Animal Vehicle Collision Avoidance Using Image Processing

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Abstract—Vehicles play an important role in human's daily life, at the same time they may cause dangerous problem to life of people and property due to accidents. Everyday around the world, several hundreds of people die from various collisions of vehicles. Most of the accidents are caused due to driver's inattention. The collision of an animal with the car at the motorway is one such massive problem. Rollover crashes belong to the most danger type of avenue injuries. Particularly vehicles with a high situated center of gravity are exposed to the rollover type of accidents. In this project we address these two issues. The collision between the vehicles and animals can be prevented by video processing technique, using which based on the distance between the animal and vehicle smooth braking is applied. This system also focuses on the reduction of untripped rollovers in vehicles. It is an active indication system which involves continuous monitoring of the inclination and acceleration of the vehicle using gyroscope sensor.

Keywords—Animal vehicle collision, rollover, image processing.

I.   INTRODUCTION

We are living in the world where we are invading animal space and blaming it by saying that animals are destroying human wealth sometimes killing humans. Construction of houses, bungalows, motels, hotels, roads in the forest and hilly regions has been a continuous scenario without worrying about the environmental issues which will affect us later. Road kill is a general name given to animal or animal that have been struck and killed by motor-vehicles on road. The animals affected by this are mostly reptiles. We could see this kind of issues every day in our news channel. Now it's very much difficult to turn back and correct our mistakes. But at the same time it is the correct time to react in order to save those creatures.

Ministry of road transport and highways says that animal crossing national highways cause about 7,734 accidents between2012-2014. As per the road ministry's information, Uttar Pradesh recorded the maximum accident cases at 1,865 followed by Andhra Pradesh and Jammu and Kashmir.

Hence our project mainly focuses on reduction of the anima to vehicle collision in the roadways. We use image processing technique to identify the animal and the distance in which it is located according to which the brakes are applied. Although only about 0.2% of the accidents leads

to rollover of the vehicle they have the highest fatality rate greater than 80%. This project also focuses on the reduction of un tripped rollovers in vehicles. It is an lively indication system which involves continuous monitoring of the acceleration and inclination of the vehicle. This can be done with the help of a gyroscope sensor.

The main objective of this paper is to avoid the collision occurrence between the vehicle and the road crossing animals by providing smooth braking using animal detection algorithms. To reduce the adverse rollover conditions by signaling the drivers with a indication system using gyroscope sensor.

II.   EXISTING SYSTEM

2.1 On board system:

On-board machine is installed inside the cars, warn drivers when animals and /or gadgets are detected. To this point, in-vehicle or on-board detectors have generally used infrared generation. Car-hooked up sensors detect while a large animal (or person) is within a certain range of the car, giving the driving force time to gradual down or prevent.
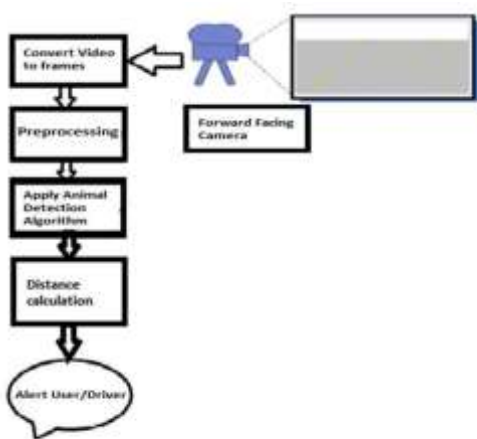

Fig.1.Block Diagram of Existing System

the video is taken from a forward-going through optical sensor (camera) wherein a shifting animal is present apart from different stationary and non-stationary gadgets. This video is saved inside the pc and transformed into extraordinary frames. Then we're doing pre-processing steps to decorate the picture. For feature extraction and studying of the gadget, we are the usage of a aggregate of hog and boosted cascade classifier for animal detection. All the picture processing strategies are applied in open cv software program. As soon as the animal receives detected inside the video, the following step is to find the space of the animal from the testing vehicle after which alert the motive force so that he can practice the brakes or carry out another vital motion that's displayed on command prompt as a message. Depending on the distance of the animal from the camera set up automobile, three varieties of messages (indication) are given to the motive force i. E. Animal very near, if animal could be very close to to the automobile, animal little far, if the animal is little a long way from the automobile and very far, if the animal may be very far and at a safe distance from the car.

Pros:

1) on-board detection do now not restriction animal as well as items moves
2) the system might not handiest stumble on massive animals as well as items, but also people and pedestrians.
3) The Cost would be distributed amongst individual motorist.

Cons:

I) Vehicle based systems only inform drivers in those vehicles equipped with such a detection system; drivers in other vehicles will not benefit.

II) It may take many years, before a substantial percentage of vehicles are equipped with on board detection.
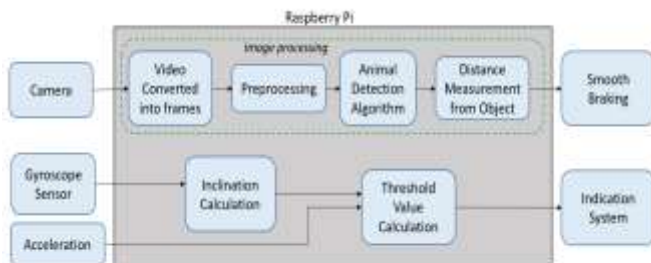
III. PROPOSED SYSEM

Fig.2. Block Diagram of Proposed System

3.1 Proposed System

Our proposed system consists of Raspberry Pi as the main processing unit which does all the preprocessing works on the video format input got from the camera interfaced with the processor. After preprocessing like converting the images captured into gray scale and doing edge detection, the obtained results are executed in the animal detection algorithm to check if there is any appearance of animals in the images captured. And if an animal is detected then the distance between the animal and the vehicle is calculated based on the type of animal and the size of the animal on the captured image. Using these data the brake are applied accordingly to avoid the collision between the animal and vehicle. On the other hand, the processor is also interfaced with the gyroscope sensor (MPU6050) whose output are acceleration and the rate of change of angle in all three axis. Based on these values got from the gyroscope sensor the inclination of the vehicle and skidding velocities of the vehicle are extracted from it. If there is an abnormality in these values i.e. when it exceeds a certain value that it might be dangerous for the vehicle the indication system alerts the driver.

3.2 Block Diagram Description

The block diagram has two parts first on is animal detection part along with a smooth braking and the second part is overbalance monitoring system.

We use optical sensor i.e. camera as the input for the Raspberry Pi which can also be used for security purposes. The camera records a video and then it is fed to the microprocessor where the video is converted into frames and then preprocessing of the image is done before the animal detection algorithm is used.

Preprocessing involves converting image into grayscale i.e. normalization of the image and then edge detection algorithm is used to get the outline of the animals capture in the camera.

Then the object detection algorithm (animal detection algorithm) compares the data on the frame with the preprocessed set of images of the animals and detects the animal and distance is measured and based on the distance the electromagnetic braking of different strength is applied.

It is easy to control the braking intensity just by varying the voltage given as input to the electromagnetic winding. By controlling the voltage over a wide range we can vary the braking intensity accordingly.

Gyroscopic sensor is used to detect the inclination angle of vehicle with the acceleration from the gyroscope. After finding the value it is compared with threshold value, if it is greater than threshold value indication will be given to the driver that an overbalance might occur.

3.3 Rollover occurrence condition:
- ➤ Traveling at high speed on curved road.
- ➤ Sever cornering maneuver.
- ➤ Traveling on collapsing road and suddenly providing steering input for a vehicle with a low level of roll stability.
- ➤ Losing control due to a rapid decrease of friction, such as driving on icy road.
- ➤ Laterally sliding of the road.
- ➤ Sliding from a cliff.
- ➤

3.4 Factors affecting roll over conditions:
- ➤ These factors are tire and vehicle characteristics, environmental conditions, and drivers.
- ➤ Rollover can happen on a flat road, on a cross-slope road, or off road.
- ➤ Tripped rollover is caused by a vehicle hitting an obstacle.
- ➤ Traveling at high speed on a curved road: When a vehicle travels on a curved road, lateral centrifugal force will pull it in an outboard motion
- ➤ Steering can cause yaw motion because forces on the tires in the 8 lateral directions are strong enough to roll the vehicle.

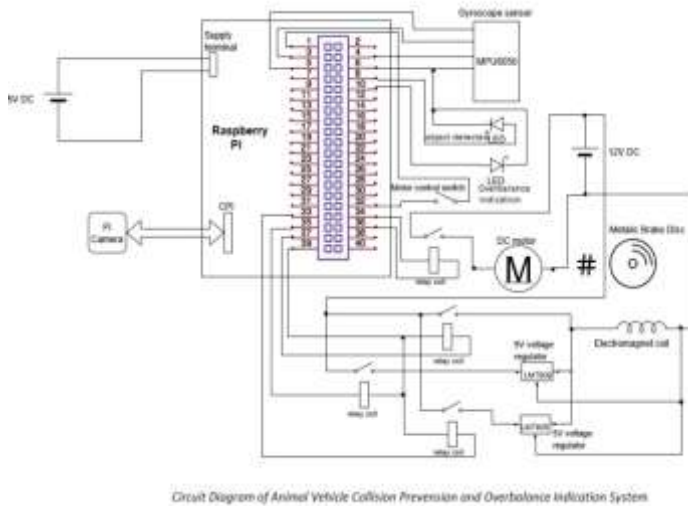Circuit Diagram of Animal Vehicle Collision Prevension and Overbalance Indication System

Fig.3.Circuit Diagram

4.1 Circuit diagram Explanation

The main drive 12V dc motor is powered by using a 12V 7Ah battery and the Raspberry Pi is powered using a 5V adapter and the electromagnet is also powered from the same 12V battery.

The Pi camera and the gyroscope sensor are interfaced with the microprocessor (Raspberry Pi). Microprocessor is programed with animal detection algorithm (object detection algorithm), distance measurement program, the sliding velocity and inclination calculations and also with how the electromagnet must be energized during what conditions with what voltage based on the distance measured.

The supply to the DC motor is also controlled by the microprocessor. It is programmed in such a way that, whenever an animal is detected in the captured image the supply to the motor is cut off and the electromagnet is energized with a specific voltage based on the distance between the vehicle and the animal.

For overbalance indication system we have a LED placed which will glow whenever the acceleration or the inclination of the vehicle goes over a certain value the LED will glow indicating the danger of rollover may occur.

There is also another LED placed to indicate the detection of the animal in the captured images. Based on the distance measured the microprocessor energizes a certain pin and these pins are connected to a 3.3V EM relay as the pins of the microprocessor has 3.3V outputs. The com terminal of the EM relay is connected to 12V battery. Its output pin (NO pin) is connected to the respective voltage regulator. The output of the voltage regulator is connected to the electromagnet.

If the distance between the animal and vehicle is very close then the electromagnet is energized with 12V and if farthest away then energized with 5V voltage regulator. And through 9V regulator if the distance is neither close nor faraway.

The image processing and gyroscope sensor outputs can be viewed from microprocessor by connecting a monitor or a laptop to the processor using a HDMI connector or using a Ethernet cable.

V.   HARDWARE RESULT

The output of the image processing part in the Raspberry Pi can be viewed by connecting it with laptop through Ethernet cable or a separate monitor.

When the image input i.e. a picture of a dog is shown in front of the camera. This system responds with the braking of the metallic disc connected with the motors shaft and also by indication with the help of a LED.

Fig.4 Hardware results

The image on the left side is the input image to the camera and the right side image is image processed output.

This system also provides a indication whenever the vehicle glides at a certain velocity and also when the inclination of the vehicle increases certain angle.

VI.CONCLUSION

In this paper, we proposed a system for detecting vehicle collision and rollover. Detecting vehicle rollover and collision and immediate notification of emergency services will facilitate fast assistance to injured occupants. The algorithm can be used to detect an animal crossing in different locations on highways. The approximate animal distance from the testing vehicle is also determined. Though the proposed work has been focused on automatic animal detection in context to Indian highways, it will work in other countries also. The proposed method can easily be extended for detection of other animals too after proper training and testing. The proposed system can be used with other available, efficient pedestrian and vehicle detection systems and can be offered as a complete solution (package) for preventing collisions and loss of human life on highways. The proposed system achieves an accuracy of almost 90% regarding animal (dog) detection.

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