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Man Machine Interaction in Autonomous Vehicles

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Abstract: *Today, and possibly for a long time in the near future, the complete driving task is too complex an activity to be fully formalized as a sensing-acting robotics system that can be explicitly solved using model-based and learning-based approaches in order to achieve fully unconstrained vehicle autonomy. This is especially true for unconstrained, real-time operations where the permissible range of error is extremely small and the number of limiting cases is extremely large. Until these problems are solved, human beings will remain an inevitable part of the driving task, monitoring the AI system as it performs anywhere from 0 to just under 100 percent of the driving. Overtaking and lane-changing is a critical part of vehicle automation. Though automation in automobiles has increased security and decreased environmental issues, it causes driver to be less active generating passive fatigue. This passive fatigue can lead to failure in responding quickly if needed. This led automation to keep driver active even though he/she is not required to take up full control all the time. This paper presents the need for alerting the driver during overtaking and lane-changing to avoid accidents and disastrous outcomes. The model uses image processing for lane detection and identification of obstacles, vehicles, and lane tracking. It calculates the relative velocity during overtaking and the system will share the scenarios with the driver, using alert systems. We demonstrate the capabilities and features of our system through real-world experiments using four vehicle's videos processed on the road.*

Keywords: Driving Assistance, Computer Vision, Object Detection, Object, Object Recognition, Object Identification, Image Segmentation, Video Segmentation, Computer Vision Representations, Image Representations, Graphics Input Device, Displays and Imager.

I. INTRODUCTION

The idea that human beings are poor drivers is well documented in popular culture. While this idea is often over-dramatized, there is some truth to it in that we're at times distracted, drowsy, drunk, drugged, and irrational decision makers. As human beings, we naturally take for granted how much intelligence, in the robotics sense of the word, is required to successfully attain enough situation awareness and understanding to navigate through a world full of predictably irrational human beings moving about in cars, on bikes, and on foot. It may be decades before most cars on the road are fully autonomous. During this time, the human is likely to remain the critical decision maker either as the driver or as the supervisor of the AI system doing the driving. Autonomous vehicles are cable of sensing environment using various techniques viz. IR and Ultrasonic rays, image processing, global positioning system, RADAR etc.

The controller is designed to gather data from all inputs and analyse it thoroughly to find the perfect path for vehicle along with obstacles. Controller should be capable of locating other cars on road travelling in same directions as well as in opposite directions with their respective speeds to avoid mishaps. Majority of the road accidents, around the world, happens because of lack of attentiveness during driving. Multi-tasking while driving, using mobile phone while driving, drunk driving, sleepiness, etc., are all cases where the driver is not attentive towards driving. Of all the accidents that happen due to lack attentiveness, a huge portion of them occur during over taking and lane changing. These two processes require complete attention and rely heavily on the driving of others on the road. An alert system, during lane changing and over taking, is an effective way of bringing the driver's attention to the action of driving. To overcome this problem, a novel but simple model is introduced that will alert the driver/drivers the driver during overtaking and lane-changing to avoid accidents and disastrous outcomes. The model uses image processing for lane detection and identification of obstacles,

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vehicles, and lane tracking. It calculates the relative velocity during overtaking and the system will share the scenarios with the driver, using an alert system.

II. LITERATURE SURVEY

Lex Fridman, Daniel E. Brown, Michael Glazer, William Angell, Spencer Dodd, Benedikt Jenik, Jack Terwilliger, Aleksandr Patsekin, Julia Kindelsberger, Li Ding, Sean Seaman, Alea Mehler, Andrew Sipperley, Anthony Pettinato, Bobbie Seppelt, Linda Angell, Bruce Mehler, Bryan Reimer- "MIT Advanced Vehicle Technology Study: Large-Scale Naturalistic Driving Study of Driver Behavior and Interaction with Automation." - In this paper, the Authors have explained and reported the requirements of creating a proposed hardware and software's for lane-detection and alerting systems. The Authors have also explained about various datasets, data logging, data processing methods, deep learning of autonomous vehicles and future extensions and scope that can be helpful for the model proposed.

Abhishek Shriram Umachigi Department of Electrical Engineering Michigan Technological University- "Human Computer Interaction (HMI) in autonomous vehicles for alerting driver during overtaking and lane changing." -In this paper, the Authors have explained about how to build a computer vision (AI) based model that will provide alerts while changing lanes and the possible challenges the model will face. The Authors have also explained how to propose graphical displays for the detection of lanes and objects and explained the heuristic evaluation of the model proposed.

Seong-Woo Kim, Member, IEEE, Baoxing Qin, Zhuang Jie Chong, Xiaotong Shen, Wei Liu, Marcelo H. Ang, Jr., Emilio Frazzoli, Senior Member, IEEE, and Daniela Rus, Fellow, IEEE- "Multivehicle Cooperative Driving Using Cooperative Perception: Design and Experimental Validation." - In this paper, the Authors have provided a design and experimental validation of cooperative driving using cooperative perception. The extended perception range by the support of cooperative perception enables the driver to know the traffic situation even beyond line-of-sight or beyond field-of-view. The proposed system provides a see-through forward collision warning, overtaking/lane-changing assistance and automated lane-change capability using cooperative perception. The Authors have also explained how the detection and alerting system should work in real life scenarios.

Joseph Redmon, Santosh Divvala, Ross Girshick , Ali Farhadi, University of Washington, Allen Institute for AI, Facebook AI Research- "You Only Look Once: Unified, Real-Time Object Detection." - In this paper, the Authors present YOLO model which processes images in real-time at 45 frames per second. A smaller version of the network, Fast YOLO, processes an astounding 155 frames per second while still achieving double the map of other real-time detectors. The Authors have also explained about how YOLO can be used for lane and object detection and how it is better than most of the other existing detection models.

Xuqin Yan, Yanqiang Li Institute of Automation, Shandong Academy of Science Shandong Provincial Key Laboratory of Automotive Electronic Techniques Qilu University of Technology (Shandong Academy of Science) Jinan, China- "A Method of Lane Edge Detection Based on Canny Algorithm."

In this paper, the Authors present a method of lane edge detection based on Canny algorithm. Firstly, according to the importance in lane markings recognition, the road image is divided into three regions. Only the regions with useful information are processed. Then by the features of gray distribution and lane markings width, some noises are removed from the image. Using the shape features of lane markings, the lane edges are detected based on Canny algorithm. Finally, by use of the Hough transform theory, lane detection is achieved.

III. LIMITATIONS OF EXISTING SYSTEMS

1. Models cannot decide over which dataset can be the best to be used.
2. Man Machine Interaction signals take much time for delivering alert messages.
3. YOLO might make some localization errors.
4. Video processor might not be able to process the video accurately.
5. Background noise during analysis of video is not avoided.

IV. PROPOSED SYSTEM

Computer Vision and AI is helping to design models which will assist drivers in the perception of any dangerous situations before, to avoid accidents after sensing and understanding the environment around itself. To date there have been numerous

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studies into the recognition. Traffic accidents have become one of the most serious problems. The reason is that most accidents happen due to negligence of the driver. Rash and negligent driving could push other drivers and passengers in danger on the roads. More and more accidents can be avoided if such dangerous driving condition is detected early and warned to other drivers. Lane detection is not enough for avoiding mishaps while driving. Our proposed software model is also providing some basic alert messages when lanes are changed while driving which can be very helpful as the driver will not have to constantly look at the screen while he/she/they change the lanes. This prototype has compared various detection methodologies, data processing techniques, data storing logic, data analysis process and has come up with a software code which will give the desired output. The model makes use of COCO dataset, YOLO and Canny edge detection, Hough transform algorithm and OpenCV python for successful implementation. At first the video is taken as an input and processed or analysed to obtain the lane detection and object detection using YOLO, Canny edge and Hough transform algorithm. Then depending upon the changing lanes, the model yields desired voice alert messages while the detection of lanes and objects is still in process. Once the entire video is analysed, the model saves the new processed video with detected lanes and objects along with canny edge detections in the drive folder mentioned. The model is brought in use using Google Collab and OpenCV using python programming. The proposed model will be very useful in autonomous vehicles and will help in reducing road accidents if brought into major level implementation. The below System Architecture diagram explains the working of the proposed model in a very basic way.

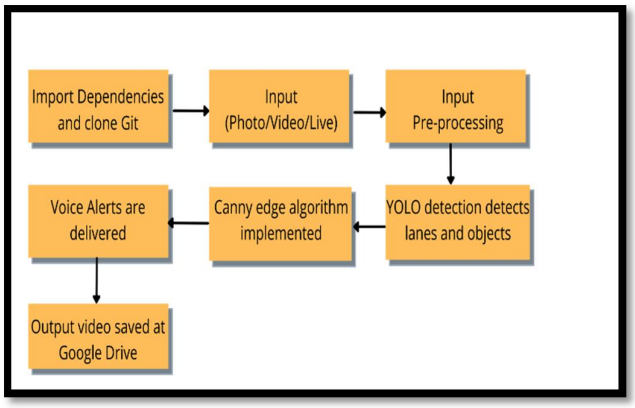

Figure 1: System Architecture.

V. CONCLUSION

Thus, a survey on lane and object detection and voice alerting system can prove to be helpful in avoiding road accidents and an efficient system in autonomous vehicles. This proposed model compares various factors to build a efficient model from the existing ones. This model proposed will be helpful in lane changing, will alert the driver/user through voice alerts and will be very cost efficient. With this project we try to shift the driver's role towards a supervisory control of their vehicle. This model will assist drivers/users with technologies that will enhance the driving experience with minimum to no mishaps.

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[6]. Sunil Kumar Vishwakarma1 Information Technology, Akash2 Computer Science & Engineering SRMCEM, Divakar Singh Yadav3 Computer Science & Engineering IET Lucknow, India- "Analysis of Lane Detection Techniques using OpenCV."