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High -Speed Detection of Vehicle for Avoidance of Accidents on Roads

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Abstract:
This paper deals with the topic of detection of high speed vehicles and sending tickets via e-mail. In past, many devices have been proposed but they require human effort. With increasing number of highways, the number of traffic policemen is quite less for observing the over-speeding vehicle and reckless driving. The proposed model will help to overcome this problem as physical presence of policeman is not required as the system will be automated. This paper discusses the various modules that will be required for speed detection system. The system requires a microprocessor, a camera for input, and network capabilities to send data. It will facilitate the traffic police to deal with traffic collision cases in real world.

Keywords: microprocessor, automated, network

I. INTRODUCTION

More than 90 per cent of road deaths in 2016 were attributed to rash and negligent driving with the latest National Crime Research Bureau (NCRB) statistics revealing 1.5 lakh deaths in 1.35 lakh road accidents due to delinquent driving. As per this report, 1.51 lakh people died in road accidents and a driver's fault was responsible for 80.3 per cent of these fatalities. Some road safety experts have raised questions on such details and argued that there might be lack of proper observation in many road accident and the failure to take any action to those found in reckless driving.The central idea surrounding this system is to identify the speed of a vehicle through the use of video processing done by a microprocessor. The system will then grab the license plate from the frame obtained by the video and using image processing extract the license number and send it to a web server. The web server will then look up details connected to the license plate and send a ticket to the registered citizen if found overspeeding.

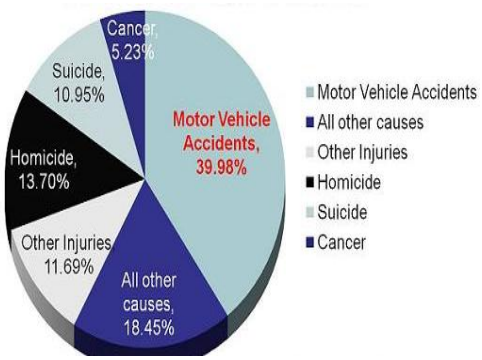

Fig 1: Cause of deaths in India.

A. Existing System

The systems that are currently employed require manual and physical input from the traffic policeman. Traffic officers patrol the highways or set up base near commonly speeding areas. They may employ devices which use Doppler Effect or other phenomena to detect the speed. These devices usually indicate a speeding vehicle by noising a buzzer or blinking lights. Another method which is employed, usually in closed tourist areas or hilly areas is by timing the vehicle." In this method it will compare in-time of the vehicle and out time of vehicle and by using it will calculate the speed of the vehicle by using the distance formula. This is currently being used in many hilly areas.

B. Limitations in Existing System

There are various drawbacks in the existing systems. As the current system requires the physical presence of policeman, large area is not covered. We need traffic authorities to cover the large area so that the overspeeding can be detected in various parts of roads. The current system is not very cost effective. The area covered to cost ratio is very low. There is also the chance of bribery if the officer is corrupt which results in no action taken against those who overspeed. Some times the speed of the vehicle cannot be computed accurately.Traffic authorities cannot work for continuous 24 hours a day. At night, visibility is much lower, which makes it harder to check the name plate of vehicle that is speeding. The current devices are not efficient as they alert the authorities after the speeding occurs. Because of this, the authorities are too late to indicate to the rash driver.

II. METHODOLOGY

A. System Requirements

Following are some of the requirements that should be implemented in the system:

- Input video should be in format that is easy to process such as .avi
- The system should provide the live feed online
- Able to detect the speed of the vehicle

- Removal of shadows to decrease the data size and processing
- Online as well as offline mode in case of network loss.
- The system should be easy to set up and portable.
- The system should be modular so that reparability is easy.

B. Proposed System

There are different modules involved in this system. The hardware part will consist of various parts. A camera for getting the input, a microprocessor to make necessary computations and a network module to send the data to centralised server. A storage device is required to store certain data in case of loss of network. When the network comes back, the data can then be sent. Whenever a vehicle crosses the speed limit, the system will try to detect the number plate on the vehicle and extract the exact number written on it and send it along with other data such as speed, time of event to a centralised server. The server checks in its database for previous incidents and based on that makes decision to send the owner of the vehicle a ticket or just a warning.

C. System architecture and description

This part covers the architecture of the system.It comprises of a hardware part and a software part.

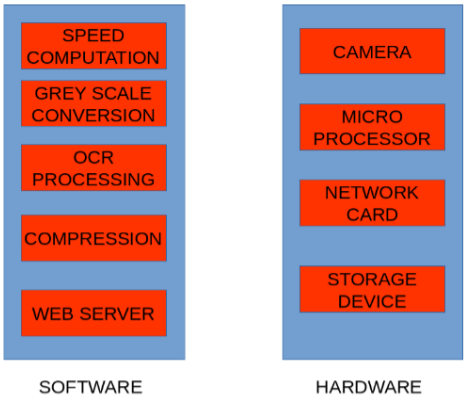

Fig 2 : System Architecture Diagram

The architecture diagram is divided into two parts, the software and the hardware part. Both the parts require continuous interaction with each other and amongst themselves. Apart from that, each of these parts are supposed to be modular or not dependent on each other so that the device easy serviceability is possible.

Hardware:

1. Camera:

Fig 3: Camera with night vision support.

The camera should be able to capture in minimum 720p quality with good framerate so as to capture fast moving vehicle. The quality of the camera should be good enough to compute the VIN through OCR. It should also be able to capture at night time as there won't be any natural light. For that a second camera with night vision is required.
Thus a module with both the camera integrated will be used.

2. Microprocessor:

Fig 4: Raspberry Pi: A Single board computer used for the current project

For the purpose of project, we have used a single board computer called raspberry pi. This board uses an ARM based microprocessor and it has a controller which can perform complicated tasks. For real systems, other microprocessors can be used which will reduce the cost of the device. They will also lower the complexity of the system. The microprocessor should have a controller capable of managing network card and the input from camera.

3. Storage:

The storage requirements depend on various factors. If the device is online, all the data will be transmitted and no storage is required. In case of network loss, the amount of storage depends on the authorities and rate of response. If the rate of response is expected to be slow, then the storage should be high. But if the rate is expected to be quick, not much storage is required. No special kind of storage is required except that it should be robust. The data can be compressed to save space but this requires more processing power. If the authorities wish to store the video data as well then magnetic hard drives are the best option to store date as they are robust and cheap.

Software:

1.Speed Computation:

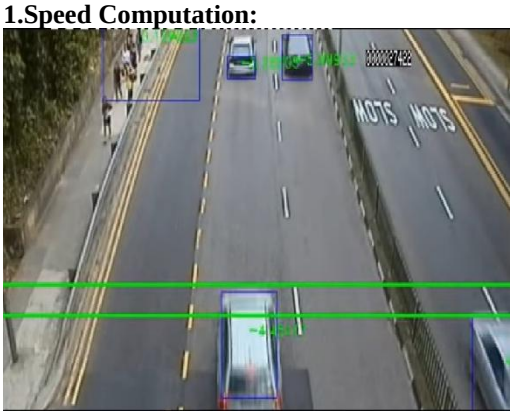

Fig 5: An image illustrating the two reference lines for calculation of speed.

This is done for a given object is calculation of speed. This is done by creating two imaginary reference points whose distance is known. One of the lines can be said as the entry line and the other exit line. Based on the time taken between the entry line and the exit line, speed can easily be calculated using the distance formula.

$$S = \frac{D}{T}$$

Where,
S=speed, D=distance, T=time
The speed is then compared against the speed limit of the particular way. If the speed is lesser than the speed limit, all the data stored is removed from the system. But if the speed is greater than the speed limit, then the images are sent to the next modules for further processing. Sending all the data requires a good network with high bandwidth as the amount of data can be quite high. But processing in place requires more processing power on individual devices which has a greater cost although the data that needs to be sent will be very low.

2. Grey scale conversion:

For OCR processing the image needs to be converted to grey scale. There are various reasons for doing this and they are as follows:

a. Reduction of noise to signal ratio

For processes such as extracting text, colour is not a useful property. We only need to identify the edges. Since we don't need colour, it can be considered as noise. This will help in reduction of the overall data size.

b. Complexity of code

Finding edges based on chrominance and luminance is additional work which need not be done for something such as text processing as the information on colour is just not useful.

3. Optical Character Recognition (OCR):

Once a vehicle is found to be over speeding the number registered on the vehicle needs to be determined. The input is in the form of an image but the data needs to be converted into a more usable form such as text format. Since the image is already converted to grey scale, this module only needs to extract the VIN from the image. Once the VIN is identified it can be sent with other data as the speed, the time of infraction, even the image of the vehicle can be sent.

4. Web Server:

A web server will be required for the camera to be accessed remotely. This system proposes to have two types of servers. A centralised server where in all the data is sent for further processing. The other server will be on the remote devices. Each of them will have a specific ip address which can be used to access it. The access can be used to check for the status of the device, get logs, some stored data. It can also be used for changing its parameters such as the speed limit, based on the time of the day.

IV. Conclusion

With technology moving forward in today's world, more and more systems are getting automated. The electronical items are getting cheaper and easily accessible. With the advancement in technology the workload on humans is reducing.
This system is highly configurable, robust and can work 24/7. The electrical energy used is very minimum and parts required can be obtained cheaply. Overall the entire system can be produced in very cost-effective manner and if implemented successfully can reduce the workload from traffic authorities to a great extent.

V. Acknowledgment

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VI. References

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