seconds are allocated to the four lanes means each lane having 30 seconds. So if the Lane one having a less traffic and it will cover in 15 seconds then remaining 15 seconds will give to the other lane having high traffic.

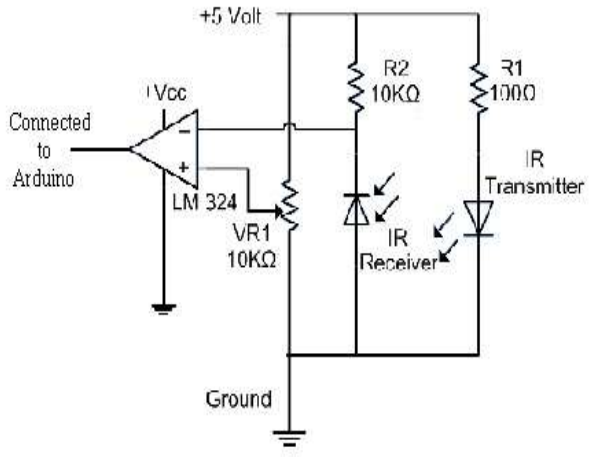


Figure 1. Circuit Diagram of IR sensor

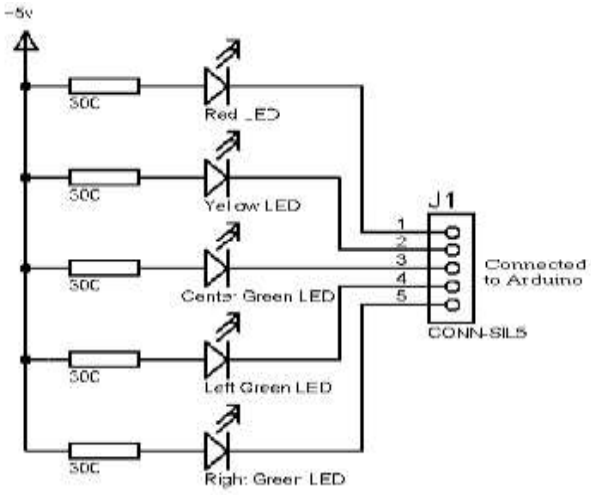


Figure 2.Circuit Diagram of LED

In above circuit diagram of IR sensor, we have combine the negative terminals of all IR transmitter together and shorted into one cable,that cable is connected to the ground of arduino and vice versa for IR receiver. And also we have combine the positive terminals of all IR transmitter together and shorted into one cable,that cable is connected to the power supplyand vice versa for IR receiver. All data cables of IR receiver are connected to the digital pins of the arduino.The data pins of all IR receiver is connected to the digital pins 42,43,44,45,46,47,48,49,50,51,52,53.

In circuit diagram of LED the positive terminal of all LEDs is combine together and shorted into one cable that cable is connected to power supply. and negative terminal is connected to the digital pins of arduino. The RED LEDs of four lanes is connected to 22,27,32,37 of arduino. Yellow LEDs of four lanes is connected to 23,28,33,38 of arduino. Centre GreenLEDs of four lanes is connected to 24,29,34,39 arduino. Right Green LED of four lanes is connected 25,30,35,40 arduino. Left Green LEDs of four lanes is connected 26,31,36,41 arduino.

BLOCK DIAGRAM:

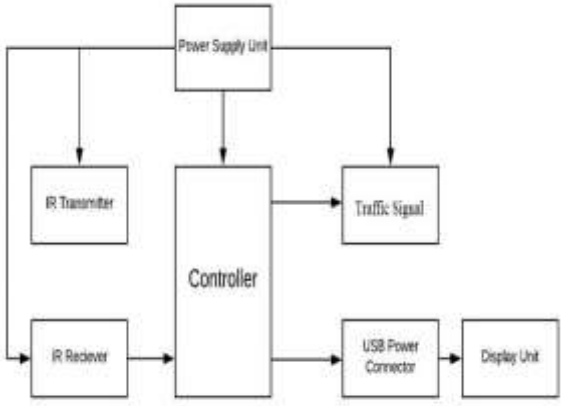


Figure 3.General Block Diagram of Traffic Light Switching System.

As shown in the above figure, we are using IR sensors for making a conventional traffic control system, an intelligent traffic control system. IR sensor contains IR transmitter IR receiver in itself. These IR transmitter and IR receiver will be mounted on the road in the line of sight manner at a particular distance. As the vehicle passes from front of these IR sensors, then IR sensor will detect the vehicle & will send the information to the microcontroller. Power supply is used to provide a power to each component in the system. The microcontroller will count the number of vehicles, and provide the glowing time to LED according to the density of vehicles. If the density is higher, LED will glow for higher time than average or vice versa. USB Power Connector is a component which is used to transfer data from hardware to the GUI at the PC side. Waiting time of each lane for the vehicle will be shown on the GUI.

Example:
Consider the following situation
condition 1: Lane 1 having traffic up to 3rd sensor.
condition 2: Lane 2 having traffic up to 1st sensor.
condition 3: Lane 3 having traffic up to 2nd sensor.
condition 4: Lane 4 will not detect any vehicle.

If the above conditions will occur, then the time switching function distributes time dynamically among four lanes as follows:
Lane 1:50 seconds allocated.
Lane 2: 25 seconds allocated.
Lane 3: 35 seconds allocated.
Lane 4: 10 seconds allocated.

IV. IMPLEMENTATION:

We have implemented the model for managing Traffic system.In which we are using twelve pair of IR sensor, signal LEDs and arduino.

When power supply is given to the circuit,IR transmitter continuously emits a rays.If object is present in front of the IR transmitter,the Rays are not reach to the IR receiver else Rays are directly reach to the receiver.according to above condition the result of arduino is given to LEDs.and we get the output in the form of the LED glow.

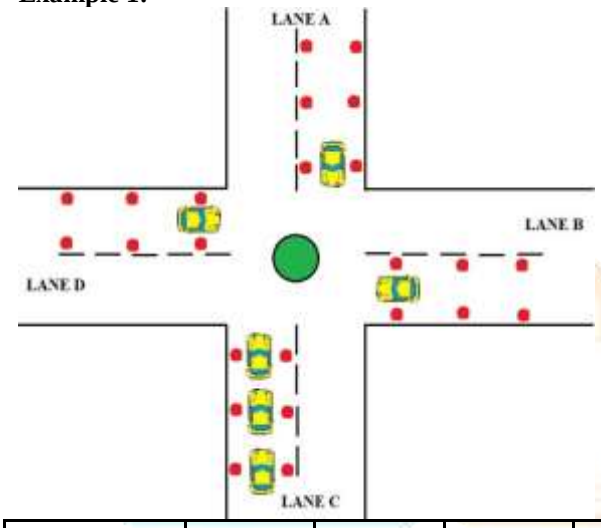
Algorithm:

1. Read data from sensor.
2. Check second sensor of all lanes if the first sensor detects vehicle.
   Else analyse output of all the first sensor of each lane and take a decision accordingly.
3. If(w1>w2=w3=w4)
   Then
   (w1=T/2) &
   (W2=w3=w4=T/6)
   Else if
   (w2=w3=w4>w1)
   Then
   (w2=w3=w4=T/3.5)
   (W1=T/8)
   Else if
   (w2>w1=w3=w4)
   Then
   (w2=T/2) &
   (W1=w3=w4=T/6)
   Else if
   (w1=w3=w4>w2)
   Then
   (w1=w3=w4=T/3.5)
   (W2=T/8)
   Else if
   (w3>w2=w1=w4)
   Then
   (w3=T/2) &
   (W2=w1=w4=T/6)
   Else if
   (w2=w1=w4>w3)
   Then
   (w2=w1=w4=T/3.5)
   (W3=T/8)
   Else if
   (w4>w1=w2=w3)
   Then
   (w4=T/2) &
   (W1=w2=w3=T/6)
   Else if
   (w1=w2=w3>w4)
   Then
   (w1=w2=w3=T/3.5)
   (W4=T/8)
   Else if
   (w1=w2>w3=w4)
   Then
   W1=w2=T/3
   W3=w4=T/6
   Else if
   (w3=w4>w1=w2)
   Then
   W3=w4=T/3
   W1=w2=T/6
   Else if
   (w1=w3>w2=w4)
   Then
   W1=w3=T/3
   W2=w4=T/6
   Else if
   (w2=w4>w1=w3)
   Then
   W2=w4=T/3
   W1=w3=T/6
   Else if
   (w1=w4>w2=w3)
   Then
   W1=w4=T/3
   W2=w3=T/6
   Else if
   (w2=w3>w1=w4)
   Then
   W2=w4=T/3
   W1=w3=T/6

Return to step 6

4. After checking second sensor of each lane if it is equal then check third sensor of each lane
   Else
   Return to step 3.
5. After checking Third sensor of each lane if it is equal then time is equally distributed.
   Else
   Return to step 3.
6. Return to step 1.

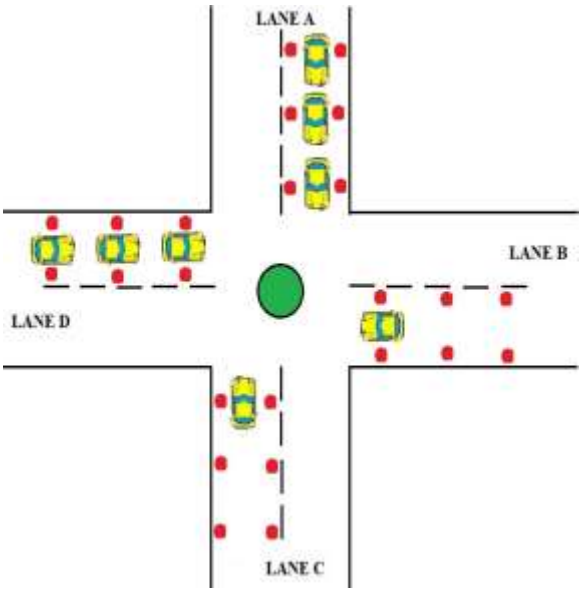
Example 1:



IN LANE	A	B	C	D
PASSING TIME	20	20	60	20

On three lanes i.e. Lane A, Lane B and Lane D having traffic density up to sensor1 and Lane C has traffic density up to sensor3 then 10 seconds from Lane A, B, D is given to Lane C which is having more traffic than other lanes. Time will be distributed for A-B-C-D as 20, 20, 60, 20 respectively.

Example 2:



IN LANE	A	B	C	D
PASSING TIME	40	20	20	40

On Lane A and Lane D having traffic density up to sensor3. Lane B and Lane C have traffic density up to sensor1. 10-10 seconds from Lane B and C is given to Lane A and D which is having more traffic than other lanes. Time will be distributed for A-B-C-D as 40, 20, 20, 40 respectively.

Result:

Table 1: Conditions for some real time situation

Way1			Way 2			Way 3			Way 4			Passing Time			
S1	S2	S3	S1	S2	S3	S1	S2	S3	S1	S2	S3	W1	W2	W3	W4
0	0	0	0	1	1	1	1	1	0	0	1	45	25	15	35
0	1	1	0	0	0	0	0	1	1	1	1	25	45	35	15
1	1	1	0	1	1	0	0	1	0	0	0	15	25	35	45
0	0	0	0	1	1	1	1	1	0	0	1	45	25	15	35
0	0	1	0	0	1	0	1	1	0	1	1	40	40	20	20
0	0	0	0	1	1	0	0	0	0	1	1	50	10	50	10
0	0	1	0	0	1	0	0	1	0	0	1	30	30	30	30
0	0	0	0	0	0	1	1	1	1	1	1	50	50	10	10
1	1	1	0	0	1	0	0	1	0	0	0	10	25	25	40
0	0	0	0	1	1	1	1	1	0	0	0	45	20	10	45

In result table 1, three sensors are placed on each lane in line of sight manner. If there is vehicle detected by sensor, then it will be denoted by 0 otherwise 1.

V. CONCLUSION:

The traffic light problem is a critical issue that worries government and people who live in cities. The influence of low efficient conventional traffic system affects the economic, health, financial, and environmental domains

The transportation system trouble and the bad monitoring may cause car accidents, traffic jam, and roads congestion that put heavy loads on businesses and works. The advancement of technologies and the miniature of control devices, appliances and sensors have given the capability to build sophisticated smart and intelligent embedded systems to solve human problems and facilitate the lifestyle. Our Dynamic traffic light control system is an attempt to contribute to the scientific society and also for managing the flow at the intersections of automobiles.

To overcome the drawbacks of existing system, there can be further improvement can be done. The system can be expanded with smart dynamic traffic light control and congestion avoidance system during emergencies.Emergency cars such as fire engines and ambulances will have priority over other traffic. If emergency vehicles are arrive then it will give highest priority to emergency vehicle. In future, the real time traffic information updated on traffic department website. It will automatically track a person who breaks the traffic laws.When the traffic is high on lane and people willing to travel by that route, then we can suggest alternative route to driver for reaching to his destination by using Google map. Image processing also we can use to implement this project so that complexity will be reduced.

VI. REFERENCES:

[1]. Avehiculardynamicsbasedtechniqueforefficienttraffic management.*ShagunAggarwal;RasmeetS.Bali 2015 International Conference on Advances in Computing, Communications and Informatics (ICACCI)*

[2]. SmartTrafficSignalUsingUltrasonicSensor.*RahulN.Dhole; VishalS.Undre;ChetanR.Solanki;SatishR.Pawale 2014 International Conference on Green Computing Communication and Electrical Engineering (ICGCCEE)*

[3]. Cyber-Physical Systems: A Framework for Dynamic Traffic Light Control at Road Intersections. *OssamaYounis; NaderMoayeri 2016IEEEWirelessCommunicationsand NetworkingConference*

[4]. DesignandImplementationofaDynamicIntelligentTraffic ControlSystem. *AmitG.Bhat;KaushikRoy;PrajeshP.Anchalia; H.M.Jeevith 201517thUKSim-AMSSInternationalConference onModellingandSimulation(UKSim)*

[5]. AReal-timeDynamicTrafficControlSystemBasedon WirelessSensorNetwork.*ChenWenjie;ChenLifeng;Chen Zhanglong;TuShiliang 2015InternationalConferenceon ParallelProcessingWorkshops(ICPPW'05)*

[6]. Handbook of Modern Sensors (Physics, Designs, and Applications) by Fraden, Jacob

[7]. Arduino-101 Beginners Guide by Erik savasgard