DETECTION AND CLASSIFICATION OF ANIMALS TO ALERT VEHICLES ON ROADS TO AVOID COLLISION

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Abstract: Animal vehicle collision is beginning to increase in our country. Though it hasn't been noticed a lot it still remains to be unsolved issues. Keeping sign board on the roadside and maintaining analyzer based on the data to detect the animal crossing on the roads doesn't seem to be effective. Most of the accidents are happening in night time where driver couldn't able to see animals crossing the road in the dark. In this paper, we are going to provide a way to detect the animals crossing on the road and intimate the users who are travelling on that way with the caution signals from a certain distance. This reduces the collision in a large scale. This can be also used in hilly regions. Nowadays, animals entering in to village has been increasing drastically. So we can also detect and warn the people in those villages about the animals entering into their places.

Index Terms - SURF, Image identification and classification, Training set, Raspberry P12
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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. Even though like Demonetization our government has banned some forest places not to occupy, some are not in the mindset to listen to that. 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. Actually, we don't have any rights do blame those animals crossing the roads or entering in to human space. We are just paying back to the mother of nature.

Roadkill 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. There are two main causes for this roadkill -Intentional collisions and road salt accumulation

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 by using this idea to safe or preserve the animals which are in extinction.

A. Intelligent Video Surveillance System

In Intelligent Video Surveillance System [IVS], there are basically six components. These components are listed below.

1) *Acquisition*: This component is basically used for acquiring the images. There is a whole array of camera models to meet different monitoring needs. They are analogue and digital, and can be power-operated or not. Solar cameras are also being useful in many applications.

2) *Transmission***:** The video captured by surveillance cam-eras must be sent to the recording, processing and viewing systems. This transmission can be done by cable (coaxial or fibre optic cables, stranded copper wire) or by air (infrared signals, radio transmission).

3) *Compression:* Digitized video represents a large quantity of data to be transmitted and archived. So, surveillance video must be compressed using codec, algorithms for reducing the amount of data by deleting redundancies, by image or between footage frames, as well as details that cannot be seen by a human eye.

4) *Processing:* Video management systems process video surveillance images, such as managing different video flows, and viewing, recording, analysing and searching recorded footage. There are four major categories of video management systems, Digital Video Recorder (DVR), Hybrid Digital Video Recorder (HDVR), Network Video Recorder (NVR), IP video.

5) *Archiving:* The video footage archiving period varies depending on surveillance needs, ranging from a few days to a few years. There are two types of archiving devices, internal and attached.

6) *Display:* Video surveillance can be viewed on different devices. In small facilities, the video can be viewed directly on the recorder, as the image is being recorded. Images are generally viewed remotely, on a computer, or on a mobile device such as a telephone or hand held device which also includes Tablets.

B. Feature Extraction

In image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant (much data, but not much information) then the input data will be transformed into a reduced representation set of features (also named features vector). There are many algorithms and techniques for feature extraction like thresholding, blob extraction, template matching, Hough transform, and haar transform etc.

C. Template Matching

Template matching is a technique in digital image processing for finding small parts of an image which match a template image. To perform template matching in mat lab, we have used the concept of normalized cross co relation. In signal processing, cross-correlation is a measure of similarity of two waveforms as a function of a time-lag applied to one of them. This is also known as a sliding dot product or sliding inner-product. It is commonly used for searching a long-duration signal for shorter, known feature. For image-processing applications in which the brightness of the image and template can vary due to lighting and exposure conditions, the images can be first normalized. This is typically done at every step by subtracting the mean and dividing by the standard deviation. Here we have used feature based template matching mechanism using NCC.

II. LITERATURE SURVEY

S.NO	PAPER NAME	PAPER AUTHOR	YEAR OF PUBLICATION	INFERENCE
1	Recognition and classification of animals based on texture features through parallel computing.	Manohar.N, Subrahmanya .S, Bharathi .R.K.	2016	The classification and recognition of animals plays a major role in preventing vehicle-animal accident, tracing animal facility, animal identification, animal-theft prevention and security of animals in zoo…etc.
2	Real Time Animal Detection System using HAAR Like Feature.	NidhiDaxini, Sachin Sharma , Rahul Patel.	2015	In this paper we can come to know that OpenCV has greater performance rate than Matlab since it has high level functions which are implemented on GPU. It also provides portability and faster processing in real time.
3	Animal-Vehicle collisions: a new cooperative strategy is needed to reduce the conflict.	CarmeRosell, Ph.D., Marc Fernández-Bou, B.F. Ferran Camps, B.C.E, CarlesBoronat, Lic,FerranNavàs, LicMercèMartínez, Lic. MercèMartínez, Lic.	2013	This paper has been our motivating factor to take this project. It provides a complete study of animal-vehicle collisions (AVC) happening all around the world and also provides some traditional methods to avoid it.
4	Speeded – Up Robust Features	Herbert Bay, Andreas Ess, TinneTuytelaars, Luc Van Gool.	2012	SURF algorithm uses Gaussian matrix for feature extraction which eliminates noise and detects blobby objects in a efficient manner.
5	Robust Techniques for background subtraction in urban traffic video	Sen-Ching S, Cheung, Chandrika Kamath.	2012	The software description of how to Implement the Speed up Robust Features. FieldProgrammable Gate Array is selected as hardware platform for implementationof modified SURF algorithm.
6	ImageNet classification with Deep Convolution Neural Netwoks	Alex Krizhevsky, IlyaSutskever, GeoFFery E. Hinton.	2011	On testing the data We can see that it can achieve top-1 and top-5 error rates of 37.5% and 17% which is better than the previous state of the art.

III. ARCHITECTURE

- In this model, we are going to provide effective solution for the issue- Road kill. This works as follows:
- Installing a device consisting of camera which is connected with Raspberry pi2 and led display is placed at a particular distance gap to cover most of the areas on road.
- A camera monitors its vicinity area every second.

- If a camera recognizes any animal in its range it will detect the animal using SURF algorithm.
- Then it will send the caution signals (a led display message or using red lights) to warn the drivers at other two ends – front and back to stop their vehicles.
- So that user can drive their vehicles with caution.
- If the animal has crossed the entire road and crossed a certain distance after the end of the road, then the microcontroller at the two ends will displayed with Green signals indicates animal has crossed the road.
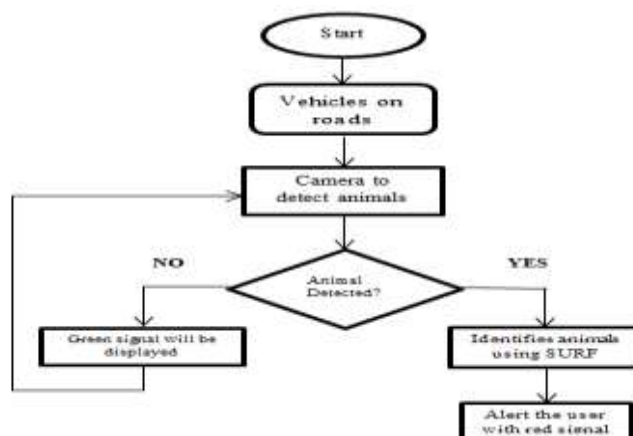
I. OVERALL WORKFLOW

Figure 1: Overall Workflow

- In the first step we will be starting the process of capturing the images using the camera which will be available throughout the time.
- Then snaps are taken if there is any movement of objects with in the frame.
- Then those captured images are compared with our training set which is already fed in the database.
- If those images are matched then we will know that some animals is been crossing the road.
- Now every animal has its own speed of travelling .so we have to classify the animals based on its features.
- All the keypoints that are extracted are compared and grouped to recognize what animal is crossing the road.
- Now if the animal is elephant then red signals are automatically activated to indicate the vehicle that has been coming to stop at a safer distance.
- If the animal is deer then yellow light is activated to indicate the vehicle to approach at a slow pace in order to avoid collisions.
- Then camera will take snap after a time interval to check that animal has crossed the entire road or not and continues the step listed above.

II. TECHNIQUES TO BE USED

A. Image Identification

Detecting the moving animals and motion based tracking are important components in this project. Here we are using SURF (Speed Up Robust Features) algorithm to detect animals in the camera vicinity area. It uses key points and draws matching lines to compare the training set images and captured image. When camera clicks a snap, a set of key points are generated on the captured image which are based on corners, blobs and T-joints. Now it is compared with our training set and tries to match those key points which are already generated. If those key points are matched then it will move to next phase of identification. Else it won't perform any more operation.

B. Image Classification

After finding the moving animal we can classify the animals in to several types so that user can know what type of animal. Here we are using same SURF algorithm to classify the animals based on their properties which will be given ass training set and also each animal's properties will be feed into the database which stores all kind of images. Such that it will be easier to classify the types of animals based on their features available to make a differentiations.

C. Signal Transmission

After finding the animal using image processing technique we are going to send the signals to both the setup which will be placed at front and back of the current post. This can be done by using WiFi setup which will be placed in that area. So that it is easy to send a signal to the posts which are located at both ends of the road.
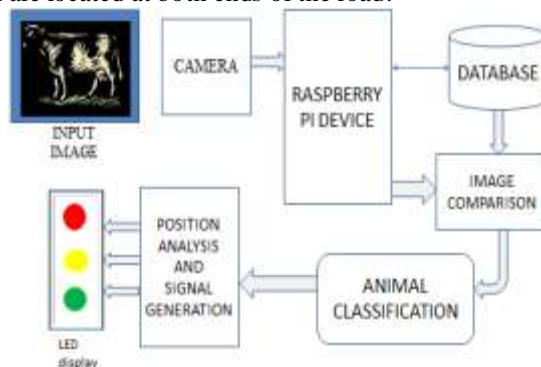

Figure 2: Basic Block Diagram

D. Surf Algorithm

Feature detection is the process where we automatically examine an image to extract feature, that are unique to the objects in the image, in such a manner that we are able to detect an object based on its features in different images. This detection should ideally be possible when the image shows the object with different transformations, mainly scale and rotation, or when parts of the object are included. This will be applied at every time when the camera captures an image and ready for processing. The processes can be divided in to 3 overall steps.

1. *Detection*: Automatically identify interesting features, interest points are found at unique locations such as corners, blobs, T-joints.
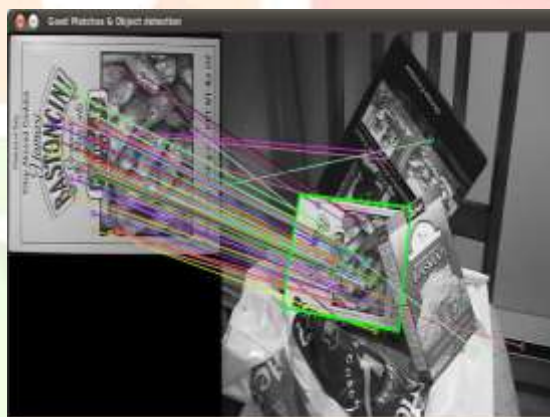

Figure 3: Matching Key points using SURF Algorithm

2. *Description*: The most valuable property of an interest point detector is its repeatability. The repeatability expresses the reliability of a detector for finding the same physical interest points under different viewing conditions. Next, the neighborhood of every interest point is represented by a feature vector. This descriptor has to be distinctive and at the same time robust to noise.

3. *Matching*: Given and input image, determine which objects it contains, and possibly a transformation of the object, based on predetermined interest points.

IV. EXPERIMENTAL RESULTS

A. RESULT SHOWING DEER

In this a deer photo is placed at vicinity area of camera. Here the picture is captured using web cam attached to raspberry pi2 kit and the resulting image is compared with our training set to detect whether it is animal and also describes the type.

Fig No 4 Result Showing Deer

B. RESULT SHOWING ELEPHANT

Here animal image is shown constantly in front of camera. So the resulting captured image is compared with our training set which is already feed in our database is related and the result will be displayed as elephant at number of times until it has been took from the area of focus.
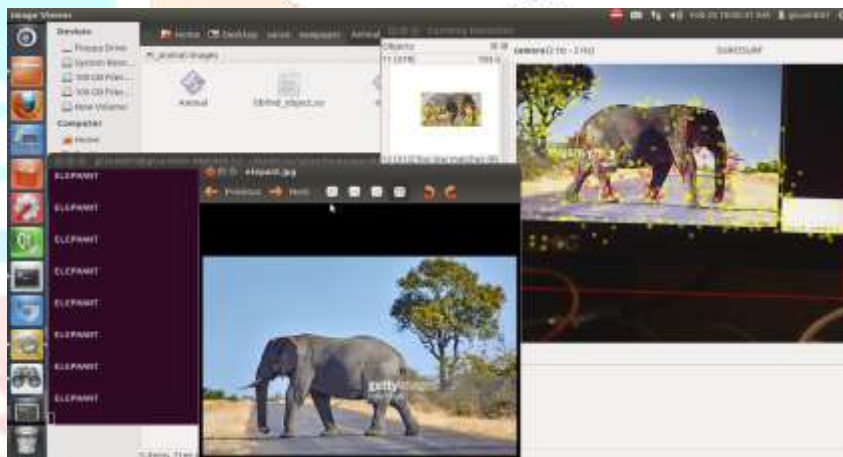

Fig No. 5 – Result Showing Elephant

V. CONCLUSION AND FUTURE WORK

This idea may look to be more costly to implement. But, still this will be the idea where every nation will install in near future because of drastic changes in animal count. This may not change the entire future or save all animals in this world but it will be a little step towards saving animals in extinction and also saves lots of human life. This idea can also be extended by installing our device near village areas to alert the people living nearby if any harmful animal has entered in to their space by giving some buzzer sound or we can directly alert the owner of the field and also forest rangers by sending them alert signal on phone.

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