Smart Traffic Mess Control and Avoidance System

Rouf Ul Alam Bhat
(Assistant professor,Department Of electronics and instrumentation technology)
(University Of Kashmir)
(J&k,190006)

Suhail Ahmad Bhat, Fayiqa Naqashbandi, Isna Khan, Naazira Badar, Rabaie Malik
(Btech ECE,Undergraduate,Department Of electronics and instrumentation technology)
(University of Kashmir)
(j&k,190006)

***Abstract*-The traffic conditions are worsening day by day, resulting in frequent traffic jams. Many important services get delayed by traffic jams with Ambulance, fire, essential and VIP services being the ones that get most affected. Moreover traffic density on roads in big cities nowadays has become so high that it requires a lot of planning for smooth flow of the traffic on the roads. Hence there is a need to develop a robust and smart traffic management system in case of normal and emergency scenarios.**

To solve this problem, we have come up with the solution of STMS "Smart Traffic Management System" which is an amalgam of small systems working independently and internetworked so as to curb traffic mess. Here we are measuring the traffic density on each road in real time with the help of sensors. Their measure is continuously sent to the base station network to update all vehicles on the road with latest traffic density scenario on a visual interface. Also, traffic clearance is prioritized for emergency vehicles. Moreover each vehicle is installed with a smart wireless sensor node that continuously monitors its speed, direction and other constraints and continuously updates the traffic management workforce about its status. The system is designed around three subsystems namely the SNS (sensor network subsystem) ,The STLS (smart traffic light subsystem) and the RTTDIS (real time traffic density information dissemination system).The SNS is a network of optical sensors along the road with additive sensation capability .These sensors give the traffic density information to the base station normally fitted inside the traffic light pole. The STLS works on the basis of inputs taken from the SNS and smartly switches the traffic lights on the basis of traffic load and prioritized traffic pattern. The RTTDIS is a central system that takes traffic load information from all the neighboring base stations and transmits the optimized real time traffic pattern to all the vehicles. The vehicles are fitted with GPRS, GSM modules for communication and location tracking, speed and acceleration sensors for speed monitoring and display module for real time traffic pattern display

1. INTRODUCTION

Traffic density on roads in big cities nowadays has become so high that it requires a lot of planning for smooth flow of the traffic on the roads. Normally the traffic lights are installed at almost all major traffic crossings in these cities. Traffic lights normally help a lot in managing traffic flow but the pattern of changing the traffic lights is a static repetitive task which does not take in consideration the real-time traffic intensity on different ways of the crossing some smart traffic light systems although designed work on the basis of getting four- way traffic intensity using inductive proximity sensors ,photo proximity sensors or light sensors thus adding to the cost of the system .some systems also use image processing technology .but these systems usually fail to work consistently throughout the day because of light intensity changes. Moreover during traffic jam, the emergency vehicles such as ambulance, fire brigade will be stuck at the traffic light junction which can prove out to be very critical problem. The paper is a work on the proposed system that will also help to curb the traffic jams on roads as well as on junctures. With the use of proximity sensors on the roads, the traffic density at each road can be measured and their collective result is then sent to the vehicles so that these can prioritize to choose the road with least traffic density and thus can reach the desired destination within time .

The heart of any system is the processing unit which controls the working of various sensors and hardware components. In our project using the Arduino Duemilanove as the processing unit. The Arduino Duemilanove ("2009") is a microcontroller board based on the ATmega168 or ATmega328. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software.

The microcontroller on the board is programmed using the Arduino programming language under an open-source license; we are free to adapt them to our needs. In this project we are using two Arduino Duemilanove boards, one on the base station and another on the vehicular system.

These two Arduino Duemilanove microcontroller board based on the ATmega168 or ATmega328 are then programmed as per our need to perform the desired operations.

The ARDUINO DUEMILANOVE Microcontroller DevelopmentBoard was selected as it satisfies our requirements in addition to already being provided with the class lab kit.As was fundamental to the course, the assembly language was utilized for the project. The ARDUINO Programmer is based on the Processing IDE and uses a variation of the C and C++ programming languages .It was more than adequate to satisfy design objectives while enhancing level of understanding of the programming language.

2. OVERVIEW

The road intersection is a very critical junction. Traffic may accumulate quickly in case the control system is not efficient to manage the traffic in a smart manner.

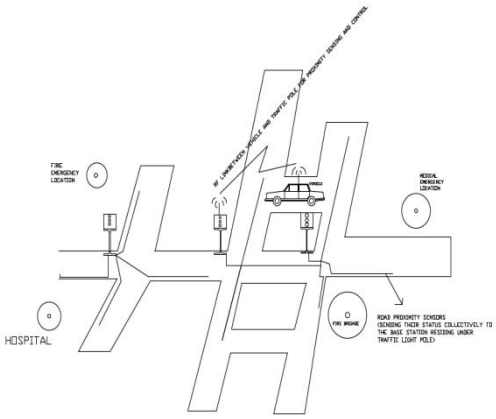


Figure 1 Illustration Diagram of the Whole system

There are number of roads which lead to certain destination and on each road we have placed the proximity sensors which sense the traffic density at a particular road. Their collective result is thus sent to the base station which resides under the traffic light post. The base station consists of PROCESSOR and a communication module. The processor checks the collective result from every road segment and on basis of it activates the required signal. The communication module transmits the density data to the vehicles in its proximity and also to the neighboring base stations using RF-LINK.

The vehicular system consists of a processor and a road map display. The received data is processed and the traffic congestion from all roads leading to the destination is displayed. This is achieved by using LEDs of three different colors, each corresponding to a particular traffic density.

The conventional traffic light controller follows the same round robin sequence of the lights. But, if an emergency vehicle is detected at any traffic light post, the controller leaves the round robin schedule and generates the green signal for it.

3.BASIC SUBSYSTEMS OF THE PROJECT

In this project we have come up with the solution of STMS “Smart Traffic Management System” which is an amalgam of small systems working independently and internetworked so as to curb traffic mess.

The system is designed around four subsystems namely

- The SNS (Sensor Network Subsystem)
- The STLS (Smart Traffic Light Subsystem)
- The RTTDIS (Real Time Traffic Density Information Dissemination System)
- The PETCS(Prioritized Emergency Traffic Control Subsystem)

3.1. Sensor Network Subsystem

It comprises of the proximity sensors which are placed on particular roads. These sensors sense the presence of vehicle and for this purpose we have used LDRs (light dependent resistors) .Since we have to simply detect the presence or absence of the vehicles during a particular time and on a particular road, here in our project we use a group of LDRs on a road and their collective result is added using a summer. Hence, all the results of traffic densities of different roads is sent to a base station.

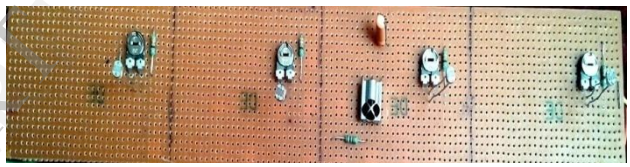


Figure 3.1 Sensor Network System

3.2.Smart Traffic Light Subsystem

Traffic Control system lies under the traffic light post and the traffic density of each road connecting the junction is sent to the Base station.

The Base station comprises of the Arduino Duemilanove board housing the ATMEGA 328 microcontroller IC which acts as a programming, logical control and processing unit of the system . It processes the analog signal which is the result of each Summer (collective result of the sensors on a particular road) .

The Base station also comprises of the RF-transmitter, which sends the status of the roads to the Vehicle.

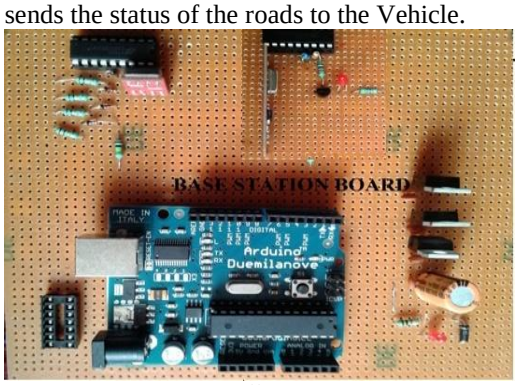


Figure3.2 Smart Traffic Light Subsystem

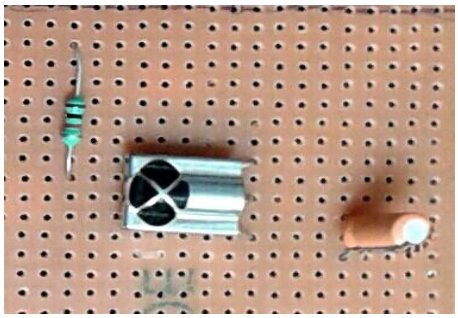
3.3. Real Time Traffic Density Information Dissemination System

This is placed inside the vehicle and comprises of the RF-receiver , Arduino Duemilanove board housing the ATMEGA 328 microcontroller IC which acts as a programming ,logical control and processing unit of the system and the Display Unit. The RF-Receiver receives the data sent from the RF-Transmitter and the processing module (Arduino Duemilanove), then accordingly processes it.

On the display unit it shows the road with less traffic density, letting the vehicle driver choose the road with least traffic density.

3.4. Prioritized Emergency Traffic Control Subsystem

The emergency vehicle system comprises of TSOP-transmitter which has an IR LED emitting radiation of 38 kHz while the road sensors consist of the TSOP1738 IR-receiver. The sensors, when receive the radiation of 38kHZ give low logic as output and accordingly the traffic clearance for emergency vehicle can be prioritized by making the traffic light signal Green on its side and Red to all other sides for a particular time period.



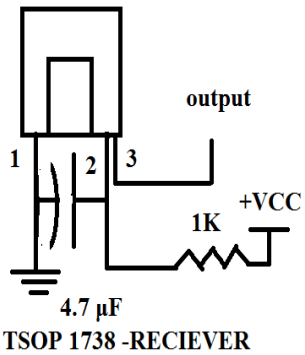


Figure 3.4.2. Vehicle Prioritization

4. LIST OF EXISTING TECHNOLOGIES

1. *Intelligent system for monitoring and control of city transport motion (SMARTNET) :*

The Smart Net system consists of Central Software which is able to collect localized data sent from the software installed in vehicles. The information used comes from traffic management systems, connected vehicles and the surrounding infrastructure. This system being software based is slow in operation.

2: The concept of intelligent transportation:

It encompasses a huge range of systems and applications. Smart electric vehicle (EV) charging, citywide traffic monitoring, real-time traveler information, transit signal priority, and centralized fleet vehicle management can all be classified as forms of intelligent transportation systems (ITS) or smart transport.

The drawback of this system is that it is difficult to implement and is not economical

5.IMPLEMENTATION BY USING VARIOUS MODULES

The Hardware part of our project consists of various modules, which are as under:

5.1.Power Module

A power electronic module provides the physical containment for several power components. This package provides an easy way to supply the working potential energy required to drive the components in the various circuits in the system.

5.2.Proximity Sensing Module

The proximity sensing module consists of our photo detectors which senses the presence or absence of vehicle and provides the measure of the traffic density.

Emergency vehicle prioritization module: The emergency-vehicle prioritization module consists of the TSOP 1738 IR-Receiver and the TSOP Matched circuit or the Transmitter. The Receiver is housed on the sensor network subsystem and the Transmitter on the emergency vehicle system. The traffic clearance is prioritized for emergency vehicle using this module.

5.3.Communication Module

The communication module consists of the RF based transmitter and receiver. We use matched transmitters and receiver. The transmitter is on the Base station and the Receiver is on the emergency-vehicle system/board.

5.4.LED Module

We use red, green and yellow LED for Smart Traffic Light Subsystem in order to control the traffic flow at each junction.

5.5.Display Module

In the display module we simply design the map of the road and place red, green and orange LED on it. The road at which there is least traffic density, the green LED glows; the road at which there is highest traffic density, the red LED glows; the road at which there is moderate traffic density, the orange LED glows.

5.6.Processing Module

In processing module, we use Arduino Duemilanove. The Arduino Duemilanove ("2009") is a microcontroller board based on the ATmega168 or ATmega328. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software.

In this project we are using two Arduino Duemilanove boards ,one on the base station and another on the vehicular system. These two Arduino Duemilanove microcontroller boards based on ATmega328 and are then programmed as per our need to perform the desired operations.

6. RESULTS

Each intersection on the road has four traffic posts (S1, S2, S3, S4).Each post has LED's of three different colors which are controlled on the basis of density of traffic on the different segments. A green colored LED is used to signify higher density traffic.
A yellow one for a medium density; and
A red LED for lowest density.
The priorities assigned to different segments in the following order:S1>S2>S3>S4
This priority sequence is however not always followed.The segment with the emergency vehicle is assigned the highest priority.

Table 6.1

Seg (S1)	Seg (S2)	Seg (S3)	Seg (S4)
0	0	0	4
0	0	4	0
0	4	0	0
4	0	0	0
5	0	0	3
5	0	3	0
5	0	5	0
2*	5	3	5

Table 6.2

S1-R	S1-Y	S1-G
1	0	0
1	0	0
1	0	0
0	0	1
0	0	1
0	0	1
0	0	1
0	0	1

Table 6.3

S2-R	S2-Y	S2-G
1	0	0
1	0	0
0	0	1
1	0	0
1	0	0
1	0	0
1	0	0
1	0	0

Table 6.4

S4-R	S4-Y	S4-G
0	0	1
1	0	0
1	0	0
1	0	0
0	1	0
1	0	0
1	0	0
1	0	0

Table 6.5

S3-R	S3-Y	S3-G
0	1	0
0	0	0
1	1	0
0	1	0
0	1	0
0	0	1
0	0	1
0	1	0
0	1	0

7.CONCLUSIONS

Although the aforementioned systems are technologically sound, but are incompetent as far as speed of operation and cost are concerned.
Keeping these in competencies in view we developed this system which is having the following **advantages:**

1. Our *Smart traffic management system* monitors' vehicle numbers and makes changes in real time to avoid congestion wherever possible in a cost-effective manner.
2.The main stumbling block to the widespread introduction of such systems is the fact that most vehicles on the road are unable to communicate with the computer systems that town and city authorities use to control traffic lights. However, the simple systems based on signals received from drivers' cell phones have a drawback .It has been found that only a few drivers have their phones switched on. In contrast to it our system does not require any cell phones, rather requires economically competitive transmitter –receiver communication.
3. We are sure you've already had the following experience: you drive on a road with no traffic; you arrive at an intersection at low speed; as you approach the light turns red despite no oncoming traffic. After one minute, a car is coming on the other road: when this car gets very close,

your light turns green, her light turns red. A side effect is an increase of texting or reading email while driving, as people try to optimize their time. But our system works above it all .It checks the traffic density and issues a signal accordingly.

4. Our smart traffic management system is completely dedicated to go green. Among the biggest threats to our environment are carbon emissions from automobile exhaust. The EPA (Environmental Protection Agency) estimates that the average passenger car produces over six tons of pollutants each year. By reducing traffic congestion, area drivers will spend less time on the road, burning less fuel and releasing fewer emissions into the environment.

Although the proposed systems the enlisted advantages but still it needs to be updated on the following fronts:
1.The approach used is fully invasive which will lead to re-addressable of the road organization.
2. When there is same traffic density on two or more roads there is no way without prioritization and our system doesn't take into consideration into consideration the traffic density of adjacent nodes. The proposed system takes the traffic density in adjacent nodes into consideration only for vehicular information dissemination.
3. Although the measures have been taken for both day and night working of the system ,but still the system looses efficiency in night hours.

8. REFERENCES

1. Sukanya Ray ,Nidhi Chandra ,Amnesh Goel (Amity School Of Engineering & Technology, Amity University, Noida (U.P.), India).
2. Wenjie Chen, Lifeng Chen, Zhanglong Chen, and Shiliang Tu.Wits. "A wireless sensor network for intelligent transportation system."
3. International Journal of Computer Applications (0975 – 8887) Volume 40– No.12, February 2012 36
Intelligent Traffic Light System to Prioritized Emergency Purpose Vehicles based on Wireless Sensor Network
4. Amnesh Goel, Sukanya Ray, Nidhi Chandra "Minimization of Waiting Time in Traffic Signals on Indian roads based on Wireless Sensor Network"
5. Sharma, A., Chaki, R., Bhattacharya, U. "Applications of Wireless Sensor Network in Intelligent Traffic System: A Review"
Sensor node information available via www at en.wikipedia.org/wiki/Traffic_light_control_and_coordination
6. Abishek C, Mukul Kumar and Kumar Padmanabh, "City Traffic Congestion Control in Indian Scenario using Wireless Sensors Network"
7. Malik Tubaishat, Qi Qi, Yi Shang, Hongchi Shi "Wireless Sensor-Based Traffic Light Control"
8. 555 Timer as astable mutivibrator http://www.circuitstoday.com/555-timer-as-an-astable-multivibrator
Easy Way to build a microcontroller project.
9. Arduino Blog- ArduinoDuemilanove.
10. Arduino.cc
11. Anderson, Rick; Cervo, Dan (May 16, 2012). Pro Arduino (1st ed.). Apress.pp. 350.ISBN 978-1-4302-3939-0
12. www.atmel.databook.com