Road Pursuit Breaker and Defaulter Trapper Using Microcontroller

S. Ratan Vishwanath, A. R. Ravi Prakas, and Prateik George

***Abstract*—There are a very few methods deployed in developing countries to penalise traffic violators. The major problem faced is that by following these methods only a few defaulters get under the scanner. Most of them bribe their way out of the situation. Looking into the systems utilised in the developed countries, the authorities are able to book violators. But, a few of them manage to slip out and engage themselves in hot pursuits. This is where the state looses a huge value allocated for its development. A lot of time, effort and money is being put into these pursuits by the government and police in order to ensure the safety and security of the country and their respective people. We have designed a system to monitor and control traffic violations such as over speeding, jumping the signal and jumping the stop line. It is not possible to maintain proper records about these violations. We have also devised a method to bring any automobile to a halt at any given point of time. This is a simple and a hassle free method. It will also reduce the loss of personnel and damage to property. The violations are observed using IR transmitters and receivers. These will be compiled by a microcontroller installed in the automobile. When any of the given violations are done by the vehicle, the data will be transmitted to the nearest receiver station. By using the recorded data at the receiver, the defaulter can be easily identified and punished in accordance to the law. In this method the manual involvement is low, the accuracy and reliability is high.**

***Index Terms*—HALT, IR transmitter, IR receiver, Kill switch, Microcontroller, Wireless transmitter, Wireless receiver.**

I. Introduction

The whole concept of this paper can be broken down into three categories. They are IR transmitter and receiver, microcontroller and RF transmitter and receiver respectively.

The IR system helps us to find the defaulters. The microcontroller helps us gather the information about the owner of the automobile. The wireless system helps us to compile the data and hence fine the user.

II. Literature Survey

There are several systems that police can deploy ahead of a chase to disable the fleeing vehicle. The most common are spikes that puncture and deflate the tires. These are generally mounted on a bar or flexible cable, and deployed across the road. Models available include the Magnum Spike, Stop Sticks and the Stinger. A method often seen in movies that police actually use is the police roadblock. By parking several cars across the road, or using some other form of barrier, police can slow or stop a criminal involved in a chase. Even if the suspect avoids the roadblock, it usually diverts their course or forces them off road, where they can't drive as fast and their car might be damaged. More elaborate (and often experimental) systems try to disable the car's electrical system. The High Speed Avoidance Using Laser Technology (HALT) system would allow officers to cut the fuel supply to the engine by simply firing a laser at the car, gradually slowing it. Only vehicles equipped with a special microchip could be disabled, however. Another company is developing a microwave gun that would overload the electrical systems and computers in a car. However, there is widespread and growing opposition to the practice of police chases. Reckless pursuits for minor infractions and tragedies in which officers, suspects or innocent bystanders are injured or killed have led many police departments and municipalities to restrict police pursuits. Only the most dangerous suspects are worth the risk, according to these new laws. In this article, we'll see how police officers train for pursuit driving, what equipment they use and what techniques give them an edge over fleeing criminals. We'll also examine the ethical and legal concerns surrounding police chases.

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III. Traffic Violation System

A. IR Transmitter

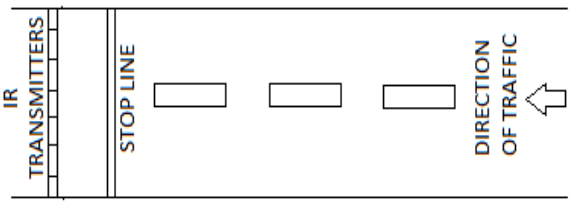

Fig. 1. Position and placement of IR transmitters on the road

The IR transmitter is embedded onto the road at a distance of one and a half metres away from the stop line. The transmitters are embedded at a distance of two feet from each other in a straight line parallel to the stop line. Here we are using IR LED as the IR transmitter, which emits IR rays in the wavelength of 970nm. The infrared LED emitter is a high power (150 mW) infrared LED. Its wide 60 degree beam width and high output power make it a great infrared transmitter. Here the IR transmitters are made to transmit IR rays only when the signal is showing red. When the signal is displaying the colours of yellow or green, the IR transmitter

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is in the OFF state.

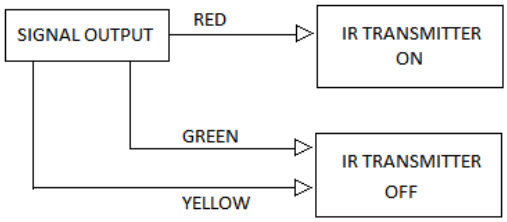

Fig. 2. Working block diagram of IR transmitters

B. IR Receivers

The IR receiver used in the car is the phototransistor which detects IR rays from the road and gives it to the microcontroller section kept in the car. We have two sections of receivers kept in the car. The set of receivers kept in the lower portion of the front bumper are called the FRONT SENSORS. Similar sensors kept in the back portion of the car, i.e. underneath the boot of the car, are called the REAR SENSORS. Phototransistors also consist of a photodiode with internal gain. A phototransistor in essence is nothing more than a bipolar transistor that is encased in a transparent case so that light can reach the base-collector junction. The electrons are generated by photons in the base-collector junction are injected into the base, and this photodiode current is amplified by the transistors current gain. Note that while phototransistors have a higher response for light that they are not able to detect low levels of light any better than photodiodes. Phototransistors also have slower response times.

C. Microcontroller

We use the ATMEL 89C51. We use this at three places namely the signal, the automobile and the regional police station. This is used at the signal to automatically change the lights between red, yellow and green. It is also used to turn ON the IR transmitter automatically when the signal displays red light and turn it OFF automatically otherwise. In the police station it is used to transmit data serially to the required automobile. This data will allow the automobile to be turned ON or OFF from the control room. The most important use of this microcontroller is in the automobile. Every vehicle is given a unique number. This will help in the identification of the vehicle and its owner.

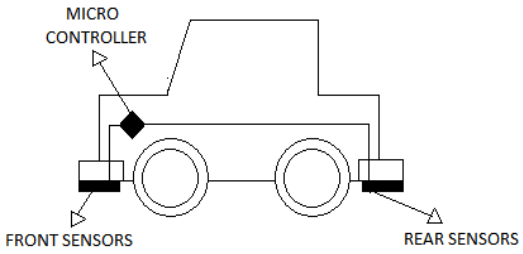

Fig. 3. Position of sensors on the automobile

This is mounted inside the automobile. It is linked with the Global Positioning System (GPS) of the vehicle. This system updates the vehicle of its position at regular intervals. This microcontroller also receives constant inputs from the speed-o-meter. The GPS and the speed-o-meter inputs are constantly refreshed every 5 seconds. These values and information are over written on top of their previous data in the microcontroller. The IR receivers are on the constant search for IR signals from the road. When they pick up the signals from the road, the position of the vehicle from the GPS, the speed of the car from the speed-o-meter are gathered. The receiver is also noted, i.e. front or back. All these information along with the unique number stored in the microcontroller are sent using the wireless transmitter in the car. The AT89C51 is a low power, high performance CMOS 8-bit microcomputer with 4K bytes of programmable and erasable read only memory (PEROM). The device is manufactured using ATMEL's high density non-volatile memory technology and is compatible with the industry standard MCS-51 instruction set and pin out. The on chip flash allows the programme memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. This provides a highly cost effective solution to many embedded control applications. Its main features are that it has a fully static operation at around 0-24 Hz and also has a programmable serial channel.

D. Wireless Transmitters and Receivers

The wireless transmitter is used in the automobile and the police station. The wireless transmitter in the car is used to transmit the compiled data in the microprocessor to the nearest police station. This will occur only in the event of traffic violation by the driver or when desired by the police. The request has to be made by an authorised person in the police department to gather data of any car suspected to be driven by a criminal. This request will reach the microcontroller. This will be acknowledged by the microcontroller in the car at any point of time. The wireless transmitter in the police station will also be used to give a command to the microcontroller to activate the engine kill switch of the automobile. Once the kill switch is activated, the driver cannot restart the car. The kill switch will deactivate the fuel injection system and hence stop the flow of fuel to the vehicle. It will also diffuse the spark plug connection which is the heart of the piston movement system. All the doors in the car will be locked automatically to avoid the escape of the criminal. He will need the permission of the police to activate the start button in the car.

The wireless receivers are mounted in the automobile as well as the police station. These are for detecting any requests by the wireless transmitters on the opposite end. Together with the wireless transmitters they complete the wireless system in the vehicle and the police station.

The operating frequency range of the wireless transmitter and receiver will be a fixed value between 300 MHz-800 MHz.

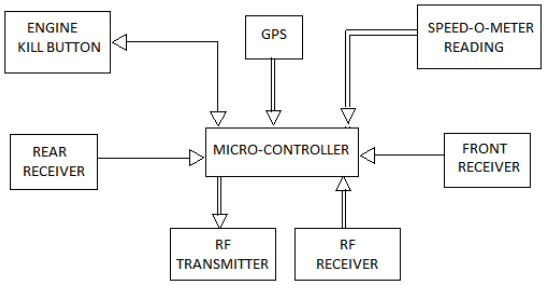

Fig. 4. Block diagram of road pursuit breaker and defaulter trapper

The transmitting distance range is in the range of 13

kilometers-15 kilometres. This is a non-line of sight distance.

This system has some better features then other types of transmitters and receivers. They include the radio frequency power of 20 W. The systems operate with a radio frequency bandwidth of about 8MHz. They have a channel spacing of 4MHz. These systems have a good transfer rate of 6Mb per second. The technique used for modulation is COFDM, 2K, QPSK. They support high-speed mobile transmission and non-line of sight transmission.

IV. Conclusions

This whole paper mainly focuses on two things. The First thing is the concept of detecting traffic violation. There is an increasing vehicular population and it will lead to a difficulty in maintaining the order of driving. There will be a lot of rule breaking and at a point it will become unviable to have policemen maintain the code of conduct in driving. So, this system will be highly beneficial. The second reason is that this system will be one of the greatest improvements in technology to track a vehicle and bring it to a halt at any required period of time. This will reduce the probability of police engaging themselves in a pursuit to zero. This will eventually lead to redirect the money spent to repair damages created by a pursuit to a better cause.

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Reference

[1] R. Bansal, "Cutting to the chase microwave car stopper," Connecticut Univ., Storrs, CT, USA , *Issue 1, Microwave Magazineieee*, vol 6, March 2005.

[2] K. Hong and S. Braidwood, "Stopping car engines using high power electromagnetic pulses," *presented at 2010 International Conference on Electromagnetics in Advanced Applications (ICEAA)*, Sept 20-24, 2010.

[3] M. Yoshida, "Optical vehicle detector for traffic control," in *Proc. 1993.*Vehicle *Navigation and Information Systems Conference*, Oct 12-15, 1993.

[4] L. Yong and X. Guo, "Traffic Control Optimization Applied on the Intelligent Microwave Detector," *presented at 2009 International Conference on Industrial and Information Systems*, April 24-25, 2009.

[5] M. A. G. Clark, P. Kidson, and A. Hodge, "Infrared detector development [road traffic sensors," *presented at 3th International Conference on Road Traffic Control*, May 3, 1990.

[6] E. Rowe, "The Los-Angeles Automated Traffic Surveillance and Control (ATSAC) System,Vehicular Technology," *IEEE Transactions* Feb 1991.

[7] B. Barbagli, L. Bencini, I. Magrini, G. Manes, and A. Manes, "A real-time traffic monitoring based on wireless sensor network technologies," *presented at 2011 7th International Wireless Communications and Mobile Computing Conference (IWCMC)*, pp. 4-8, 2011.

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