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DENSITY BASED TRAFFIC CONTROL SIGNAL WITH EMERGENCY OVERRIDE

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Abstract: **With the increase in human population in cities and therefore number of vehicles, traffic control signals have been playing significant role in managing traffic flow in cities. It provides safety and convenience to both drivers and pedestrians. However, traditional traffic control signals fails in time management, as it allocates equal time slots to each road it is managing. This creates unnecessary waiting for drivers, which could not be endurable in every case, as being in time, is important to everyone. Therefore, here we proposed density based traffic control signal, which allocates different time slots to each road according to vehicle density on it and therefore doing time management function. This system also comes with RF signal override control in case of emergency vehicles such as fire brigade, ambulance, etc. So this is also a priority based system. This system, therefore, offers advantages over ordinary traffic control signal.**

Keywords: **Density Based Traffic, traffic control signals, safety and convenience.**

I. INTRODUCTION

Nowadays one of the major problems faced in any metro city is traffic congestion. Getting stranded in between heavy traffic is a headache for each and every person driving the vehicle and even to the traffic police controlling the traffic. One of the oldest ways of handling traffic was having a traffic police deployed at each junction and manually controls the inflow of traffic through hand signaling. However this was quite cumbersome and then came the need for a different type of control - using Traffic Control Signals. Conventional Traffic signal started playing important role in cities, but as time passed, with increase in population in cities, this system became less efficient in traffic management. This called the need of traffic control signal which works more efficiently. So density based traffic control signal is proposed which allocates time for each road depending on the density of traffic on it. And also the project aims to provide signal override for emergency vehicles through RF signal. It happens when there is an emergency situation like ambulance, fire brigade stuck in the traffic. This project therefore happens to be the perfect solution in high population cities.

This circuit makes use of IR sensors to measure the density of traffic. These sensors are interfaced with microcontroller of 8051 family which in turn allocates time for each road according to the output of IR sensors through traffic signal. For the emergency override it uses RF transmitter and receiver.

II. OVERVIEW OF DENSITY BASED TRAFFIC CONTROL SYSTEM

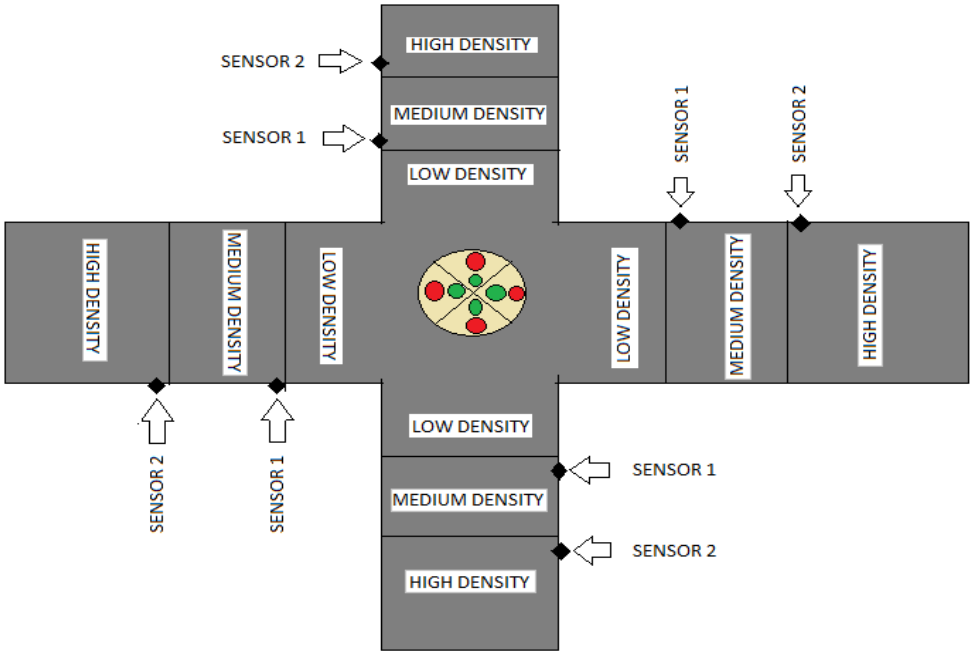

Fig. Overview diagram of Density Based Traffic Control Signal with Emergency Override

The above figure shows Density Based Traffic Control Signal System. As shown, each road is divided into three sections as Low, Medium and High traffic density regions. At the beginning of medium and high density sections, sensors are mounted to show the respective traffic situation on a road and to assign appropriate green light time to each road.

When density of traffic is measured by IR sensors mounted on each road, system gives pre-defined interval of time to each road in accordance with the traffic density on it to clear its traffic by making green light ON for that road. This normal operation continues until override signal occurs.

When override signal occurs system halts its normal operation and starts executing the override signal and again comes back to the normal operation after execution. This helps the emergency vehicles like ambulance, fire-brigade etc. on any road to pass the signal without unnecessary waiting for the signal to be turn green for a road it is on.

III. DESIGN AND WORKING OF A SYSTEM

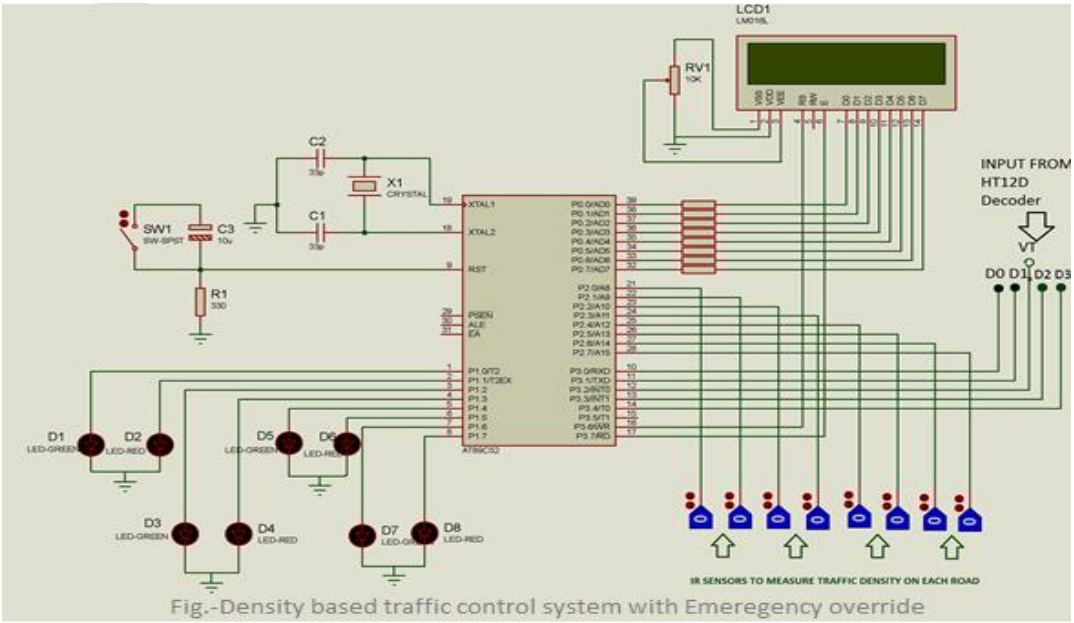

Fig.-Density based traffic control system with Emeregency override

The system consists of a pair of microcontroller on each road to measure its density, a display to show countdown for each road and which road it is currently processing. RF encoder (HT12E) and a decoder (HT12D) to perform override operation and a pair of Red & Green LEDs on each road for signaling the traffic.

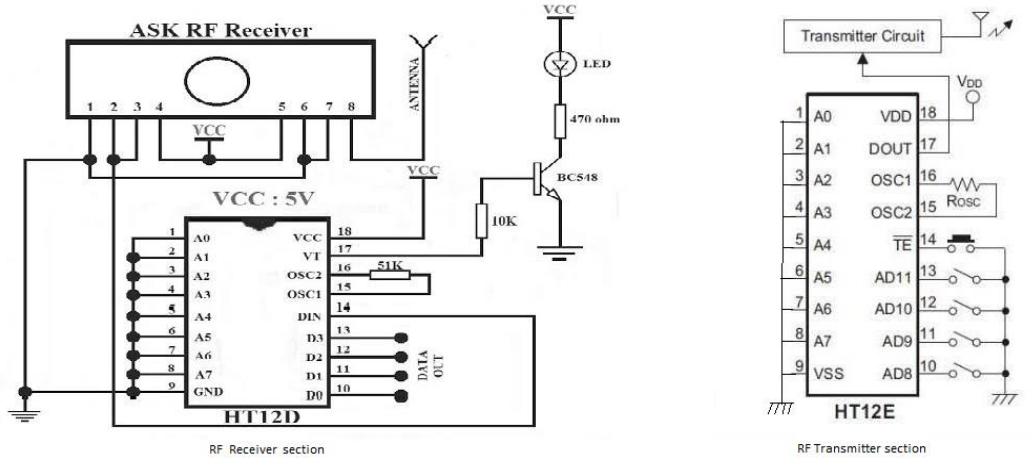

Fig.- RF Signal Emergency Override Unit

(Note: The circuit shown above is for demonstration only. However, in practical application we can use four different displays for four roads at a junction to show Green as well as Red light countdown of each road. Also use of third IR sensor and Yellow LED can also be made if desired)

A. Measurement of density:

Measurement of density is done by IR sensors which are aligned aside of each road. Two IR sensors are used for each road to determine traffic condition on each road. For this, road is divided into three sections from the traffic signal to determine low, medium and high traffic level on road. Each section is a range of low, medium or high traffic level to which particular pre-defined time intervals are need to be assigned in order to achieve time efficient traffic management. The sensors are mounted at the beginning of second and third sections which are the ranges of medium and high traffic levels respectfully.

Low traffic density: To show low traffic level no sensor is used; because, no output from sensor to microcontroller is assumed as low traffic level on road and minimum pre-defined time is assigned to that road of which no sensor is giving output.

(Note: No sensor is used for this case assuming highly populated area of operation. However, a sensor can be used for this region if area of operation has low population where skipping the green signal for any road is feasible**)**

Medium traffic density: Medium traffic level is shown using a sensor mounted at the beginning of a second section. When this sensor gives output, it means that traffic on the given road is in a medium range. So time interval, predefined for a case of medium density traffic is assigned to this road when signal turns green.

High traffic density: Measurement of high traffic level is done by using two sensors mounted on each road. When both the sensors on a road gives output it means that traffic on the given road is in the high traffic level range. So, more time interval is assigned to the road having high traffic density to clear traffic on it.

B. Allocation of time:

Allocation of time is done in such a way that for each traffic level condition like low, medium and high, enough time intervals get assigned for a particular road having any three of the conditions. So that none of the road gets extra time to clear its traffic nor gets less time. The microcontroller makes decision about assignment of time to a particular road in accordance to the output of sensors on that road just before the instant the signal for given road turns green.

For a road having low density traffic that is no sensor on that road was giving output prior to the instant when signal turns green to that road, minimum time is assigned when signal turns green. So that no extra time is given to the road under consideration, avoiding unnecessary waiting by the traffic on a road whose signal is supposed to turn green next. e.g. 5 sec. for low traffic density.

(Note: If a sensor is used to show low traffic density also and it is not giving any output, we can skip the green light time for that particular road or otherwise if giving output we can assign time interval as explained)

For a road having medium density traffic that is first sensor which is mounted at the beginning of second section was giving output prior to the instant when signal turns green to that road, so much time interval is assigned to that road as to allow enough time passage for the traffic on that road to be cleared when signal turns green. This avoids unnecessary waiting by the traffic on the next road and also getting enough time to clear traffic on the current processing road. e.g. 10 sec. for medium traffic density.

For a road having high density traffic that is both the sensors giving output prior to the instant when signal turns green to that road, maximum time interval is assigned to this road so as to clear traffic on it effectively. e.g. 20 sec. for high traffic density.

When override signal occurs for any road, system halts its normal operation and starts executing the road which is to be override. In this case, sufficient time say 15 sec. is given to that road so that any emergency vehicle on a road can pass the signal without spending so much time at it.

C. Emergency override:

The emergency override is done by using a set of RF transmitter and Receiver. RF encoder is used to assign different RF frequency for each road. RF decoder is used to identify the RF signal frequency and determine to which road it belongs. When RF transmitter sends particular frequency signal assigned to a particular road through encoder, at the decoder end it determines to which road it belongs and sends the corresponding data to microcontroller. Then microcontroller makes green light ON for that particular road to which transmitted signal frequency belongs just after currently processing road. After the green light timed-out occurs to a road which had been override, normal system operation resumes with turning ON the green light for the road which is next to a road which had been under processing just before override signal has occurred.

The emergency vehicle carrying RF transmitter can transmit the override signal in the event of emergency. To make easy for the operator to know exactly which road he wants to override, common names/symbols are given to roads at each traffic signal junction and transmitter device also has same names/symbols on it to show which frequency belongs to which road. So operator can override particular road by sending frequency of a road he wants to override. The common names/symbols should be given to roads at each signal junction in such a fashion that a name/symbol on a transmitting device and of a road at each junction belong to same frequency.

IV. RESEARCH TRENDS AND CHALLENGES

The system can be made to turn-off signaling LEDs automatically or to show yellow signal to each road, if it encounters low traffic condition on each road for some time. They can turn-on automatically when system encounters medium traffic condition on any of roads. The system can save the data about traffic conditions it had to plan for development of easy transport.

As proposed system uses RF signal for override, there is possibility that someone will bring the system down by transmitting false override signals. Therefore, highly secured coded signals should be made to use for emergency override operations.

V. CONCLUSION

This proposed system provides time efficient system by avoiding unnecessary waiting at traffic signal junction due to use of density based controlling. It is priority based system as it provides Emergency override and therefor avoiding any possible damage.

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