A Survey on Accident Avoidance and Improving Road Safety with Use of Raspberry Pi

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Abstract: Nowadays, due to increase in traffic there is also an increase in occurrence rate of accidents .To avoid these problems, the system is designed using Raspberry pi. Digital image processing plays an important role in the capture and detection of various objects on the road. Image processing algorithms is used to perform the necessary operations on the image of the captured object. The Raspberry pi camera port is used to capture a road object using image enhancement techniques. The system is onboard as a small computer which detects and recognizes the object ahead of the vehicle by studying its characteristics. The main objective is to implement a system which can be used for accident avoidance and improving road safety. The paper also conducts survey on many object detection systems, methods and techniques.

***IndexTerms*–Raspberry pi, Image processing, Accident avoidance system, Convolutional Neural Network (CNN).**
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I. INTRODUCTION

India has the highest number of deaths from road accidents rather than diseases. Approximately 45% of people die in traffic accidents within a year. The high-speed road hazard detection is one of the most complicated operations in the vehicle-to-vehicle system. In 1988, Goleta, California, States developed the first obstacle detection system to detect obstacles on the road and warn about obstacles on the road. After several years at Santa Barbara research and Corp. (Sbrc), California first introduced obstacle detection techniques, which use ultrasound, infrared lasers and radar of the implants [1]. In recent years, many driver assistance systems have been developed to increase driver and passenger safety and also includes use of various active sensors such as millimeter wave radar, LIDAR(Light Detection And Ranging), light sensor, infrared laser sensor and ultrasonic sensor which are considered as embedded technology [2].

To provide safety and transport efficiency, intelligent automobile vehicles are used nowadays. Obstacle detection systems are designed to reduce the harmful effects of accidents [3]. In order to undertake safety measurements, by using new technologies such as radar, lasers, cameras and ultrasonic sensors it is possible to efficiently detect obstacles in the front or rear of vehicles [4]. Object detection is the process of detecting and determining objects in an image of a certain known class. Only a few years ago it was difficult to solve this problem. Before Krizhevsky presented by Cnn[5] AlexNet2012 in Imagenet large-scale visual recognition competition, researchers are struggling to find solutions for image classification, with very low error rates. Since then, many object detection methods using CNN have shown excellent performance and efficiency.

The Raspberry Pi is a small single-board computer, no bigger than a credit card. Single-board computers do not have the computing power of traditional desktop systems, but due to their low cost and small size, they may be many times preferable for some tasks [6]. Object recognition and detection has long been a challenge in the field of computer vision, and many different approaches have been adopted to overcome it. Some of these approaches involve matching the visual aspects of an object, such as edges, contours, and color, with similar instances in the image, or using more specific objects for the same. Then in 2012, AlexNet, a CNN-based object recognition model, entered the annual ImageNet challenge. It outperformed its competitors by a wide margin, reaching 15.3% of the top-5 error compared to 26.2 % of the second best entry. This was in many ways the emergence of CNNs, and since then CNNs have become extremely popular. CNNs, however, was nothing new. An important example of this is the LeNet model from 1998, which was used to read handwritten numbers in postal codes. The increase in computing power of computers and the increase in available data have been used to explain the rebirth of CNNs in 2012 and since [7].

II. LITERATURE SURVEY

Sindhu Fares Jalled [1], this paper aims to avoid unwanted collisions and damages of UAV(Unmanned Aerial Vehicle). UAV is also used for surveillance that uses Voila jones algorithm to detect and track humans. This algorithm uses cascade object detector function and vision. Zhihai he, Zhi Zhang, Guitao Cao, and Wenming Cao [2] paper, consider the animal object detection and segmentation in the wildlife area/regions to monitor the video captured by motion triggered cameras, called camera traps. The author develops a cross-frame temporal patch verification method to determine if these region proposals are true animals or background patches.

R. Pavithra, M. Jagadeesan [3], This paper presents a simple and inexpensive system for automated animal detection for the purpose of collision prevention of animals and objects using image processing technology and computer vision technology. Method of finding distance, animal in the real world units camera mounted on the vehicle is also presented. The presented system consists in testing the speed of different cars on the highway of different video clips animals with positive and negative images more than 2200 km. Pranjali ulhe, samta gawande, kajol taksande [4], proposed methodology for the detection of highways, proposed classification of cavities and road markings, and proposed an automatic operation guidance mechanism.

Murad Benjaballa, Stevika Graovac and Mohammed Amin Bulahlib [5], this work consists of three main stages: (1) Image segmentation, which reflect the road image; (2) Detection of obstacles in the coverage area of the vehicles and obtaining their description and monitor the identified frame; and (3) Using the camera module, the distance between the described obstacles and their rate of change (relative speed) are computed. Rosida Vivin Nahari, Riza Alfita, Hairul Anam, Kunto Aji Wibisono, Mirza Pramudia [6], the author develops road damage detection system using image processing and Traffic Injury Mapping which are saved in the database . This system uses a webcam, taking the road images with a real-time webcam in a font car and a GPS module is used to detect the location of road damage. Ratnaprabha Kasde and G. Gugapriya [7], the article goes on to describe the interactive mechanisms and intelligence against accidents on the road. As a safety improvement, the multi-sensor control network (CAN) system is coupled to the engine control unit (ECU) using the ARM-7 microcontroller. V. Kumaravel, R. Sharmila gowri [8], to avoid accidents and human being problems, the system is designed and installed mainly on two processors (the Raspberry pi, microcomputers). Digital image processing plays an important role in code acquisition and detection systems. The Raspberry pi Camera unit is used to capture road signs using image enhancement technology.

Table 2.1: Survey Table

Sr. No	Paper Title	Authors	Description	Advantages	Disadvantages
1	Object Detection Using Image Processing	Fares Jalled.,	Develop an OpenCV-Python codeusing Haar Cascade algorithm for object and face detection	To avoid unwanted collisions and damages of UAV.	Object is not properly detected.
2	Animal Detection From Highly Cluttered Natural Scenes Using Spatiotemporal Object Region Proposals and Patch Verification	Zhi Zhang, Zhihai He, Guitao Cao, and Wenming Cao,	Generate animal object region proposalsusing multilevel graph cut in the spatiotemporal domain.	Improves the performance while maintainingLow computational complexity.	Only animal detection system.
3	Automatic Object Detection and Collision Avoidance System using Cascaded Random Classifier	R.Pavithra, M.Jagadeesan	Automatic animal detection on highways for preventing animal and object vehicle collision using image processing andcomputer vision techniques is presented.	Finding the distance of the animal in real world units.	Low detection accuracy (82 %).
4	Image processing on road detection	Pranjali ulhe, samta gawande, kajol taksande	The system make a survey of Indian roads, to suggest the method to detect lanes, potholes and road signs and their classification and to suggest automated driver guidance mechanism.	To reduce a loss ofconcentration and to prevent an accident while driving.	Poor image filtering technique, so road Sign detection, classification andrecognition gives a lower efficiency.
5	A classification of on-road obstacles	Mourad Bendjaballah, Stevica	Obstacle detection method using a monocular camera	Calculates automatic classification of	Does not verify the algorithm in real road-traffic situations.

	according to their relative velocities	Graovac and Mohammed Amine Boulahlib	mounted on a vehicle receiving the light variations in the scene on the road ahead and analyzing the captured images to carry out the obstacle detection.	the on-road obstacles according to their relative velocities.	
6	Camera-Based Road Damage Detection System with Edge Detection Algorithm.	Rosida Vivin Nahari, Riza Alfita, Hairul Anam, Kunto Aji Wibisono, Mirza Pramudia	Develops road damage detection system by using image processing and road damage mapping which are saved in database.	Detect road damage, minimize road accidents.	Poor classification between a road damage object and a normal road.

III. PROPOSED METHODOLOGY

Road accidents are a human tragedy. The man suffers from high momentary costs in terms of death, injuries and possible loss of income. In calendar year 2010, there were close to 5 lakhs road accidents in India, resulting in more than 1.3 lakhs fatalities and injuries to 5.2 lakhs. This resulted in a traffic accident every minute and a traffic accident every four minutes. It is now clear that the main causes of road accidents are related to driving. So we can develop a system, which helps the driver, it can help reduce the number of accidents and this is the research we are focused on the object detection system for road safety. When an object is identified, drivers are notified by voice message. Figure 1 shows the proposed system architecture.

- The camera is used to take the continuous images to get the object from the real world. The images available through the camera the system send these images to the raspberry pi to perform car's control action.
- Raspberry pi is a small one-card computer chip. There are various raspberry models available on the market, namely the Pi1 Model B Raspberry tree, the Pi1 Model B+ Raspberry tree, the pi2 Raspberry tree, the Pi3 Model B. They have different memory and hardware features.
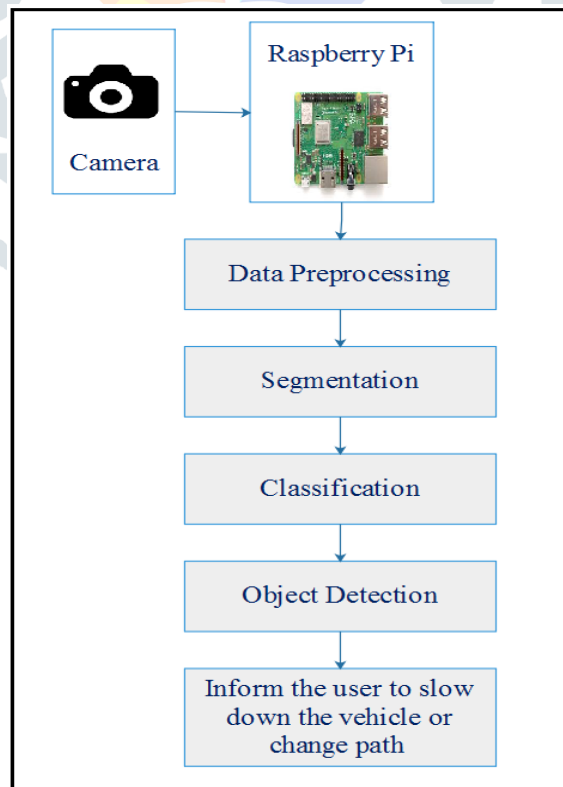

Fig. 1: Proposed System Architecture

- The system performs pre-processing using Mean Subtracted Difference Enhancement (MSDE) and then segmentation is performed. The classification is done by using Convolutional neural network (CNN). The system can classify the

objects like animals, humans, vehicles etc. Once the object is detected the system inform to the user to slow down the vehicle through voice message.

IV. CONCLUSION

This article discusses various methods of object detection, tracking, recognition, feature descriptors, and segmentation methods, as well as various tracking technologies. The approach is used to increase the detection of objects with new ideas. Road safety is becoming a serious social problem with the increasing number of vehicles every day, and due to different traffic conditions, accidents can happen to other vehicles, people, as well as animals, so object detection is very important. This work aims to carry out real-time object detection system running on Raspberry Pi at to avoid accidents, prevent road safety to improve. In which the system perform preprocessing using Mean Subtracted Difference Enhancement (MSDE) and then segmentation is performed. The classification is done by using Convolutional neural network (CNN). The system can classify the objects like animals, humans, vehicles etc. Once the object is detected the system inform to the user to slow down the vehicle through voice message.

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