Automated Driving Car Using Image Processing

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Abstract: In day to day life many car accidents occur due to lack of concentration as well as lack of judgement. Automatic Parking system and Automatic Driverless Cars are the current solution for the erupting problems. Multiple cameras are used to guide the car and make it a safer option to ride. An Image Processing Unit is used to store few basic instructions and make the car changes according to the road signs present on the road as well as follow the GPS to reach a specific destination. The car also adjust its speed according to the density of vehicles present on the lane and changes if found significant less density on the other lane.

Keywords: Image acquisition, Histogram, Binary Images

I. INTRODUCTION

According to an observation, every hour 16 people die by road accidents\textsuperscript{[1]}. According to Global Status Report on road safety 2013 by WHO states that every year 1.24 Million people die due to road accidents\textsuperscript{[2]}. Using various concepts of Signal Processing such as Image Processing and Computer Vision along with algorithms of Data Structures we have developed a prototype of an autonomous vehicle with an intention of decreasing the accidents. In this process symbol detection is carried out in a single section while direction responses are carried in the other. Obstacles such as potholes, speed breakers and other objects can be detected using connectivity of pixels, slope of pixels, morphological operations, and connected components at the boundary of the path of the road\textsuperscript{[3]} . Further traffic density is estimated by the grayscale values of vehicles, road, obstacles (in our case white for vehicle and black for the road (binary colors used) thus properly estimating the time to wait at cross roads\textsuperscript{[4]} . Speed of a vehicle and its distance from another vehicle is shown by Histogram.

II. WORKING

a) Video acquisition: Different Cameras mounted on the Car give real time RGB frames. The Compiled program fetches the frames(RGB) from the camera at regular trigger intervals which is set at a particular frame rate. The performance and accuracy depends on the refresh rate and fps.

b) Pre-processing: The images received are converted to GRAY scaled images and then to binary images to apply thresholding algorithms. After it various noise removing algorithms are applied like Median and Gaussian filtering techniques. At last Morphological functions are applied to binary frames with no noise present in it.

c) Detection of Objects: Red layered matrix obtained from processed frames is passed to circle finding functions which locate the road symbols appearing on the way. These objects are located and are circled and compared with the prestored direction matrices. Then the direction images are converted to grayscale and further divided to nine segments. White pixels present in these segments are saved and generate 1D array of different directions\textsuperscript{[5]} . If coordinates of an object are changing for different frames, it implies
that a moving object is detected. The detection process is iterated by checking different frames for particular coordinates [6]. Each of the frame input from video source thus generates two mathematically calculated arrays for the respective right and left direction. The input array from the frame is appended and minimum difference algorithm is applied by simultaneously checking the both the frames for minimum sum of differences. The array that generates the minimum value gives us an exact approximation of the direction that must have been under consideration from the video source.

d) Speed Change : The change of coordinates of moving objects at different time intervals is calculated and stored in an array. Utilizing the array, rate of change of speed is calculated for object around the vehicle [7]. When the direction to be processed is detected then the program initiates the microcontroller with signals in form of pulses modulated according to their width hence effectively controlling the speed of the actuators (motors). Histogram represents tabulated frequencies such as rectangles / triangles erected over discrete intervals with an area proportional to the frequency of observations. It helps in speed variation and monitoring it.

e) Data processing : The Processor calculates everything from the upcoming inputs and revert back by sending active commands. The controller in return transmits the decoded logic for the actuators in form of a binary electrical value to be processed. It is then transmitted to receiver which is fixed on the vehicle. Different signs are stored as data blocks and are matched by using best match algorithm.

III. RESULT

Due to the processing and continuous image capturing, the processor decides accordingly and guides the car accordingly. It follows lane driving and changes lanes if found heavy density on the lane and also variates its speed. It also reads different road symbols present on the road and acts accordingly.
Fig – 2: (i) Left Right Database
(ii) Left Right Gray Scaled Images
(iii) Lane Detection (iv) Road Symbols in different formats

Fig – 3: Histogram of dense traffic
Fig – 4: Histogram Of Empty Roads

Fig – 5: Vehicle Detection on the road

IV. CONCLUSION
Lots of practical applications are found by using this Image Processing Algorithms and further studies are carried out. Due to the above efforts a betterment of the traffic management is occurring and improving its accidental results. This algorithm can be further improved by training our dataset using machine learning algorithms which can lead to much better results with better efficiency due to reduction in processing time and output deliverance and with an up to date technology. Histogram used in this have different usages in other fields too.

V. FUTURE SCOPE
Research on improving latest algorithms and making it more efficient and accurate may help perform better and achieve huge success. Inter-Vehicle communication and corporate driving are the future areas where efficiency could be a matter of fact. Usage of high Pixelated cameras in order for processing clear images to the processor helps in improving the technology. Wireless transmission to the processor is the main area on which research could be carried out.
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