International Journal of Advance Research in Science and Engineering
Volume No.07, Special Issue No.07, April 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

AUTOMATIC TRAFFIC DENSITY CONTROL WITH EMERGENCY SERVICES AND LANE DEVICE

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ABSTRACT

It is very important to collect the information of road conditions. Because the existing road condition collecting systems are incomplete in inspecting the traffic density, efficiency and to provide emergency services. In this proposed project, a method is implemented for detecting the reason of road traffic congestion with the help of a monitoring system providing emergency services, if accident or any emergency situation occurs. The first part involves smart signal pole which detects the volume of traffic based on which signal timing is increased or decreased accordingly. The second part involves emergency services. An alert message will be triggered to the nearest traffic police if the traffic density is high even after the signal is green. For emergency situations like accident, fire, vehicle breakdown, etc panic buttons are provided at the pole that triggers alert messages. Considering signal violation as one of the major reason for accident, a smart lane device concept is implemented that deducts fine when traffic signal is violated by any vehicle.

Keywords *- emergency services, monitoring, panic button, sensors.*

1. INTRODUCTION

1.1 Introduction to traffic congestion:

Traffic congestion is a condition on road transport networks that occurs as usage increases and is characterized by slower speeds and increased vehicular queuing. The most common example is the physical use of roads by vehicles today as shown in the Figure 1 below. When traffic density is high, it slows down the speed of the traffic flow and this results in traffic congestion.

Figure 1: Traffic Congestion.

1.2 Controlling traffic based on density:

The traffic is controlled by sensing the density of vehicles present in all lanes. Sensors are being placed at certain distance from the signal poles. In this system, sensors will sense the density of vehicular traffic on all the lanes for every cycle. [1]Assuming the traffic density to be less in lane-1(pole B1) and the vehicular density in lane-2 (pole B2) is more and then the signal flow time (green signal) is incremented for lane-2. Once the traffic is cleared, flow time is set back to default.

1.3 Additional features to present system:

In the existing traffic system, the signal is manually controlled by a policeman during emergency situations [2]. In order to overcome the existing manual control system we have designed an automatic control system which provides an alert message to the nearby traffic police if the traffic is not cleared even after 2 consecutive green signals. It also has emergency service system that has panic buttons for services like ambulance, police, fire service and traffic police. Another important technique is smart lane device, it deducts fine if any vehicle violates or jumps the traffic signal.

1.4 Alert message through LCD:

When the density is more and there is a requirement to approach an alternate route, an alert message is displayed in the preceding junction through LCD display [4].

2. METHODOLOGY

In the existing traffic system, the signal is manually controlled by a policeman during emergency situations. In order to overcome the existing manual control system we have designed an automatic control system which alerts a message to the nearby traffic police if the traffic is not cleared even after 2 consecutive green signals. It also has emergency service system that has panic buttons for services like ambulance, police, fire service and traffic police. In addition to this, another important technique is smart lane device that deducts fine if any vehicle violates or jumps the traffic signal. By placing sensors at certain distance from the traffic signal poles, the approximate traffic densities on all lanes are estimated and the flow time is incremented accordingly. When there is necessity for manual approach, the signal can be controlled manually. We have five phases in this prototype:

2.1 Traffic density control system:

Ultra sonic sensors are placed in each lane at certain distance from the traffic signal poles, so that the traffic density in the particular lane is estimated and data is given to microcontroller to increment the timer (green signal) if there is heavy traffic.

2.2 Alternate routing for vehicles based on density:

Consider a situation when the density is more in a junction and there is a requirement to approach an alternate route, an alert message to avoid that route is displayed in the preceding junction through LCD display.

2.3 Emergency services:

It has emergency service system at the signal pole that provides panic buttons for emergency services like ambulance, police, fire service and traffic police [3]. This will help in providing emergency services as fast as possible.

2.4 Manual controlling unit and server:

For some cases, we make use of manual control present at signalling unit. To simulate the prototype we make use of few hardware components such as ultrasonic sensors, switches and these components are connected to development board consisting of microcontroller.

2.5 Fine deduction using smart lane device:

This project also involves smart lane device technique that deducts fine if any vehicle violates and jumps the traffic signal. This is implemented to reduce accidents caused by signal violation.

The proposed system works on 5V DC. An ultrasonic sensor is an electric device which is used to detect any obstacle and measure the distance and convert them to an electric signal and given to microcontroller. The development board used here is Genuino Mega 2560 which consist of microcontroller includes 54 digital I/O pins and 16 analog I/O pins with a 5V DC supply pin, the development board can be powered by either DC jack input or USB port. We also use STM32F that consists 14 digital I/O pins and 8 analog input pins. It is 32-bit CPU. STM can be powered via Micro-USB connection, 6-20V unregulated external power supply or 5V regulated power supply. Genuino Mega 2560 is connected to several ultrasonic sensors that are placed in all the lanes to measure the traffic density. LCDs are also connected to the microcontroller. Panic buttons for emergency services are also connected to it. STM32F is connected with ultrasonic sensors detect the vehicle and ESP8266, wireless module is also connected to STM to find out the land in which a vehicle is entering and to check whether the vehicle violates signal or not, if the vehicle jumps the signal then fine will be deducted automatically. LCD displays are used to display alert messages in the preceding junction to avoid the next junction if there is heavy traffic jam or any emergency situation. The panic buttons provided will help to contact police or fire service or ambulance or traffic police if any emergency situation is happened. Hence the project is said to seek the answer for at least some amount of reduction in traffic jam and lending instant services to emergency situations.

3. BLOCK DIAGRAM

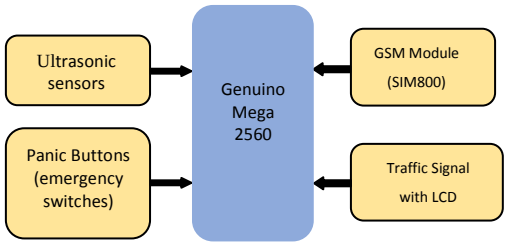

Figure 2: Block Diagram for Traffic Density Control and Emergency Services.

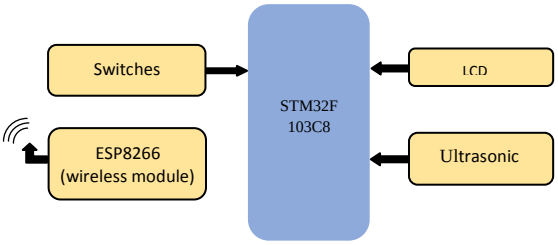

Figure 3: Block Diagram for Smart Lane Device.

The system consists of Sensors, microcontroller, Wi-Fi module, LCD display and Switches as shown in Figure 2 and Figure 3. STM32F is not featured with Wi-Fi module, an ESP8266 Wi-Fi module is externally connected using serial Tx and Rx pins of microcontroller. GSM module is also externally connected to the Genuino Mega 2560 as GSM module is not featured internally. For traffic density control, Genuino Mega will collect the data from ultrasonic sensors and analyse it. But for signal jump, STM32F will analyse the data collected from the ultrasonic sensors as well as ESP wireless module.

4. PROPOSED SYSTEM

Under the considerations of concepts in the literature survey, our proposed system is titled as "Automatic Traffic Density Control with Emergency Services and Lane Device" with the aim of reducing the traffic density during accident or any technical issues of vehicle. The proposed system also provides emergency services like accident, fire service and ambulance. Figure 4 shows the block diagram of the proposed system. It has two junction traffic control system and an alternative route, which will be provided in the preceding junction if there is a heavy traffic on the junction ahead (when the traffic is high even after two green signals). Ultrasonic sensors are placed at the road sides with the distance of some meters from the traffic signal pole to sense the density of vehicles. The information about the traffic density will be updating to the microcontrollers.

Figure 4: The block diagram of the proposed system.

Depending on the traffic density like medium or high, the duration of green signal will be increased or decrease with respect to the traffic density of the other road. Information about the traffic density will be updating to the Genuino Mega 2560. If any accident occurs, the updates will be displayed on 16*4 LCD which will be placed at the traffic pole. Emergency services will play very important role in the proposed system and 1*4 switches will be placed at the traffic pole which consists of services like ambulance, traffic police, police station and fire service for emergency situations like accidents, vehicle breakdown, heavy traffic and fire. In case of emergency situations, any person can operate the switches. Major traffic accidents happen due to signal violation. If a vehicle does signal jump there is a chances of clash of vehicles from other side which causes accidents. This is avoided using Smart Lane Device technique. When the vehicles move from first Lane through ultrasonic sensors, the information will be passed to microcontroller (STM32F). If the vehicle moves even when signal is

red, the information goes to LM8266 and trigger an immediate message to the particular vehicle and fine will be deducted. To use this technique every vehicle should have the proposed vehicle module.

5. RESULTS

A working prototype has been successfully developed. The interfacing of the various components like ultrasonic sensors, LCD, LM8266 is successful. The moving vehicles through the particular lane are detected by using ultrasonic sensors. Immediate information is sent to the microcontroller regarding density of the traffic and timing is changed accordingly. Message is triggered to the nearest traffic police when the traffic density is high even after two consecutive green signals. The operating mode is able to change from automatic mode to manual mode if needed. When the road of first junction consists of heavy traffic, the information is displayed on LCD of the preceding junction displaying to avoid the junction ahead. Alternate directions are given to the vehicles to avoid high traffic congestion. If any person triggers the switch regarding emergency services like accident or fire, immediate message is sent to the nearest traffic police or ambulance or fire service respectively. The vehicles are sensed passing through ultrasonic sensors. If any vehicle violates the signal, immediately fine is deducted.

6. CONCLUSION

In this system, traffic density is analysed on large traffic lanes and the density of vehicles is sensed in that particular lane and the flow time is increased accordingly. When any switch for emergency service is triggered, the nearest respective department will locate to that place. Any person can operate the panic buttons for any kind of emergency situations so that chances of maximum damage can be reduced as instant alert messages are triggered to particular departments. Also alternative route is provided to the particular junction if the junction ahead is to be avoided. The information will be displayed on LCD. Since fine is deducted for signal jump through a particular lane, signal violation by vehicles will be reduced at large extend so that chances of accidents will be less.

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