Raspberry Pi Based Road Sign Recognition System with Additional Safety Parameters Using Image Processing

V.Kumaravel[1], R.Sharmila gowri[2]
[1]PG Student, Jay Shriram Group of Institutions, Tiruppur, INDIA
[2]Assistant Professor, Jay Shriram Group of Institutions, Tiruppur, INDIA

ABSTRACT

At present situation the Human beings are faced many accidents during the road way transportation. At the same time they lose our life and valuable properties in those accidents. To avoid these problems the system designed with the help of two main processors (Raspberry pi and PIC microcontroller). The Digital image processing plays important role in the sign capturing and detection system. The image processing algorithms to takes the necessary action for resizing the captured signs.The Raspberry pi camera port used to capturing the road signs with image enhancement techniques. The embedded system small computing platform studies the characteristics of speed signs. In that daylight vision time to take the shape analysis for recognizing the signs using edge detection algorithms. After that the night time travelling to detect the speed signs using color enhancement techniques. To avoid the circuit complexity the additional parameters added with the PIC microcontroller likewise automatic headlight dimming system using LDR sensor, vehicle collision avoidance system using ultrasonic sensor and tire pressure measurement system using pressure sensor.

Keywords-- Digital Image Processing, Raspberry Pi, Embedded System, Road Sign recognition,LDR sensor,PIC microcontroller,ultrasonic sensor,pressure sensor

I.   INTRODUCTION

The road sign recognition system is not very old with the system on the topic published in 1984. In this method the computer vision tries to recognize the signs.

A real-time automatic road sign detection and recognition system can help the driver, significantly increasing passenger's safety. Road sign detection and recognition system also implemented lately by many companies. In earlier days the drivers detect the road signs manually. But now the Autonomous Driving Assistance System (ADAS) can easily to recognize the signs using raspberry pi camera module. This system worked focused on a low cost, off the shelf solution, a mini embedded computer Raspberry Pi. That is capable of doing everything that one would expect a desktop computer to do, from word processing, image processing to playing games. The system has originally been developed by Raspberry Pi Foundation in an effort to give young people an easy solution to learn coding and computer programming.

The requirement of headlight is a necessity during night travel. The same headlight which assists the driver for create the glare is responsible for many accidents. The driver has the control of the headlight which can be switched from high beam (bright) to low beam (dim). During the travelling time the opposite vehicle to switched the headlight manually in recent days. But sometimes cannot switch the circuit in that time to create blind spot of oncoming vehicles. To avoid these problems using the automatic headlight dimming system can easily to switch their vehicle's headlight system using LDR circuitry.

The vehicle collision avoidance system is also connected with the controller unit. In this parameter the ultrasonic sensor used to avoid the vehicle collision.

The tire pressure measurement system is easily connected the peripheral port of PIC microcontroller. The system can implemented the additional parameter for passenger's safety.

II.   PROPOSED METHOD

The proposed system has been used the PIC 16F877A micro controller for additional safety parameters likewise automatic automobile headlight dimming system and vehicle collision avoidance system Additionally the tire pressure measurement system is combined with the above processor to avoid the circuit complexity.

The Raspberry pi processor is a small sized

embedded computer. This processor having many developed versions is available in the market. But in this system used the Raspberry Pi 3 model B. It is shown in Figure1. In this system support the following operating systems Raspbian, Fedora, Ubuntu. The basic software tool is required for OpenCV with any of the above programming languages.
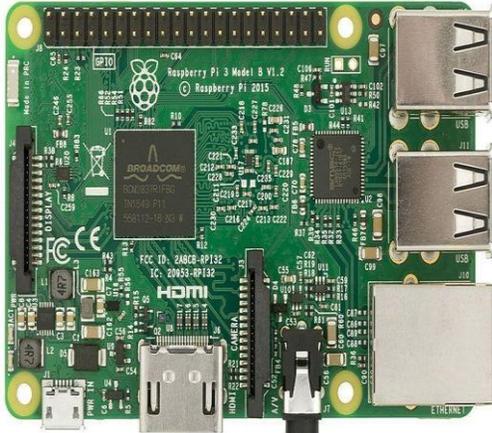
Figure -1: Raspberry Pi 3 model B

To design a good road sign recognition and detection system, the system requireshaving 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. The general block diagram 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 speed 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.

A.ROAD SIGN RECOGNITION SYSTEM

A Raspberry Pi is capable of capturing a sequence of images rapidly by utilizing its video- capture port with JPEG encoder. However several issues need to be considered:

• The video port of rasperry pi processor is captured the road signs in the time of traveling. The particular sign is processed by the following parameters to done the proposed system operation.

•The JPEG encoded captured images do not have exitinformation (no coordinates, time, not exchangeable).
• The video-port captured images are usually"more fragmented" than the still port capture images, so before we go through pre-processed images may need to apply more denoising algorithms.
• All capture methods found in OpenCV (capture, capture continuous, capture sequence) have to be considered according their use and abilities. In this system, the capture sequence method was chosen, as it is the fastest method by far.

Using the capture sequence method our Raspberry Picamera is able to capture images in rate of 20fps at a 640×480 resolution. One of the major issues with the Raspberry Pi when capturing images rapidly is bandwidth. The I/O bandwidth of Raspberry Pi is very limited, and the format of systemsare pulling pictures Ultrasonic ranging and detecting device makes the process even less efficient. In addition, if the SD card size is not large enough, the card will not be able to hold all pictures that are being captured by camera port, leading to cache exhaustion.

In this case the Global Interpreter Lock is really helpful to ensure consistency between the way of our thinking and between threads. Technical details about GIL can be researched by Python repository

The system look at the pictures of speed signs, the most defining feature of a speed sign is rectangular shape with mostly round edges. Before finding the rectangles in a captured image, the system retrieve the contours, thus the shape detection algorithm employed loops through a subset of contours and checks if the contour shape is rectangle. The shape detection is based on the OpenCV's Python implementation preceded by filtering and edge detection.

The available road signs are classified into four shapes. Such as square, rectangular, round and triangular

During the travelling time the camera port detect the road sign means immediately that signal given into the processor. The automatic breaking system is applied for the vehicle when entered into the restricted zone.

The round shape signs are given the more importance than the other shape signs. When the round shaped signs are received by the camera means the vehicle speed is reduced to the notified value. Any other shaped signs are located means the system given the notification via buzzer.

The image processing technique takes the necessary action when the histogram value can be equalized with the original image.

Many peripheral ports are available In the Raspberry pi processor. The receiving images are getting some difficulties to the practical life. So the corresponding python coding can be achieve the image resizing operation. Many signs are getting the blurred image quality in this approach the system can easily handled the image

enhancement techniques to improve the image quality up to normal value.
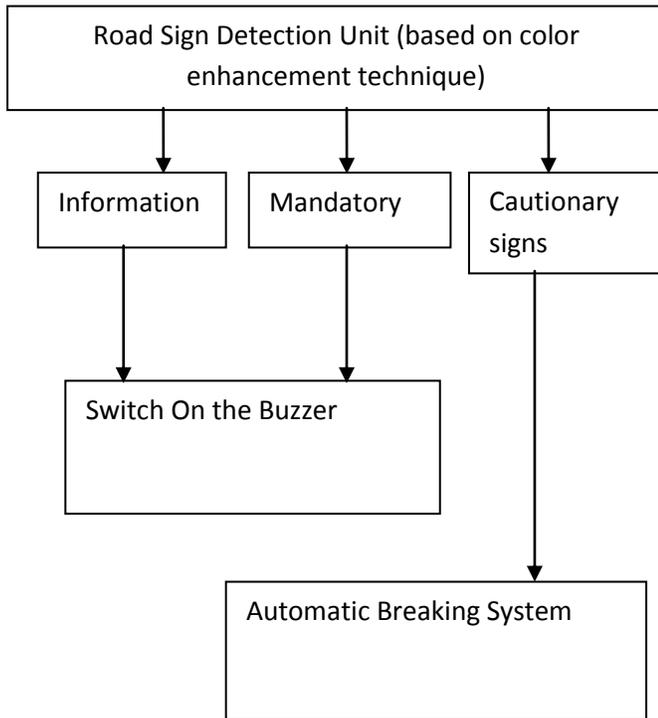
Figure -2:Operation of the system based on color

The road signs are basically available four major shapes (Round, Triangular, Rectangular and Square) in India.

The Road sign recognition system detected the signs in the form of Information and Mandatory sign means the system triggered the buzzer to give notification to the driver or otherwise the cautionary sign is detected means immediately applying the Automatic Breaking System (ABS) in the particular zone only it is shown in Figure 2. After crossing the restricted zone the ABS removed automatically.
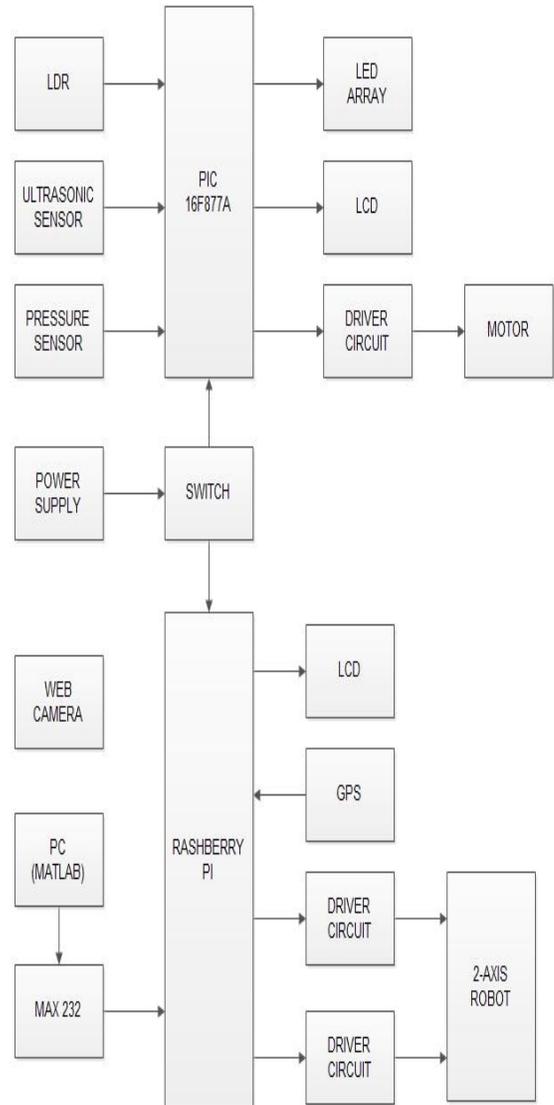
Figure -3:General block diagram

B. VEHICLE COLLISION AVIODANCE SYSTEM
i. Ultrasonic Transducer

The Ultrasonic transducer**s** are divided into three categories: transmitters, receivers and transceivers. Transmitters convert electricalinto ultrasonic sound, receivers convert ultrasonic sound into electrical signals, and transceivers can both transmit and receive ultrasonic sound.

The system shown in Figure 4. The ultrasonic sensors are fixed in front of the vehicle. Any objects moving in front of our vehicle means immediately given the notification to the driver.
ii. Driving circuit

It consists of a 555 timer working in an astable multivibrator mode. This mode is designed to generate a square wave of frequency 40 kHz. This circuit is responsible for combine the ultrasonic transducer.

iii. Motors

150 RPM maximum speed permanent magnet DC motors are using in this system. These motors are interfaced to the microcontroller through the motor drivers

iv.LCD (liquid crystal display)

The LCD is used to display which obstacles are detected in front of our vehicle. This device uses very small amount of electric power.

v. Buzzer

A buzzer device is used to get the notification in the form of beep sound.This device used in this project when that the ultrasonic sensors can detect the obstacle on the road.
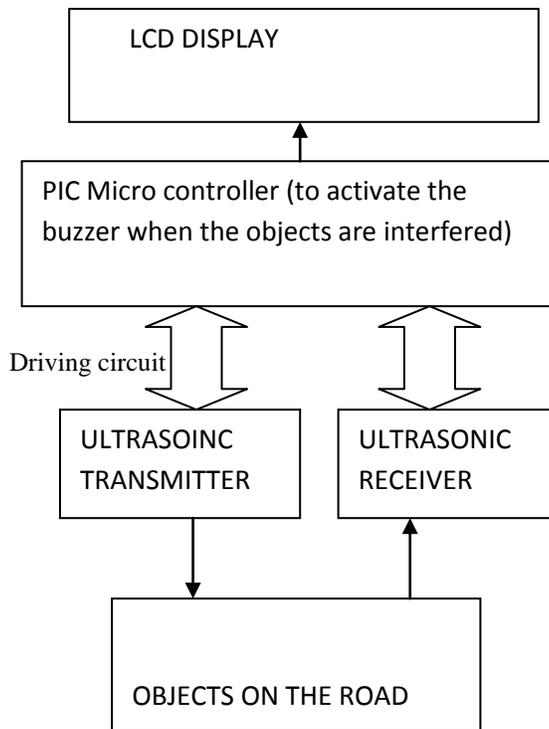

Figure -4: Vehicle collision avoidance system

C.AUTOMATIC AUTOMOBILE HEADLIGHT DIMMING SYSTEM

The headlight requirement of night time travelling is necessary. But this headlight system some time creates the major accidents for driver's carelessness. So the system designed for headlight dimming operation switched as automatically based on the oncoming vehicle's headlight intensity using LDR sensor.

The LDR sensors are fixed on front of our vehicle that sensors are connected with the controller. The additional safety parameters using PIC 16F877A are shown in Figure5**.**

Oncoming vehicles does not switching the headlight operation manually means our headlight dimming system is perform the switching operation when the oncoming vehicles entering into the particular zone. After crossing the zone the headlight system is automatically switched into the bright state.
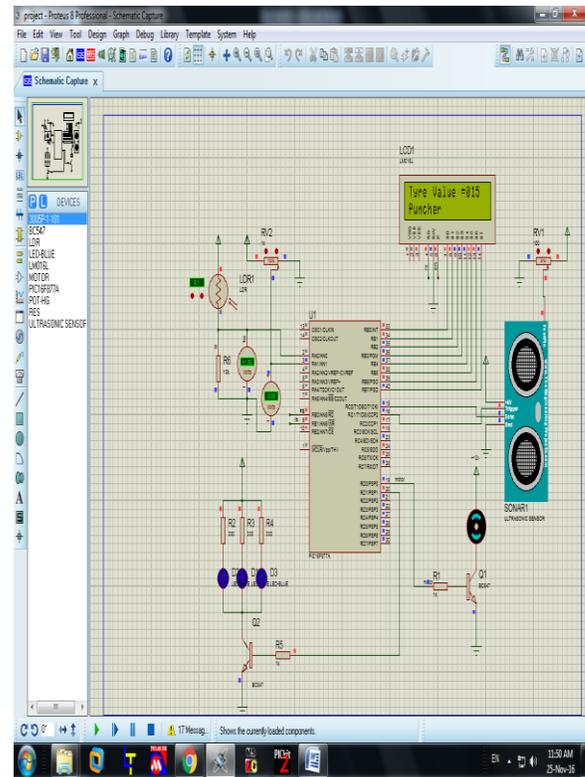

Figure -5: Additional Safety Parameters using PIC 16F877A

III. CONCLUSION AND FUTURE WORK

The proposed work is split into two parts. It is called as "detection" and "recognition". In the detection part, edge detection algorithms were used because color-based segmentation in night time is much less reliable than shape-based segmentation. In similar cases to speed sign detection, they were many different techniques used such as genetic algorithms, artificial neural networks, and Hough transforms based algorithms.

The system designed focused on real-time sign processing, however, for future work the system can found the direction and oncoming vehicles headlight intensity control. The designed system should have the good efficiency and less weight compared to the old one. Tire pressure measurement system output is given to the controller via wireless medium.

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