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Smart Traffic Video Surveillance System using IoT

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Abstract - Traffic Rules Violation Detection is one of the issue with growing importance in today's world. This paper presents the study of various issues related to the problem along with the solutions. This paper deals with the use of Internet of Things (IoT) for developing a system which can be used for detection of Traffic Rules Violations and generating e-challan without manual monitoring. The Survey of existing systems and techniques used to solve the issues are discussed. Different issues like automation of Triple Riding, No Parking, and Signal Jumping Violation Detection and methods to solve these are explored. We propose our "Smart Traffic Video Surveillance System using IoT" consisting of Raspberry Pi and Pi Camera as hardware to gather live video stream of Traffic. The System detects the violation if made any by people and generate e -challan against the violator by gathering the Number plate of the vehicle. This will lead to automated traffic control and remove the need for manual monitoring of traffic.

1.INTRODUCTION

In Today's world, any process that is not automated requires more manpower which can be time consuming and lead to human errors. Same is the case with Traffic Surveillance. Without automated system, Police Officials need to be present physically to monitor the traffic and capture the offenders. But if the system is automated to detect the violations and generating e-challan without physical presence of official, then it will reduce the workload of Police. So we propose the automated System for Traffic video Surveillance. In this system the IR sensor will be placed near the zebra crossing line. If any vehicle violates the law, a desktop application will be launched and will capture a number plate image. A request for identification of a plates is made and system will detect the number plate using an image processing algorithm and an SMS will be sent to the offender in the event of a violation. The system works satisfactorily with a variety of situations and different types of number plates. It is used and made in OpenCV and performance is tested on real images. Detection can be done by using a neural network technique called neural network (CNN). CNN consists of three layers, these are:

1. Convolutional layer

In convolutional layer, a mathematical operation known as Convolution operation is carried out between input image and a filter grid of size KxK. The result of this operation is Feature map which is fed to further layers.

2. Pooling layer

Pooling layer is the second layer in the architecture of CNN. It carries out various pooling operations depending on the situations to reduce the complexity of feature maps so that the cost of computation can be minimized.

3. Fully Connected Layer

FC layer consists of mechanisms to connect various layers. It generally carries out the classification process for the problem in hand.

Together these layers help in detecting violations carried out by people on road.

2. METHODOLOGY FOR TRIPLE RIDING VIOLATION DETECTION

1) In the proposed system, first we apply algorithm to detect moving objects.
2) These moving objects are then fed to model which then classifies them into two classes, namely motorcycles and non-motorcycle drivers.
3) Subsequently, items other than motorcycle riders are discarded and only items predicted as a motorcycle driver for the next stage are passed where we determine the number of riders on a bike.
5) We assume that the head lies at the top of the incoming images and thus locates the top at the top one quarter of the images.
6) If the number of Faces recognized are more than 2, then it generates the triple riding violation alert.
7) Algorithm used in this is Haar-Cascade Algorithm.

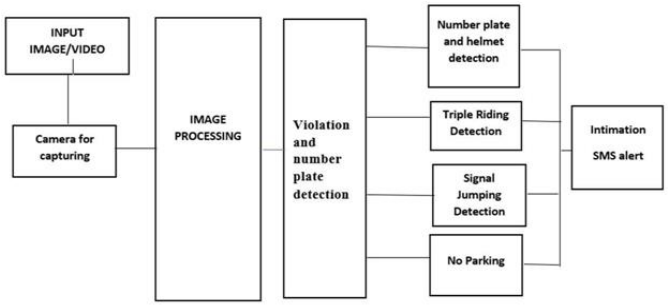
3. METHODOLOGY FOR NO PARKING VIOLATION DETECTION

1. Image acquisition: In this phase first we are collecting no parking dataset from . collecting data. Next step is pre-processing.
2. Pre-processing: In this step, we will remove unwanted / noisy images. If there are any blurred images or noisy images that have to be removed
3. Segmentation: In this step, System gathers all the meaningful parts into one cluster so that it can form a pattern which can be further matched to generate output.
4. Feature Extraction: In this Step, System identify necessary features that can be used to recognize required patterns. Extraction of features help in determining the location of the vehicle and determining no parking zone.
5. Training a neural network: In this step, dataset is fed to the the model and learning is carried out. A training dataset would classify this as no parking and general images.

4. METHODOLOGY FOR HELMET DETECTION

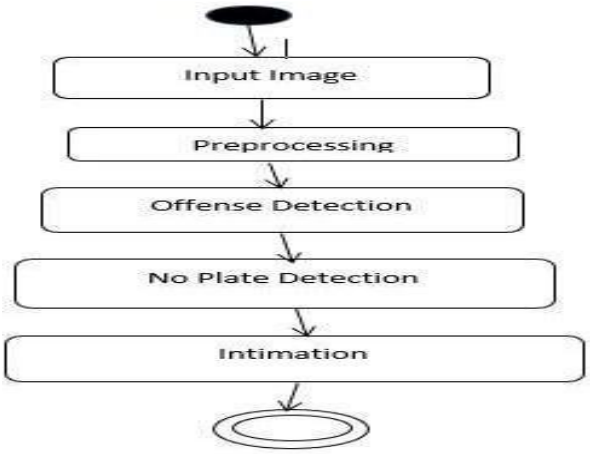
1) In the proposed system, first we apply algorithm to detect moving objects.
2) These moving objects are then fed to model which then classifies them into two classes, namely motorcycles and non-motorcycle drivers.
3) Subsequently, items other than motorcycle riders are discarded and only items predicted as a motorcycle driver for the next stage are passed where we determine whether the motorcycle driver has worn a helmet or not using any other CNN classifiers.
5) We assume that the head lies at the top of the incoming images and thus locates the top at the top one quarter of the images.
6) The head of the motorcycle driver is then given as input to another CNN classifier trained to classify helmets versus helmets.

5. ARCHITECTURE DIAGRAM



System Architecture of the Project is given above. It depicts that the flow of program will start by giving the system the input stream after which image processing will be done as a pre-processing step and then traffic rule violation detection is done. Once the violation is detected, the control goes to number plate recognition module and number plate is recognized by using OCR technique. In the End, the e-challan generated will be forwarded to the offender's contact.

6. ACTIVITY DIAGRAM



The above Diagram shows the activities that take place in the project and the order in which it takes place

7. ALGORITHMS USED

We have used YOLO Algorithm for detection and classification along with CNN. YOLO is the short form for "You Only Look Once". It is a very efficient algorithm for detection and classification purpose.

$$Pr(Class_i|Object) * Pr(Object) * IOU_{pred}^{truth}$$
$$= Pr(Class_i) * IOU_{pred}^{truth}.$$

The probability for each cell is given by formulae:
Similarly, the formulae used to Calculate loss and optimize confidence is:

$$\begin{aligned} Loss = & \\ & \lambda_{coord} \sum_{i=0}^{s^2} \sum_{j=0}^{A} \mathbb{1}_{ij}^{obj} [(b_{x_i} - b_{\hat{x}_i})^2 + (b_{y_i} - b_{\hat{y}_i})^2] \\ & + \lambda_{coord} \sum_{i=0}^{s^2} \sum_{j=0}^{A} \mathbb{1}_{ij}^{obj} [(\sqrt{b_{w_i}} - \sqrt{b_{\hat{w}_i}})^2 + (\sqrt{b_{h_i}} - \sqrt{b_{\hat{h}_i}})^2] \\ & + \sum_{i=0}^{s^2} \sum_{j=0}^{A} \mathbb{1}_{ij}^{obj} (C_i - \hat{C}_i)^2 \\ & + \lambda_{noobj} \sum_{i=0}^{s^2} \sum_{j=0}^{A} \mathbb{1}_{ij}^{noobj} (C_i - \hat{C}_i)^2 \\ & + \sum_{i=0}^{s^2} \mathbb{1}_{i}^{obj} \sum_{c \in classes} (p_i(c) - \hat{p}_i(c))^2. \end{aligned} \quad (3)$$

8. RELATED WORKS

Implementation of deep learning layer assignment in edge computing based smart city environment

Published by Kyuchang Lee, Kijun Han
Published on 12/Dec/2019
Edge computing is a next gen technology in the field of Internet of Things. It got host of benefits that can be utilized for a greater good by simplifying various processes like it enables transferring and processing bottlenecks. Although to make Edge computing a stellar success there are key things to be kept in mind, like assigning more deep learning tasks on IoT. Defining proper algorithms which can augment computing capacity as well as bandwidth of each edge separately. Simulation results shown very encouraging results as it handled the deep tasks at the same time maximising the resource utilization of edges. Its benefits can be drawn from a host of factors like its usage in CCTVs, autonomous driving vehicles, designing of smart city etc. It consists of multiple layers through which data gets transferred and processed.

The Prototype of Traffic Violation Detection System Based on Internet of Things

Published by D Hirawan, A Hadiana, Abdurakhim

A breakthrough technology has been devised in the area of Traffic Control System for checking of the violation of the vehicles at zebra crossing. The Prototyping method consists of five stages namely Communication, Quick Plan, Modelling, Quick Design and construction of Prototype. The entire Prototype is designed in such a way that a sensor will detect the front side of the vehicle, then a camera will be used to click a picture of the same and subsequently a sound will be generated through speakers as a warning to the driver for violation of traffic laws. Thus, this technology will enable to monitor and keep an eye on traffic violators. But the existing technologies are not sufficient enough to keep a tab on all those violations, as CCTVs which are installed at road cross sections are in-sufficient and not in proportional to the number of violations taking place.

A System for Traffic Violation Detection

Published by Nourdine Aliance, Javier Fernandez, Mario Mata, Sergio Bemposta
This paper is basically a work towards the goal of improving and monitoring traffic violation and for this an advanced driver assistance system (ADAS) is devised on experimental stage.
The system works in two model process by detecting specific traffic violations and at the same time allowing visualization of these traffic violations through Google Earth tool. It will basically function as a Data Recorder working in all circumstances given the diverse weather conditions. Therefore, it is a part of an early warning tool to monitor traffic for preventing its violations as a part of larger good. Therefore, to address this issue a new system can be devised like 'Driver Assistance Systems', which can alert drivers before anything go seriously wrong.

Traffic Violation Alert and Management

Published by: Mario Mata, Javier Fernandez, Sergio Bemposta
Published on 24/Nov/2014
Traffic violation being one of the major concerns of the traffic management and there exists a glaring gap in the existing system, whereby the current technology is focussed on three signs namely speed Limit, Wrong Turning and Stop Sign. All these are reactive in nature. Thus, a new technology is being devised which can enable the driver to know about the impending danger and warn him/her sufficiently in advance. It can detect any traffic violation and warn by emitting vocal warnings. Also, as a matter of preventing it from

happening again a history of all traffic violations being committed will be saved for further analysis by way of data recorder. The prototype is currently been tested with positive results coming on the way. The main aim is to solve the problem before they happen and here it comes the system of SACAT.

Safety, Behaviour, and Sustainability under the Mixed Traffic Flow Environment

Published by: Yongzheng Yang, Laxia Zhang, Changxi Ma
Published on 10/Mar/2020

There have been more and more applications of traffic violations monitoring in many countries. Currently, the traffic flow is recorded by the speed camera, which is then processed by the SPSS software for further analysis.

But there exists an underlying problem in the current system as a vehicle upon approaching a speed camera slows down and then increases its speed. Thus, it evades the rule of the law of maintaining a unified speed.

Therefore, a system has been devised wherein the distribution of the speed of vehicles can be calculated based on speed probability density models.

A traffic violation system is there in place which checks into various factors like speed of the vehicles, illegal lane change, traffic sign violation and many others. At the same time, it is imperative to study the behaviour of the driver.

9. CONCLUSIONS

In this research, we tried to develop an automated traffic video surveillance system with the help of OpenCV and Object Detection. The automation of Rules Violations is necessary to reduce the number of violations occurring which in turn reduces the number of accidents on the road as people become more alert while driving due to stringent laws and monitoring. In the end, we found out that the accuracy of violation detection is 83% in our study and that of number plate recognition is 61%.

REFERENCES

[1] Mohammadi M, Al-Fuqaha A, Guizani M, Oh JS. Semisupervised deep reinforcement learning in support of IoT and smart city services. IEEE Internet Things J 2018;5(2):624–55.
[2] Mohammadi M, Al-Fuqaha A. Enabling cognitive smart cities using big data and machine learning: approaches and challenges. IEEE Commun Mag 2018;56(2): 94–101.
[3] Zhang B, Liu CH, Tang J, Xu Z, Ma J, Wang W. Learning-based energy-efficient data collection by unmanned vehicles in smart cities. IEEE Trans Ind Inf 2018;14 (4):1666–76.
[4] Zhang P, Zhao Q, Gao J, Li W, Lu J. Urban street cleanliness assessment using mobile edge computing and deep learning. IEEE Access 2019;7:63550–63.
[5] Silva BN, Khan M, Jung CS, Seo JH, Muhammad D, Han JH, Yoon YT, Han KJ. Urban planning and smart city decision management empowered by real-time data processing utilizing big data analytics. Sensor. 2018.
[6] Misbahuddin, S., Zubairi, J.A., Saggaf, A., Basuni, J., Sulaiman, A. and Al-Sofi, A., 2015, December. IoT based dynamic road traffic management for smart cities. In 2015 12th International Conference on High-capacity Optical Networks and Enabling/Emerging Technologies (HONET) (pp. 1-5). IEEE..
[7] Hirawan, D. and Sidik, P., 2018, August. Prototype Emission Testing Tools for L3 Category Vehicle. In IOP Conference Series: Materials Science and Engineering. 407(1), pp. 099. IOP Publishing.
[8] He, W., Yan, G. and Da Xu, L., 2014. Developing vehicular data cloud services in the IoT environment. IEEE Transactions on Industrial Informatics, 10(2), pp.1587-1595.
[9] Kyriazis, D., Varvarigou, T., White, D., Rossi, A. and Cooper, J., 2013, June. Sustainable smart city IoT applications: Heat and electricity management and Eco-conscious cruise control for public transportation. In 2013 IEEE 14th International Symposium on" A World of Wireless, Mobile and Multimedia Networks"(WoWMoM) (pp. 1-5). IEEE.
[10] Foschini, L., Taleb, T., Corradi, A. and Bottazzi, D., 2011. M2M-based metropolitan platform for IMS-enabled road traffic management in IoT. IEEE Communications Magazine, 49(11), pp.50-57.
[11] G. O. Young, “Synthetic structure of industrial plastics (Book style with paper title and editor),” in Plastics, 2nd ed. vol. 3, J. Peters, Ed. New York: McGraw -Hill, 1964, pp. 15 –64.
[12] W. -K. Chen, Linear Networks and Systems (Book style). Belmont, CA: Wadsworth, 1993, pp. 123 – 135.Bergasa, L. M., J. Nuevo, M. A. Sotelo, R. Barea and

E. Lopez, "Visual Monitoring of Driver Inattention", Springer Berlin / Heidelberg, Vol. 132, pp.25 -51, 2008.
[13] Horrey, W.J. and M. F. Lesch, "Driver -initiated distractions: Examining strategic adaptation for in -vehicle task initiation", Accident Analysis & Prevention, Vol.41, no. 1, pp.115 -122, 2009.
[14] Manubhai M., T. G. Trivedi, J. C. McCall, "Looking -In & Looking - Out of a Vehicle: Computer -Vision -Based Enhanced Vehicle Safety", IEEE Intelligent Transportation Systems, Vol. 8, no.1, pp.108 -120, 2007.
[15] Horrey, W.J., M. F. Lesch, and A. Garabet, "Assessing the awareness of performance decrements in distracted drivers". Accident Analysis & Prevention Vol. 41, no.1 pp. 675 –682, 2008.