Decision Support for Autonomous Car by Exemplar 3D Model Depth Estimation

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***Abstract* - As an automatic/autonomous vehicle, it is capable of sensing its environment and navigating without human input. Many sensors are being used in detection of object and its distance. But in this project "image processing technique" is used for detecting and computation of the direction angles. Exemplar 3D model is being used for detection. Exemplar model is a template that is being matched with extracted object in road. Once object is being detected, its distance and speed is being calculated. This concept can be applied to autonomous car application by training the neural network with the help of multilayer feed forward neural network controller namely 'Hindrance evading Controller'. Hindrance evading Controller ensures collision free motion of car. The controller is trained by the calculated distance and speed. It takes decisions such as to brake or to take left or to take right or to slow its speed. And thus it avoids accidents and controls the speed.**

***Key words* - Exemplar model, Hindrance evading Controller, Neural network.**

I. INTRODUCTION

Autonomous car is a self driving car and is getting attention now a days because of its effortful development and its trendy features. The type of the autonomous vehicle area already being deployed over various types of applications and it is widely being supported in many environments[5]. There are many technologies that re clumped together to form an autonomous car. Among those are the use of the sensor and actuators, special algorithms and integrating software that runs on powerful processor[6].

Nowadays people are driving very fast; accidents are occurring frequently, by losing our valuable life by making small mistake while driving (school zone, hills area, and highways). The main objective is to design a Smart Display controller meant for vehicle's speed control and monitors the zones, which can run on an embedded system. Smart Display & Control (SDC)[7]can be custom designed to fit into a vehicle's dashboard, and displays information on the vehicle. It is composed of two separate units: zone status transmitter unit and receiver (speed display and control) unit. Road facilities are a major concern in the developed world. Recent studies show that one third of the number of fatal or serious accidents are associated with excessive or inappropriate speed, as well as changes in the roadway [8] (like the presence of road-work or unexpected obstacles).

Speed control is in the need of the hour due to the increased rate of accidents reported in our day-to-day life. During 2011, in India a whole of 4, 97,686 road accidents were reported which is a result of lack of speed control and violating the road rules. Road accidents can be prevented by adopting measures such as Traffic management, improving quality of road infrastructure and safer vehicles. The existing techniques still doesn't able to reduce the number of accidents.

Hence there is a need to implement Intelligent Speed Adaptation (ISA) in which vehicles speed can be automatically controlled by various limit techniques which are based on zones, highway, traffic density etc. In this research work, it proposes automatic speed control system based on speed calculation system (SCS) [7] for highway road and the roads where the speed control within limit is required.

The methodology explains that a various speed calculation system(SCS) are marked on highway road or the roads where the speed control within limit is required and vehicle will have a color sensor attached which will recognize the color marked on the highway road and accordingly maintain the vehicles speed in that particular limit. In this developed system, the color detecting sensor of specific intensity is used to activate/deactivate the system of speed control within the speed calculation system(SCS) marked on the road.

In actual practice, the system works that when vehicle enter in speed limiting roads like express–high way, high way and any other roads where the speed limit is required etc.,[8] When the system activated then our vehicle is controlled at given limited speed or below that limiting speed and cannot exceed beyond that limit till the next speed system crossed. This reduces the road accidents and also calculates the other vehicles speed and distance through miniature camera at front gets driving comfort for the driver, after implementation of this automatic speed control system.

II. PROPOSED APPROACH

Even through there are many methods in image processing for analyzing an object, Exemplar model is being used. Because this model is a effective in comparison of objects[1]. As this is very fast and it does not require the need of human interaction for comparison.

Main objective of this paper is to make autonomous car applicable to Indian transport system and make the autonomous car to take decision by training set of object details obtained without the use of sensor. Thus the speed of vehicle is controlled and the rash drives are avoided.
As this approach is being used in autonomous application for its feature of making decision and control speed. This can also be adopted in other automated machines. As the exemplar 3D model can also be adopted to conversion of 2D images to 3D. Because the techniques of exemplar model such as silhouette matching, structural fitting, Edge aware depth refinement and ground aware depth adaption are efficient in conversion[2]. Thus it makes the conversion to be fully automated and no need of scribbling input of user[3].

Structural Fitting

Structural fitting is a non-linear operation on shape and feature of image. It is a ordering of pixels of the image. Shape or the feature of image is the structural element. This structural element is compared to neighbouring pixels of image[1]. It checks whether pixels matches to the neighbouring pixel. So, the operations are carried out here. The structural fitting method applies to binary images and so it uses the matric form to make comparison to neighbouring pixels of image.
Three axis of the image are used. But, while comparison z axis is being ignored. While making the deformation of the model image sparse set of feature points is deformed.
If f be an image, s1 and s2 are the pair of structural element. Then, the comparison is defined as

$$f \theta s2 \approx (f \theta s1) \theta s1$$

Silhouette matching

The silhouette matching fits the boundary of 3D model to silhouette of 2D object. This extracts the contour of 2D object by trimap based formatting technique[3]. Contour correspondence is made by matching the vertex positions.
Matching the contour points (p1, …pn) and (q1, … qm). Assume a starting match either get one heuristically, or try many. Build table of costs reflecting all possible matches. c(pi,pj) is the cost of matching pi to qj. o(pi) is the cost of not matching pi. C(i,j) is the cost of the best matching that accounts for (p1…pi), (q1, … qj).

If C(1,1) = c(1,1) Then,
C(i,j) = min (C(i-1,j-1)+c(i,j), C(i-1, j)+min(o(pi), c(pi,qj), C(i,j-1)+min(o(pj), c(pi,pj)).

C(n,m) is the cost of matching entire contours. It Can also keep track of which points matched.

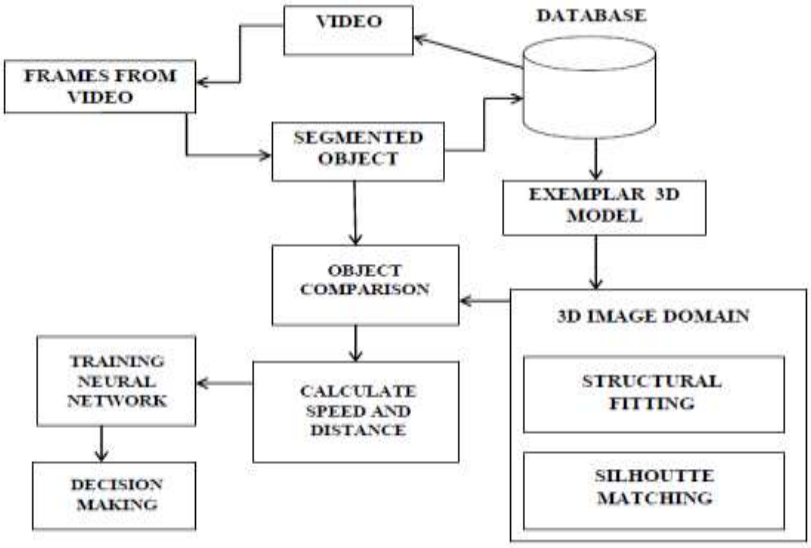

Fig.1. Proposed architecture.

Neural network training

The neural network is the collection of nodes connected to each other. Each node in input corresponds to single output unit in the network. The output of the hidden nodes are available only within the network. Hidden node computes the combination of outputs from the input nodes. The input for the neural network is the distance between the autonomous car and the vehicle moving before it [4]. The neural network is created by multilayer perceptron and it is trained by using back propagation algorithm.

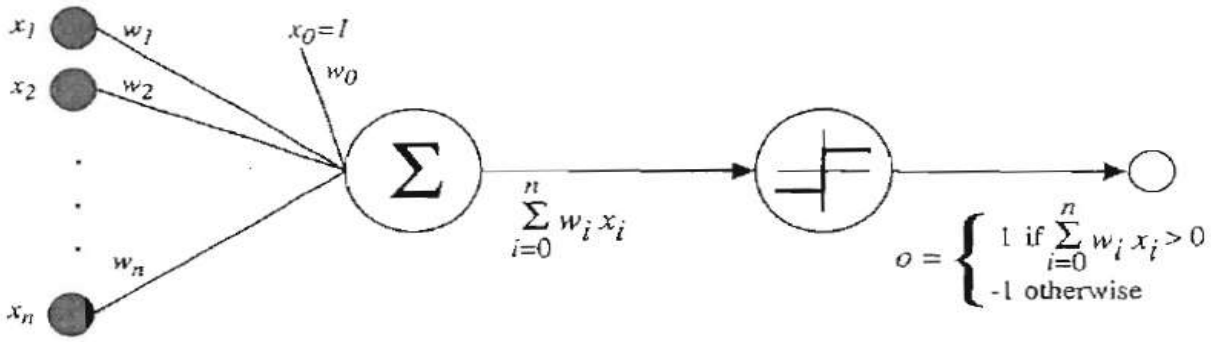

Fig.2. Neural Network-Multi layer perceptron

III. CONCLUSION

This paper presents an architecture for autonomous car adaptation of controlling the speed and make decision support. Thus it decreases the cause of fatalities. Since the proposed approach is based on the image processing and neural network, the architecture is adaptable and portable to any commercial car with minimal modifications. By this approach speed of the vehicles is controlled. Thus the accidents and rash drive are avoided and saves many people's life. By calculating the distance and by decision support it may be able to provide a sustainable automatic driving without any fault occurrence. This approach makes a cost effective over autonomous car application.

REFERENCES

[1] Jungjin Lee, Younghui Kim, Sangwoo Lee, Bumki Kim, and Junyong Noh "High-Quality Depth Estimation Using an Exemplar 3D Model for Stereo Conversion", 2015.
[2] S. Lee, Y. Kim, J. Lee, K. Kim, K. Lee, and J. Noh "Depth manipulation using disparity histogram analysis for stereoscopic 3D", 2014.
[3] N. Kholgade, T. Simon, A. Efros, and Y. Sheikh "3d object manipulation in a single photograph using stock 3d models", 2013.
[4] Timothy A. Zimmerman, "Neural Network Based Obstacle Avoidance Using Simulated Sensor Data",2014.
[5] USA Department of Energy/ Energy Efficiency and Renewable Energy/ Fuel Economy, Driving More Efficiently Date visited: March 25, 2007 .
[6] European Commission/ Information Society and Media, i2010:Intelligent Car Date visited: March 27, 2007 .
[7] European Commission/ EUROSTAT/ Transportation, Panorama of Transport (2003 edition) Date visited: March 27, 2007 .
[8] A. Nijholt, D. Tan, B. Allison, J. Milan, , and B. Graimann. Braincomputer interfaces for hci and games. In CHI '08: CHI '08 extended abstracts on Human factors in computing systems, pages 3925–3928, 2008 .
[9] Umar Farooq, Muhammad Amar, Muhammad Usman Asad, Athar Hanif, and Syed Omar Saleh, "Design and Implementation of Neural Network Based Controller for Mobile Robot Navigation in Unknown Environments",2014.
[10] Meng, H., Picton, A Neural network motion predictor. Artificial Neural Networks, 1993.,

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