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Automated Vehicle Noise and Over Speed Detection System

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Abstract: ***This paper introduces an ongoing project on the surveillance of speed vehicles and which makes more noise on the road. Noise pollution created by vehicles on urban roads is becoming more severe. To enforce current measures, we developed a vehicular noise surveillance system including a vehicle speed measurement method. Samples of vehicular noise were recorded on-site using IR sensor. When IR Sensor detects more vehicle noise greater than 90 decibels, then the transmitter sends the data to the receiver. The receiver recieves the data then makes the RaspberryPi camera on. RaspberryPi camera captures the vehicle number plate and rider photo or video using OCR and the buzzer will turn on it gives the intimation and at the same time the data will store in cloud. License Platform Detection is a computer technology that enables us to identify digital images on the platform automatically. Different operations are covered in this system, such as imaging, number pad locations, alphanumeric character truncation and OCR. The final objective of the system is to construct and create efficient image processing procedures and techniques to position a licensing platter on the Open Computer View Library picture. It was used and implemented the K-NN algorithm and python programming language. The technology can be used in different industries such as security, highway speed detection, lighting violations, manuscript documents, automatic charging system, etc.***

Auto plate recognition is an integrated technology which identifies the auto licence plate. Auto plate auto recognition. Multiple applications include complex safety systems, public spaces, parking and urban traffic control. Automatic Vehicle License Plate Recognition (AVLPR) has undesirable aspects because of many effects, such as light and speed. This work presents an alternative technique to leverage free software for the implementation of AVLPR systems including Python and the Open ComputerVision (openCV).

I. INTRODUCTION

The Department for Transport (DfT) has commissioned a research project to identify and recommend options for methods and equipment available for the detection and policing of excessively noisy road vehicles. High levels of noise have been linked to a number of human health issues and vehicle noise is a significant contributor to this, particularly in urban environments. Excessively noisy vehicles, which have often been modified, also lead to significant annoyance and complaints from the public in both urban and rural areas of the INDIA. Current in-service noise compliance of vehicles is assessed through periodic roadworthiness testing (the MOT). However, given that many vehicles are found to be in contravention of the relevant noise regulations when stopped in use on the road, the MOT test may not provide adequate outcomes. This may be due to tampering and/or substitution of components. The DfT has procured research through the Highways England SPaTS framework to inform policy on potential improvements to policing methods for noisy vehicles and highlight any technologies that could be used as an aid to detection and enforcement.

A. Project Definition

The primary aim of this project is to understand if there are reliable and robust ways of ascertaining noise emissions from an individual vehicle at the roadside which could then be used for enforcement purposes. This is to be achieved by a review of best practice approaches and technology, both existing and in development, and supported by trials and validation noise measurements as necessary. This work will assist in the development of future policy and enforcement of in-service noise limits.

The project comprises two distinct phases as follows:

1) Phase 1 – Identification
2) Phase 2 – Trials and analysis

The first phase of the research established the methods currently used across the UK and internationally for policing excessively noisy vehicles and determined whether any strategies can be used more widely within the UK. Existing and prototype technologies for the detection of excessively noisy vehicles were identified and their feasibility of use, cost and reliability were assessed. The technologies were focused on the assessment of in-use vehicle noise, such as a roadside pass-by noise detector, rather than the assessment of stationary noise.

The study identified two potential noise camera technologies that could be used for this purpose that were put forward for consideration for the next phase of research.

II. LITERATURE SURVEY

N. Abdul Rahim, proposed a "Moving Vehicle Noise Classification using Multiple Classifiers",The hearing impaired is afraid of walking along a street and living a life alone. Since, it is difficult for hearing impaired to hear and judge sound information and they often encounter risky situations while they are in outdoors. The sound produced by moving vehicle in outdoor situation cannot be moderated wisely by profoundly hearing impaired community. They also cannot distinguish the type and the distance of any moving vehicle approaching from their behind.

In this paper, a simple system that identifies the type and distance of a moving vehicle using artificial neural network has been proposed. The noise emanated from a moving vehicle along the roadside was recorded together with its type and position. Using frequency-domain approach, simple feature extraction algorithm for extracting the feature from the noise emanated by the moving vehicle has been developed. One-third-octave filter bands were used and the significant features from the emanated noise were extracted.

The extracted features were associated with the type and zone of the moving vehicle and a multiple classifier system (MCS) based on neural network model has been developed. The developed MCS is tested for its validity.

Chandrashekhar. M proposed a Vehicle placed a camera alongside of the traffic light to capture image sequences. These images were processed to control the state change of the traffic light in order to decrease the traffic congestion and to avoid the wastage of time in a greenlight during empty road

Apoorv Agha proposed a "A Noisy Vehicle Surveillance Camera (NoivelCam) System", Traffic noise is one of the main contributors to noise pollution near urban settlements. To keep a check on the vehicle noise emissions in Singapore, a pilot project has been carried out to identify offending vehicles that exceed the stipulated noise limit set by the environmental agency in Singapore. In particular, noise due to tail pipe emission and engine are the main concerns.

The current law enforcement practice includes holding roadblocks, and measuring noise of stationary vehicle at different revolution per minute. However, this approach is highly manpower-intensive, costly and does not determine the actual driving pattern of drivers on highway.

To provide an efficient and automated alternative to noisy vehicle monitoring, a standalone integrated vehicle noise tracking system, known as the "NoivelCam," is designed and built for a single lane monitoring in expressways.This system will be scaled up to multiple-lane monitoring in the next stage of the project. In this paper, we present the design and technical functioning blocks of the NoivelCam system and how it is currently being deployed in overhead bridge spanning highways to estimate the tail pipe level noise generated from individual vehicle passing through the overhead bridge. Vehicles that exceed the stipulated noise level threshold will be tracked and captured through the cameras. The collected evidences, which include audio and video clips of the captured footage, snapshots of the vehicle number plate, and data log files of sound pressure level with time stamp, serve as a mean to identify offending vehicles in an in-situ operation. In addition, we will also highlight some situations of false alarm or error detection, and how multimodal information can assist in filtering out these false detections..

Chuang Shi,proposed a "A vehicular noise surveillance system integrated with vehicle type classification" ,This paper introduces an ongoing project on the surveillance of noisy vehicles on the road. Noise pollution created by vehicles on urban roads is becoming more severe. To enforce current measures, we developed a vehicular noise surveillance system including a vehicle type classification method. Samples of vehicular noise were recorded on-site using this system. Harmonic features were extracted from each sample based on an average harmonic structure. The k-nearest neighbor (KNN) algorithm was applied to achieve classification accuracies for the passenger car, the van, the lorry, the bus, and the motorbike of 60.66%, 65.38%, 52.99%, 62.02%, and 80%, respectively. This study was motivated by the demand of monitoring noise levels generated by different types of vehicles. The classification method using audio features is independent of lighting condition, thus providing a replacement to machine vision based techniques in vehicle type classification.

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III. HARDWARE DISCRIPTION

A. Raspberry P

RPI 2 Model B was chosen to be the processing and controlling unit of the projectsinceit satisfies the required specifications. Ithas 512 MB RAM, two USB ports, a 10/100Mbps Ethernet.

B. Power Supply

In our system a LINDO power bank model 310 with capacity of 80000mAh 29.6 Whand output 5V -2A was used to supply the Raspberry Pi with the required power.In thereal implementation the device will be powered from the vehicle battery. Theboard requires a 5 Volts power to make it work, the sensor and all other hardware devices works in this much of power

C. Arduino Uno

The Arduino is having the following pin configuration: There are some 28 pins for makingthe input and output fromthe Arduino board. These pins are very much helpful for themaking theboard do some useful work for example it can beused to take some sensor values from the sensors and makethe decision based on the programming we have done on it.

D. LCD Display

The below figure is a simple LCD display device which is available in the market its 16X2 display where one can able to view the 16 characters in each line and having a maximumof 2 lines. Inmost the embedded projects, LCD modules are very commonly used because of its cheap price, programmerfriendly and availability. LCD is a very important part of the application to display the speed of the particular moving object. LCD's are thinner and lighter when compared toLED and cathode ray tube. it has major application in the field of science and engineering on electronic devices. LCD's provides excellent contrast.LCD's consists of some microwatts for display in comparison to some mill watts for LEDs. The major applications in the field of science and engineering aswell on electronic devices

E. IR Sensor

First two digital IR Sensors are used,which is of an IR Transmitter i.e., IR LED and an IR Receiver i.e., Photo diode, a Comparator IC and a fewsupporting components. To form a Reflective Type IR Sensor, IRTransmitter and Receiver pair are placedside-by-side.

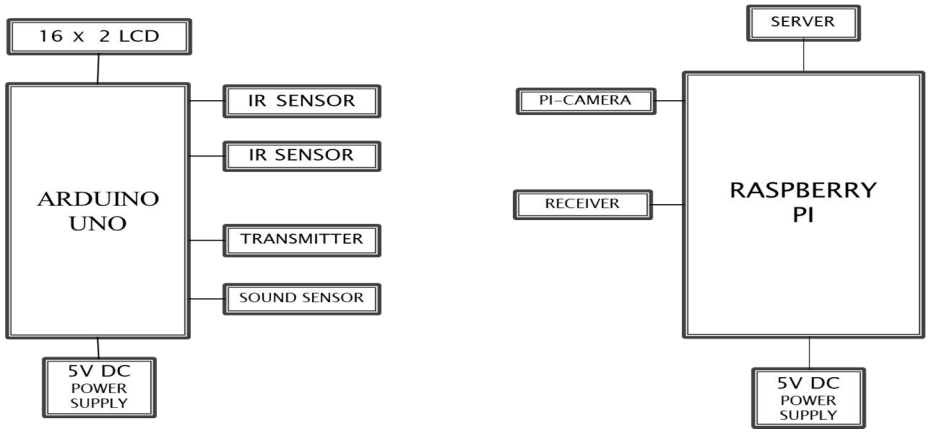
F. Buzzer

An electric buzzer was used to alarm thedriver when he exceeds the speed limit. It operates in therange of (3-24) V.

G. Pi camera

module is a portable light weight camera that supports Raspberry pi It communicates with Pi using MIPI camera serial interface protocol

IV. METHODOLOGY



The coding which has been done in computer using Python software and which is tested using the prerecorded video for classificationand counting of vehicles and also for speed identification, until satisfactory results are obtained. After that following steps are asfollowed.

1) The code is transferred to memory card and it is inserted to the Raspberry pi
2) Then the camera is connected to Camera Serial Interface (CSI) camera port and power bank is connected to Micro USB power supply port.
3) The OLED (Organic Light- emitting Diode) connected to Display Serial Interface (DSI) display port
4) The Raspberry pi is covered with casing along withfan mounted on it in order to avoid excess heating.
5) After all this setup model isplaced on a highway such that there is obstruction forentire road width visibility and there is no over lapping of vehicles
6) The results will be displayed on the OLED display.

V. EXPERIMENTAL RESULTS

The license plate detection is performed byapplying the above AVLPR code. So that is accurately generating characters'form extracted rectangular shape of the frame ofnumber plate recognition. Whenever the proposed method is performed through thefollowing steps which are discussed below:

1) *Step 1:* The proposed model is smartlycapturing an image of the license plate whichis forwarded to the python module for numberplate extraction. So it is shown in Figure 4.
2) *Step2:* License plate detection process(Localization) is displayed in this step where the Grayscale and also canny images are generated which is Figures 5 (a) and (b).
3) *Step 3:* The License Plate is detected, segmented, and recognized in this step which is depicted in Figure 6.
4) *Step 4:* For the final step, The number plate is detected and displayed in a new dialogue window, that is shown in Figure 7(a). Similarly, the characters of the license plate are extract-ed in the tested frame interface that is shown in Figure 7 (b).

Fig. 1. Real time inserted vehicle license plate at time of driving

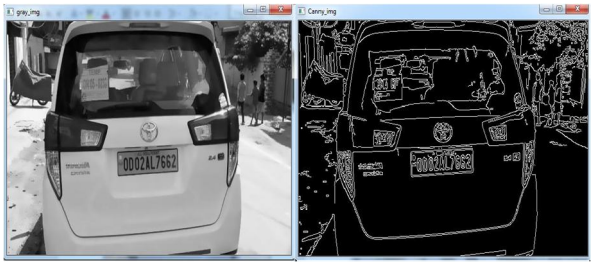


Fig. 2.a.Grayscale image of inputted vehicle & b. Canny image is generated by inputting Grayscale image

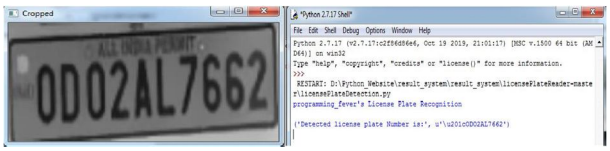


Fig. 3 . a. Cropped License plate detected frame & b. Character extracted from cropped license plate detected frame

VI. CONCLUSION

The measurement data collected from the prototype noise camera has demonstrated that it is possible for a noise camera to identify vehicles and for measured noise levels and speeds to be attributed to individual vehicles. This establishes thatnoise camera systems can identify individual vehicles and assign noise levels to them under certain conditions, theoretically and in practice. Noise camera systems arein their infancy and the technology has the potential to be used to identify excessively noisy vehicles. However, it is clear from the trial that further development is required toovercome various technological and acoustic challenges before one can be considered proficient for enforcement. For a noise camera to become a worthwhile technological solution for enforcement against excessively noisy vehicles, the key priorities for further development are:

Automating post-processing of individual noise camera components so that the data outputs arelinked together, taking into account the small-time differences betweeneach component encountering a vehicle asit passes the noise camera.

Without this, the task of manually linking together datasets would prove too onerous and it is considered likely that the system would not beused;

1) Identifying vehicles and matching noiselevels to them for more complex traffic scenarios, such asvehicles passing the noise camera in quick succession or at similar times in opposite carriageways;

2) Using purpose-built components toimprove the identification ofvehicles; and

3) Developing a more portable solution that could be deployed in residential or urban environments.

Any further development or trials of noise cameras should consider the use of a microphone array and the collection of acceleration data as a potential indicator of an adverse driving style and excessive noise being produced. Although it was possible to identify driving styles or behaviours from the acoustic data collected by the prototype noise camera, further research is required to characterise those that are ‘excessively noisy’. From an enforcement perspective, it is considered that adverse driving styles should not be enforced separately with anoise camerabut any evidence that can be used todemonstrate that a driving style mayhave resulted in a vehicle being logged as ‘excessively noisy’ would be useful in theevidence package. The analysis of the data from the prototype noise camera has indicated that it is possible to numerically define what an excessively noisy vehicle might be based on the measured maximum noise levels from vehicle pass-bys, and that the use of a ‘not-to exceed’ noise limit is viable. The relationship between objective and subjective definitions ofexcessivelynoisy vehicles require examination toensure that enforced pass-by noise limitsachieve their aim. Further data is neededfor motorcycles to robustly conclude whether it is appropriate to apply different noise limits to cars and motorcycles. As the potential application of noise cameras for addressing the issue of excessively noisy vehicles is leading to the development oftechnologies that could one day be deployed for enforcement, the use of a design and installation specification or standard will become increasinglyimportant. Direct application of existingvehicle pass-by measurement methodologies (ISO 362 and ISO 11819) to use for a noise camera is not possible due to logistics with placement of the measurement equipment and the difficulty of controlling variables at a roadside environment. However, some aspects can be adopted for such a standard. The standard will ensure that certain criteria aremet to maximise the performance of thenoise camera and that there is uniformity in their performance (so that two noise cameras behave the same). It would also enable prospective suppliers to optimise their products to the selected enforcement criteria. The development of a design and installation specification will be arequirement to preserve the integrity of theevidence package and to withstand legal challenges.

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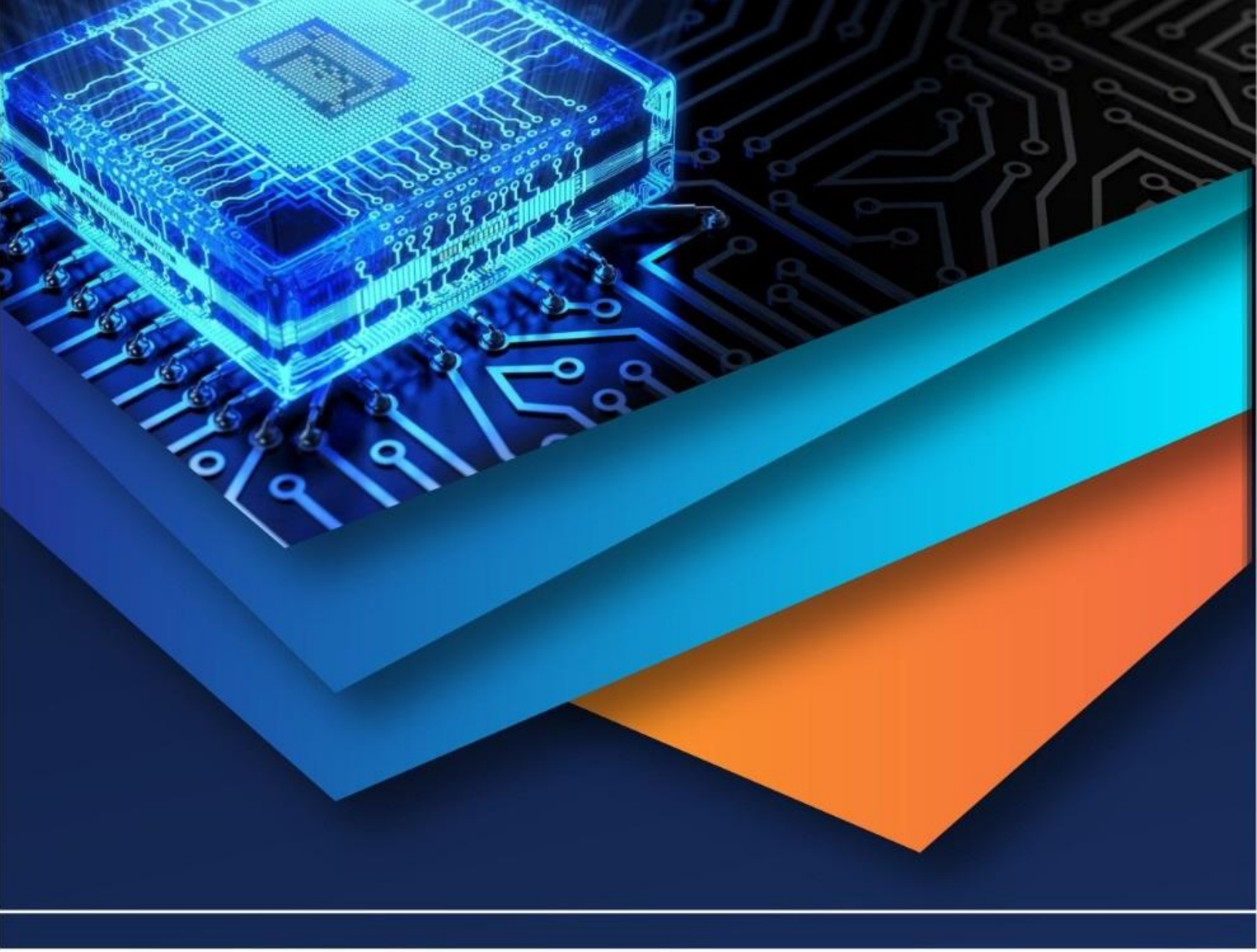

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