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Review on Car Traffic Sign Annunciator

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ABSTRACT: With more and more applications of on-vehicle information system, the connection between the information system and vehicle network is becoming a trend. The interface between the information system and vehicle is an important communication path which contains all kinds of on-vehicle information. This project presents the advanced driver assistance implementation in real time using traffic symbol recognition based on raspberry Pi. On Raspberry Pi we have OPEN CV software which is used to process the images using Image processing Tool box. The image is then given to raspberry Pi which processes these images using algorithms such as feature extraction, boundary detection, color extraction etc. Depending upon these image processing result the images are identified according to different category and the driver is alerted instantly. Also as soon any symbol is identified the Raspberry Pi will announce the respective symbol via on board speaker system i.e. annunciator and display the road sign on LCD display. Thus alerting the driver of impending danger. The symbol recognition for different Countries which have different symbols for the same action is also being implemented. The user has to choose the country in which he wants to implement the sign annunciator system and then accordingly the symbol database is used.

KEYWORDS: Driver alert system; Raspberry Pi; Image Processing; OPEN CV.

I. INTRODUCTION

In Previous days, vehicular journeys were often determined by topographic occurrences and very few decisions had to be made during travelling. Now a days, because of increasing vehicular traffic on the road, there is a need to study the traffic signs. The first paper on the traffic sign recognition published in Japan in 1984 when the aim was to try computer vision methods for the detection of objects. Since then however, the field has continued to expand at an increasing rate. Traffic sign recognition is used to maintain traffic signs, warn the distracted driver, and prevent his/her actions that can lead an accident. A real-time automatic traffic sign detection and recognition can help the driver, significantly increasing his/her safety. Traffic sign recognition also gets an immense interest lately by large scale companies such as Google, Apple and Volkswagen etc. driven by the market needs for intelligent applications such as autonomous driving, driver assistance systems (ADAS), mobile mapping, Mobileye, Apple, etc. and datasets such as Belgian, German mobile mapping [9].

The main objective of this project is to demonstrate the ability of image processing algorithms on a small computing platform. Specifically create a road sign recognition system based on an embedded system that reads and recognizes road traffic signs. In this project lightweight techniques were mainly used due to limitation of real- time based application and Raspberry Pi capabilities. Raspberry Pi is the main target for the implementation, as it provides an interface between sensors, database, and image processing results. The project work focused on a low cost, specifically a mini embedded computer Raspberry Pi, that is capable of doing everything you would expect a desktop computer to do, from word processing, image processing to playing games[14].

As a result of a survey more than 90 percent of road accidents happen due to the driver mistakes. These mistakes are red signal jumping, over speeding, not following road signs like stop board, speed limit, school crossing etc [8]. So to overcome this problem designing of a system that itself takes the real world data of the traffic and take action by annunciator in the cause driver will not responding according to the traffic signals. Annunciator is basically an audio

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visual warning system, which highlights the fault or mishap which is going on, or even before it happens. This is very necessary for safety concern also, and sometimes the warning comes before improper procedure which warns the operator to avoid unwanted accidents etc. So that we can reduce the human error as well as reduce the traffic problems caused by human due to phone calls and other facilities of entertainment or by the human avoidance of the traffic signals. So, proposed system can assure that the people in the car and outside the car both are saves while travelling to their destinations. System of the car automatically determine the distance of the vehicles a head of our car using IR sensor module accordingly we can slow down or speed up the car. Using IR sensor at the back of the car will also reduce the problem of parking accidents because of unaware of the distance of the obstacles at the back of the car since system will get the distance of the obstacles without seeing it. People will also able to do their work while driving because car itself take the responsibility and perform required action like controlling brakes, speed, wheels control etc.

In order to provide fast processed results, this project aimed to demonstrate use of simple shape recognition algorithms and open source optical character recognition (Tesseract OCR) on Raspberry Pi. Tesseract OCR is an open source optical character recognition module for various operating systems and its development supported by Google since 2006. Tesseract OCR is one of the top character recognition engines in terms of accuracy. Tesseract can detect letters in various forms of images, and it uses the open source C library Leptonica library. In this project, images able to passed to Tesseract OCR and read them. To improve accuracy we had to do pre-processing on images before pass them Tesseract OCR engine. The system can be scaled down to improve the conditions of highly automated driving systems [15].

II. RELATED WORK

When somebody gets ready to drive for the very first time on road, one needs to take many lessons about the road. The most common things the student driver will need are road familiarization, knowledge of traffic rules and road road ethics, learner's license, enrollment in a driving training school etc. Out of all these one fundamental aspect of driving training which should always be taken seriously and mastered before venturing on the road is the comprehensive knowledge of road signs and markings. Every person, he may be a passenger, driver, pedestrian would have noticed along the roadside various sign boards that serve important purposes. These important road paraphernalia help us as route guides, warnings and traffic regulator. As control devices for traffic signs need full attention, respect and appropriate driver's response.[6]

The convention on road signs and signals held on 8th November 1968 lays down the classes of road signs, which were broadly categorized into:

1. Danger warning signs
2. Regulatory signs
3. Informative signs

There are three basic types of traffic signs: signs that gives orders, signs that warn and signs that gives information. Each type has different shape. Circles gives orders, Triangles warn and rectangls inform.

Circles Triangles Rectangles

A further guide to the function of a sign is its colour. Blue circles give a mandatory instructions, such as "Compulsory Turn Left" etc. Blue rectangles are used for information signs. All triangle signs are red.

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STOP GIVE WAY

There are few exceptions to the shape and colour rules, to give certain signs greater prominence. Examples are the "STOP" and "GIVE WAY".

Many techniques have been developed to detect and recognize road signs. Normally, the design of road sign detection and recognition algorithm is composed of two phases: detection and recognition. Color segmentation is the most common method applied for the initial detection of road signs.

Ghisio proposed a procedure with three phases which composed of color segmentation, shape detection and sign classification using neural network. They use RGB color space in order to reduce processing time, and employ simple models of pattern matching, edge detection and geometrical cues in the recognition phase [2].

Lopez and Fuentes detected the road signs in CIELab color space, and modeling color pixels using Gaussian distributions. Their approaches are tested using image sequences with extreme clutter [7].

Wu converted images into HSV color space to detect the road signs. They also used morphological techniques to reduce noise environment. Finally, the road signs are extracted using geometric property [16].

Lalonde and Li described a color indexing approach to isolate the road signs. Road signs are identified by comparing color histogram produced by the extracted road signs images with those pre-stored in a database [10].

Shneier detected the road signs using rules that limit colors and shapes and require signs to appear only in limited regions in an image. Then, road signs are recognized using a template matching method and tracked through a sequence of images [11].

Farag and A. Hakim used Bayesian approach for detecting road signs from input images based on color information. Scale Invariant Feature Transform (SIFT) is employed in order to extract a set of invariant features for detecting the road signs labels. Road sign recognition is done by matching the extracted features with previously stored
features of standard signs [1].

Fang studied an approach for detecting and tracking road signs in complex traffic scenes. In the detection phase, two neural networks are developed to extract color and shape features of traffic signs from the captured images. In the tracking phase, Kalman filter is used to track road signs that are identified in the preceding phase through image sequences [4].

Liu applied Step Genetic Algorithm(Step-GA) and Simple Vector Filter(SVF) for recognizing road signs from moving images. The Step-GA code with search region limits is employed to detect the position and size of the road signs; their SVF was employed to segment the road signs colors [5].

Fawnizu Azmadi Hussin used HSI color space and a simple algorithm based on region of interest (ROI) are used to detect the shape of road signs. The characteristics evaluation in the region of interest (ROI) will indicate the shapes of the road signs whether they are triangular, diamond, rectangular, square, circular or hexagonal. Library templates of a MATLAB-based algorithm are developed by considering shape measurements. The ratios of area and perimeter are finally determined to recognize the actual image of the road signs such as a crossroad sign, a stop sign, and others [3].

Table 1: Summary of various detection and recognition methods

Authors	Year	Detection Algorithm	Recognition Algorithm
Eclasera and Salichs	1997	Color thresholding	Neural network
Escelera	2003	Genetic algorithm	Neural network
Claus Bahlaam	2006	Ada Boost algorithm.	Bayesian generative modeling.
Mourtarde	2007	Shape detection through Hough transform	Neural network
Arlicot	2009	color segmentation	SVM
Oruklu	2013	Color segmentation.	Template matching and Neural network
Chokri Souani	2013	Color segmentation	Neural network
A.T .Hoang	2014	Shape detection through rectangle matching algorithm	-
Karunalithika	2015	OpenCV Library is used for	Mobile based application

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		detection	
Rihab Hamida	2016	Color segmentation based on Xilinx System Generator	Simulink model based on Xilinx System Generator

Most of the previous work is done on the MATLAB software for detection and recognition of road traffic signs. As i want to develop the real time based portable system for road sign detection and recognition, I can't use the MATLAB software because it do not supports to every OS and requires large memory space for installation. For these reasons, I m using OPEN CV software instead of MATLAB for image processing.

This project is an extension to the previous work which provide the portable system for traffic sign detection, recognition and annunciation based on raspberry pi. This system provides several enhancements to the proposed shape classification methods in order to select the best technique with high efficiency and less processing time for the implementation in embedded systems. I use Haar Classifier for shape detection and LBP (Local Binary Pattern) classifier for colour detection and recognition of road traffic signs.

III. PROPOSED METHODOLOGY

To design a good recognition system, the system needs to have a good discriminative power and a low computational cost. The system should be robust to the changes in the geometry of sign (such as vertical or horizontal orientation) and to image noise in general. Next the recognition should be started quickly in order to keep the balanced flow in the pipeline of Raspberry Pi allowing for processing of data in real time. Finally, the optical character recognition engine must be able to interpret a pre-processed image into a text file.

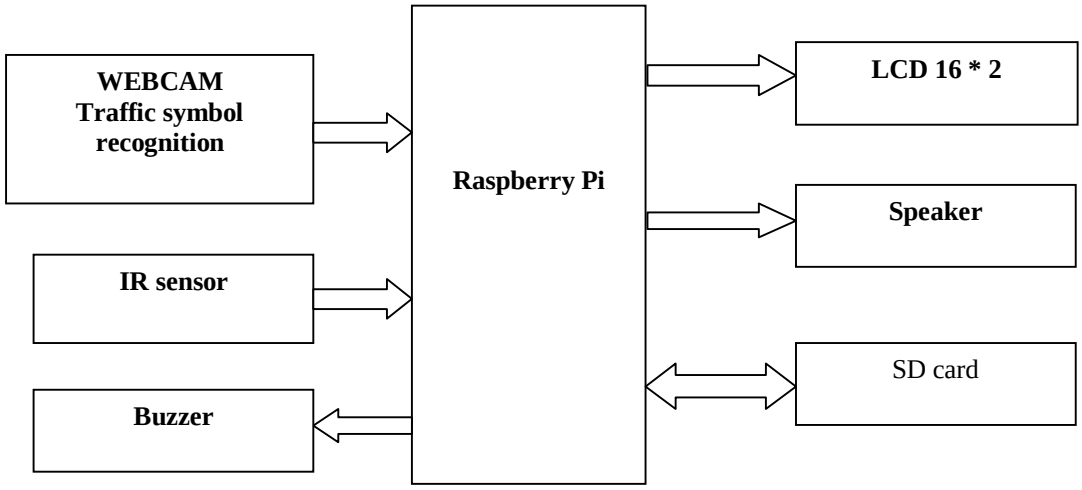

Figure 1. Block Diagram of Car Traffic Sign Annunciator

Here the webcam is connected to one of the USB ports of raspberry Pi. On Raspberry Pi we have OPEN CV software which is used to process the images using Image processing Tool box [12]. The Image is then given to raspberry Pi which processes these images using algorithms such as Feature extraction, boundary detection, Color extraction etc. I use Haar Classifier for shape detection and LBP (Local Binary Pattern) classifier for colour detection, recognition and classification of road traffic signs. Depending upon these image processing result the Images is identified according to different category and the driver is alerted instantly. Also as soon any symbol is identified the Raspberry Pi will announce the respective symbol via on board speaker system. Proposed system helps to solve the parking problems with the help of IR sensors which will detect the obstacles. Thus alerting the driver of impending danger.

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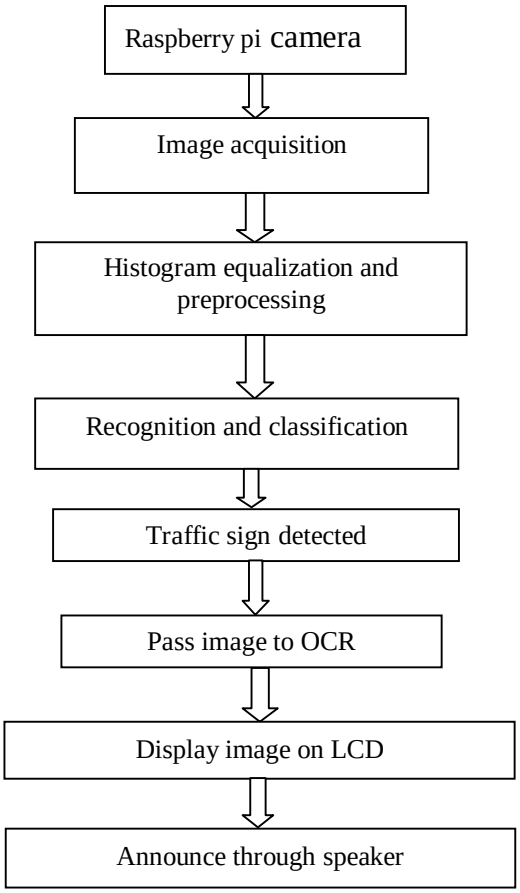

Figure 2. The Road Traffic Sign Detection And Recognition Flow Chart

The flowchart of the proposed method is shown in Figure 3. The identification of the speed signs is achieved by two main stages: detection and recognition. In the detection phase the image is pre- processed, enhanced, and segmented according to sign properties such as color, shape, and dimension. The output of segmented image contains potential regions, which can be recognized as possible traffic signs. The effectiveness and speed are the important factors throughout the whole process, because capturing images from the video port of Raspberry Pi and processing images as they come into to the pipe should be synchronized. After detection and recognition of traffic signs through OCR, it will be display on LCD and announce through the on board speaker.

This system has advantages such as high stability, good reliability, high precision, a higher real-time of driver assistance, high degree of automation. This is Cost-effective and also provides a long-time and continuous observation. This system can be used in Public transport, Ambulances, Cabs etc.

IV. CONCLUSIONS

This project is an extension to the previous work which provides the portable system for traffic sign detection, recognition and annunciation based on raspberry pi. As compare to the other softwares such as MATLAB, Xilinx etc for image processing, OPEN CV software has more advantages in terms of memory space, supportable to every OS,

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less processing time, high efficiency. Therefore, I used OPEN CV library which has Haar Classifier for shape detection and LBP (Local Binary Pattern) classifier for colour detection and recognition of road traffic signs.

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