IJCAT International Journal of Computing and Technology, Volume 1, Issue 6, July 2014
ISSN : 2348 - 6090
www.IJCAT.org

Automatic Traffic Congestion Detection and Alert System

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Abstract - The increase in the number of vehicles has led to traffic congestion. To overcome these problems, a system has to be designed which can alert for congestion. "Automatic Traffic congestion detection and alert system" does the needful and thus helps in reducing the traffic congestion. The suggested system detects the congestion levels in road traffic by processing camera image which are placed on roads to monitor the traffic condition. A LCD screen is placed at neighboring junctions for displaying message. When congestion is reported a LANE BUSY message is displayed on LCD along with an alert message is received on the mobile phone of control room including the location of traffic jam. Thus the rider has alerted for the congestion condition beforehand. This facilitates the rider in taking an alternate congestion free route, avoiding being stuck in the traffic jam. After the particular lane clears, the LANE CLEAR message is displayed on LCD. This helps in diverting the traffic and hence reducing congestion.

Keywords **- GPS, GSM, Arduino, Digital Image Processing**

1. Introduction

The main aspiration of the designed system is to compute total traffic density at targeted area which is then further used to reduce the traffic congestion caused by vehicles. During the busy hours of a day, the traffic is at its peak and there are various problems related to traffic congestion. One such problem is fuel consumption. An average of 90 minutes is spent daily by a vehicle in congested traffic. People forget to switch off the engines which cause wastage of the non renewable resources such as petrol, diesel and LPG. This incurs a heavy revenue loss to the country. For the emergency conditions such as ambulance, fire engines to pass through, the congestion poses hindrance. To recover for the lost time spent in congestion people tend to hurry and disperse the congestion, causing accidents. Indian roads are the witness of accident in every minute and death in road mishap. This paper engross of nine sections in addition to the introduction, which convey the goal of this designed system. Section 2 presents the related work done in real time traffic congestion detection. Section 3 gives a brief introduction regarding the project. Section 4 depicts the hardware and software used in the system. Section 5 and 6 presents circuit diagram and the flow of designed system and, whereas the Section 7 and 8 outlines an experimental results, draws the conclusion and future scope.

2. Related Work

Major headings are to be column centered in a bold font without underline. They need be numbered. "2. Headings and Footnotes" at the top of this paragraph is a major heading. In the area of traffic surveillance system Sabya Sanchi [2] has implemented traffic light and congestion control system for day light sequences using image processing and sends information of congestion to the road side unit using Zigbee protocol. Pejman Nitksaz [6] has implemented an Automatic Traffic Estimation Using Image processing to accommodate information regarding the size of traffic in highway and detects the occurrence of accidents and violations on highways. The implemented system has extreme sensitivity to light as sunlight potentially causes interference with camera.

Image Processing Based Intelligent Traffic Controller System via Vikramaditya Dangi et al. [3] has designed to favour advancement in traffic control technologies along with the emergency vehicles detection system using the

most effective canny edge detection algorithm and Radio frequency identification (RFID). Dr. Y.P. Singh [7] has suggested an approach called Structured System Analysis to analyze the existing traffic congestion problem by using image mosaicking technique that decides the timing of traffic signal according to the inter-arrival and inter-departure time measured to avoid the road traffic congestion. José Geraldo Ribeiro et al. [5] proposed a Collaborative and Opportunistic Traffic Monitoring System called COTraMS to monitor traffic using IEEE 802.11 networks. The performance of the system gets evaluated by using a prototype of IEEE 802.11 b/g network for detecting both the position of the vehicle and estimation of road condition. The proposed system uses mobile nodes to send the information regarding location of vehicles and to communicate with road side units.

Jie Zhou et al. [9] proposed an example based algorithm for moving vehicle detection introducing scheme for adaptive background estimation by making use of camera to offer an alternative to sensors which allows the device to precise vehicle tracking and classification. The proposed algorithm can eliminate the difficulties come from casting shadows, vehicle headlights, noise and bad illumination and feasible at night. G. Lloyd Singh et al. [8] suggested an embedded system based system that is implemented on image processing algorithm to control the traffic lights efficiently using prewitt operator to avoid wasting of time by green light on an empty road.

Real Time Traffic Light Control Proposed by Ms. Pallavi Chovdekar et al [4] uses image processing to detect vehicles instead of electronic sensors. The images captured by camera are analysed for vehicle detection to control traffic light. It has been noticed that the present devices does not alert the traffic congestion status. As there will be no alert, more vehicles are coming into the same lane which will increase the complexity of congestion. Although form the previous work it has been observed that zigbee protocol and IEEE 802.11 network is used which requires with high maintenance cost and does not accessible in the remote areas and a separate network setup is needed.

3. Project Overview

"Automatic Traffic Congestion detection and Alert System" project automatically alerts the traffic congestion condition. It can be implemented in the lanes and junctions which carry heavy traffic. Cameras are placed on roads to monitor the traffic condition. In each junction a transmitter and receiver will be present along with a LCD screen for display of message. When congestion is reported an interrupt is sent to the controller and the corresponding alert, LANE BUSY message is sent to the neighboring junctions. The GSM modem (SIM 300) is used for transmitting and receiving messages on GSM network. The alert message is received on the surrounding junctions using GSM modem (SIM 300). This message will be displayed on the respective LCD screen. Thus the rider is alerted for the congestion condition beforehand. This facilitates the rider in taking an alternate congestion free route, avoiding being stuck in the traffic jam (congestion). After the particular lane clears, the LANE CLEAR message is also displayed. This helps in diverting the traffic and hence reducing congestion.

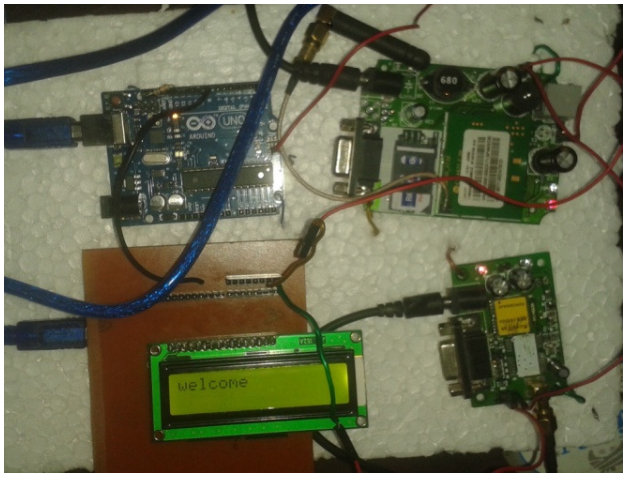


Fig. 1 Circuit of designed System

4. Project Description

Traffic Congestion detection and Alert System use different hardware components and software to govern the system are as follows:

- Arduino Uno (ATMega 328) Board
- GPS Receiver
- GSM (SIM300) Module
- External Web Cam

4.1 Arduino Uno (ATMega 328) Board

Arduino was founded by Massimo Banzi and Davidc Cuartielles in 2005. It is based on "Wiring Platform", which dates to 2003. The Arduino uses open-source hardware platform whose project was started in Italy to develop low cost hardware for interaction design. The Arduino consist of libraries and easy-to learn programming language which is a simplified version of C/C++, available for Windows / Mac / Linux Operating System environment. The Arduino Uno provides

potentiality to communicate with a computer, another Arduino, or with the other microcontrollers [10].

4.2 GPS Receiver

The Global Positioning System (GPS) is a satellite based navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology, one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). The basis of the Global Positioning System(GPS) technology is a set of 24 satellites that are continuously orbiting the earth. These satellites are equipped with atomic clocks and send out radio signals as to the exact time and their location. These radio signals from the satellites are picked up by the GPS receiver. Once the GPS receiver locks on to four or more of these satellites, it can triangulate its location from the known positions of the satellites. It is a high performance, low power satellite based model. It is a cost effective and portable system which accurately detects the location.

4.3 GSM (SIM300) Module

The GSM (Global System for Mobile communications) is an open, digital cellular technology used for transmitting mobile voice and data services. Global System for Mobile communication uses a variation of Time Division Multiple Access (TDMA). It operates at either the 900 MHz or 1,800 MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6 kbit/s, together with the transmission of SMS. Using module SIM300, it is a Tri-band GSM/GPRS that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. The SIM300 provides RF antenna interface with two alternatives: antenna connector and antenna pad. The SIM300 is designed with power saving technique, the current consumption to as low as 2.5mA in SLEEP mode. The SIM300 is integrated with the TCP/IP protocol, Extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, for data transfer applications. Both GPS and GSM are interfaced to the control unit using serial communication protocol [1].

4.4 Digital Image Processing

The digital image processing deals with developing a digital system that performs operations on a digital image. An image may be defined as a two-dimensional function, fxy, where x and y are spatial coordinates, and the amplitude of f at any pair of coordinates (x,y) is called the intensity or gray level of the image at that point. When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image. In this paper we are concern on vehicle detection and find out number of vehicle on camera viewing angle. The area calculation and colour detection both are performed to find out vehicle.

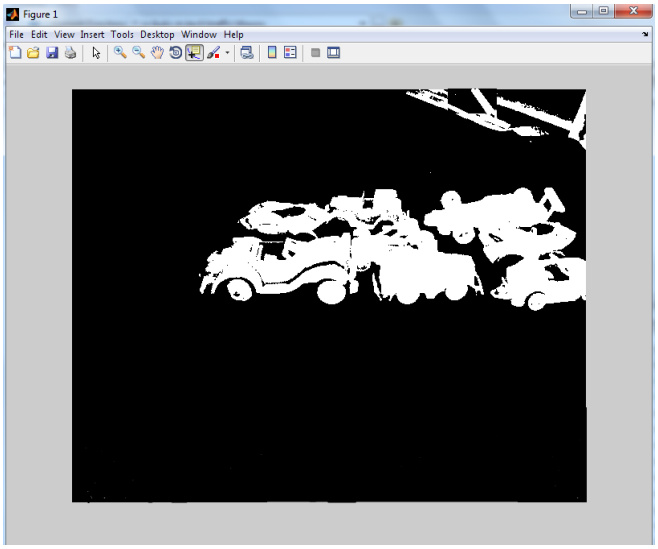


Fig. 2 Example of Sharp Boundaries of Vehicles generated using Digital Image Processing

5. Circuit Design

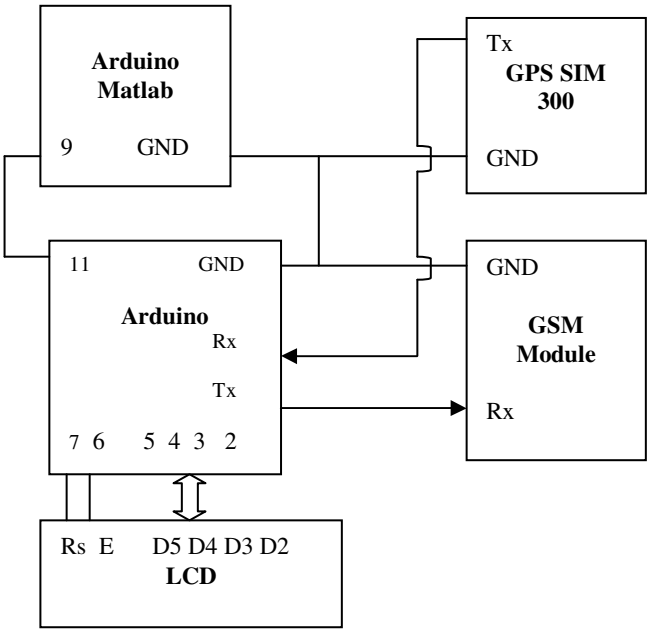
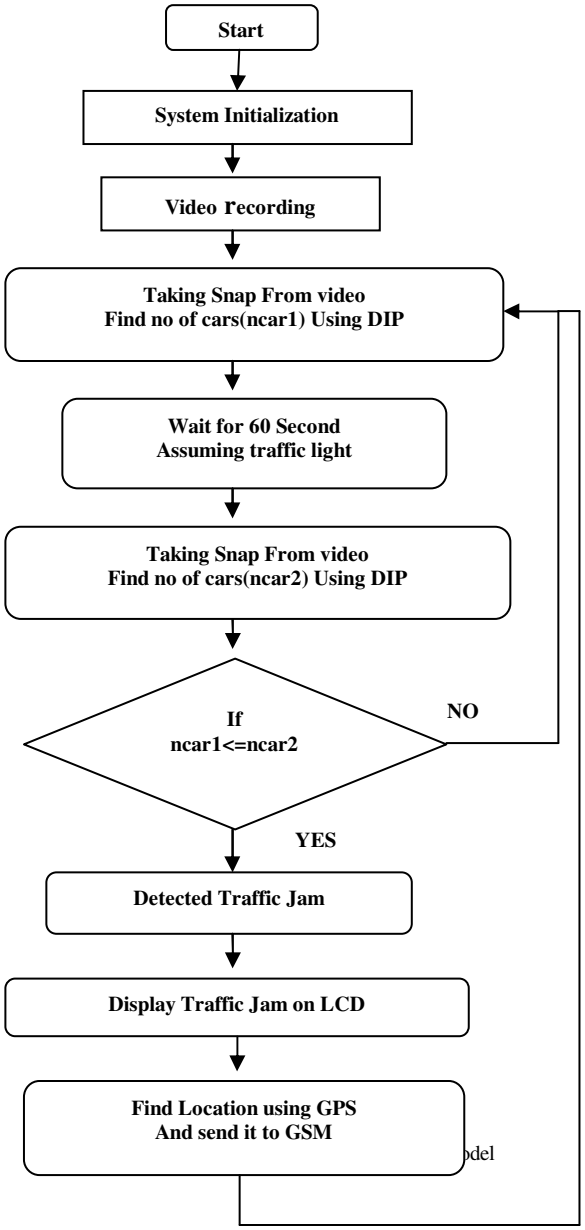


Fig. 3 Block diagram of designed system.

6. Flow Chart



7. Conclusions and Result

With the advent of science and technology in every walk of life the importance of vehicle safety has increased and the main priority is being given to reduce the alarming time when an Traffic jam and accident occur, so that the time can be save. This paper provides the design which has the advantages of low cost, portability, small size and easy expansibility. The platform of the system is ARDUINO along with MATLAB, GPS and GSM, interfacing, which shortens the detection time to a large extent and locate the site of traffic Jam accurately. This system can overcome the problems of lack of automated system for Jam location detection. Consequently, the time for resolving Jam is reduced. This system will have broad application prospects as it integrates the positioning systems. The Jam can be detected by image processing in MATLAB which will give the accurate information. The controller will process the data, as soon as input is received by the controller the interrupt is ON and message is sent through the GSM module. The geographical coordinates and the time of the site of the Jam are detected by the GPS module. The Jam location automatic detection will help us to provide security to the vehicles and to save time. This paper gives a different way of approaching the problem. The traffic location can be located easily and the detection of traffic is precise unlike the prior approaches, where detection of traffic is done by image processing in MATLAB. Here the other approaches provide only one way of detecting the Traffic. Hence this paper has an edge over the other earlier approaches.

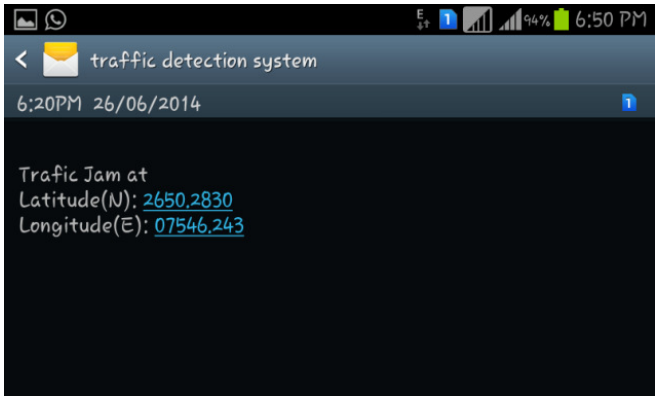


Fig. 5 Example of Text message of Traffic Jam Location.

8. Future Work

The proposed system can be prolonged further by make use of same system for vehicle number plate detection which will help the cops and traffic management system for identifying vehicles. In future this system can be used to inform people sitting on a single place about traffic conditions of different places by developing a mobile phones application. LCD can be increased in N numbers to display traffic conditions and control the traffic of whole city.

Acknowledgments

The authors would like to thank the anonymous reviewers for their valuable comments.

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