



# ACCIDENT PREVENTION AND COLLISION AVOIDANCE

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**ABSTRACT** — *In the time of road way travelling the peoples can suffering on many accidents for driver's carelessness to detect the road signs. Instead of avoid these problems we have designed the automatic road sign recognition system using raspberry pi processor. The system can help the driver to detect the road signs and automatically reduce the vehicle's speed. This system also increasing the passenger safety during travelling time. For avoiding rash driving of the drivers and from accidents, the system has designed with the help of two main controllers Raspberry pi and PIC microcontroller. The Digital image processing takes major place in a road sign recognition system. The system reads and recognizes the speed signs using image processing techniques based on shape and dimension analysis. During night time travels the system can easily identified the road signs by colour shape detection. Raspberry pi processor provides an interface between sensors, database and image processing results. Apart from this an another unit i.e. the PIC controller unit gives a major play to the vehicle by controlling the small signaling parts, which may cause to an major issue in future for example puncher of tires, headlight failures etc. To avoid these issues while driving, the indication of tire pressure is done displayed in the screen and the headlight dimming is controlled by the use of LDR sensor. As well as, in addition to this system have added the control of motors through ultrasonic sensors which are very helpful to avoid accidents and it maintains a gentlemen distance to the fronted vehicles. Hence through this, the performance of the vehicle is controlled automatically according to the situation .*

**Keywords**— Open CV, road sign recognition, raspberry pi , LDR sensor, Ultrasonic sensor

## I.INTRODUCTION

Image processing is the examining of any algorithm that takes pictures as input and returns the processed picture as output. Image Processing is widely divided into analog and digital image processing. Analog image processing may be used for the hard copies like printouts and pictures. Image analysts use various basics of interpretation while using these visual methods. Digital image processing technique helps in manipulation of digital image by using computers. All forms of data undergo pre-processing, enhancement and feature extraction while using digital technique.

Computer vision is a process by which we can understand the images and videos how they are stored and how we can manipulate and retrieve data from them. Computer Vision is the base or mostly used for Artificial Intelligence. Computer-Vision is playing a major role in self-driving cars, robotics as well as in photo correction apps. OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as Numpy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features. The first OpenCV version was 1.0. OpenCV is released under a BSD license and hence it's free for both academic and commercial use. It has C++, C, Python and Java interfaces and supports Windows, Linux, Mac OS, iOS and Android. When OpenCV was designed the main focus was real-time applications for computational efficiency. All things are written in optimized C/C++ to take advantage of multi-core processing.

#### Applications of open CV:

There are lots of applications which are solved using OpenCV, some of them are listed below

- face recognition
- Automated inspection and surveillance number of people – count (foottraffic in a mall, etc)
- Vehicle counting on highways along with their speeds
- Interactive art installations
- Anamoly (defect) detection in the manufacturing process (the odd defective products)
- Street view image stitching
- Video/image search and retrieval
- Robot and driver-less car navigation and control
- object recognition
- Medical image analysis

## II. METHODOLOGY

The proposed system demonstrates how Open CV can effectively help overcome these challenges. The implementation of system is divided into two parts:

### 2.1 Accident prevention

In the time of road way travelling the peoples can suffering on many accidents for driver's carelessness to detect the road signs. Instead of avoid these problems to design the automatic road sign recognition system using raspberry pi processor. The system can help the driver to detect the road signs and automatically reduce the vehicle's speed. This system also increasing the passenger safety during travelling time. The mini embedded computer (Raspberry pi) having many port connections to interface the external devices. The headlight requirement is necessary for night time travel. But now a day the headlight system is responsible for many accidents. The drivers have the control of headlight switching system which can be switched from high beam (bright) to low beam (dim). But in some time the drivers does not switched the headlight system it can be create the temporary blindspot for oncoming vehicles at the particular time involuntary closing the driver's eyes. This phenomenon is the main reason for road accidents at night time.

### 2.2 Collision avoidance

To avoid these type of accidents to design the automatic automobile headlight switching system. The designed system can be easily switched from high beam (bright) to low beam (dim).

The LDR based electronic circuitry arrangement which senses the illumination of light from oncoming vehicles to perform the switching operation. The vehicle collision avoidance system is combined with the above systems. It is also a vehicle safety system. It should be designed to avoid the collision of two vehicles in same direction. It is also known as precrash system. The ultrasonic sensors are fixed in front of the vehicles. To approaching the sensed data through database if any vehicle going in front of our vehicle means immediately applying the automatic breaking system during this situation our vehicle cannot entering into the 10 feet distance.

Additionally the tire pressure measurement system is also combined with the above systems. Now a day the drivers must be checked the tire pressure is done by manually. so the system was designed to check the tire pressure automatically. The pressure sensor senses the current tire pressure value and given the notification on the LCD display to view the drivers lagging.

## III. SYSTEM ANALYSIS

### 3.1 Existing system

On reviewing the existing methodologies the Headlights of vehicles pose a great danger during night driving. The drivers of most vehicles use high, bright beam while driving at night. This causes a discomfort to the person travelling from the opposite direction. He experiences a sudden glare for a short period of time. This is caused due to the high intense headlight beam from the other vehicle coming towards him from the opposite direction. We are expected to dim the headlight to avoid this glare. This glare causes a temporary blindness to a person resulting in road accidents during the night.

To avoid such incidents, they have fabricated a prototype of automatic headlight dimmer. This automatically switches the high beam into low beam thus reducing the glare effect by sensing the approaching vehicle. It also eliminates the requirement of manual switching by the driver which is not done at all times. but this system uses LDR for light detection. Signal transmission in the system is done using Zigbee module. In urban areas this system becomes inefficient. The usage of Zigbee module in the system is not essential. Only the vehicles at close range are detected by the system.

### 3.2 disadvantages

- No camera-based signal detection
- No indicator
- With controller application
- Suffering on many accidents for driver's carelessness to detect the road signs.

## IV. PROPOSED TECHNIQUES

In our proposed systems recognize speed limit signs, stop signs and warning signs such as pedestrian crossing, railroad crossing etc along with Raspberry pi. The proposed system has been used the micro controller for vehicle collision avoidance system and automatic headlight switching system user can be manually controlled the switch to achieve which operations it should be performed. These processors are having lightweight techniques so both processors can be used easily in real time application. A micro controller for additional safety parameters likewise automatic automobile headlight dimming system and vehicle collision avoidance system The Raspberry pi processor is a small sized. This processor having many developed versions is available in the market. But in this system used the Raspberry Pi 3 model B. 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.

### 4.1 CLAHE-CONTRASTLIMITED ADAPTIVEHISTOGRAM EQUALIZATION

The visibility of local details of an image by increasing the contrast of local regions can be enhanced by using the Contrast Limited Adaptive Histogram Equalization (CLAHE) technique. CLAHE is an adaptive contrast enhancement method. It is based on Adaptive Histogram Equalization, where the histogram is calculated for the contextual region of a pixel. Depending upon the pixel's intensity rank in the local intensity histogram, the pixel's intensity is transformed to a value within the display range in a proportional manner.

### 4.2 SEGMENTATION

The setting of few pixel values in a digital image to zero or few other to background values is defined as masking. Following two ways are accustomed to mask a digital image.

- An image is utilized as a mask. A masked image is a combination of few zeros and non zeros.
- Within the mask image when the pixel intensity value is zero, then the resulting masked image are going to be set to the background pixel intensity value (normally zero).
- A set of Region of Interest is employed as mask. The mask is defined using each slice of the Region of Interest.

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Masking is performed on individual slices or whole images.

- Soft masking is performed with the help of the Region of Interest as mask to place the intensity of masked pixels value that depends on an individual pixel values inside the mask but not to the background value.

The pixel values in the masked image do not change but the same intensity is left in the image as same as the input image. The Masking Algorithm resultant is a binary image. The Masking Algorithm takes the enhanced image as the input image and performs the masking operation. In the new image pixel intensity value is set to zero and remaining to chosen background intensity values where the new image is the replica of the input image. The masking of the image can be performed by using the HSV image intensity values. Depending on the HSV image intensity values the oil spilled regions will be represented as 1 and the normal regions of the sea will be represented as 0.

### 4.3 BINARY CONVERSION

A binary image could be a digital image. It has only two possible values for every pixel. White and Black are the two typical colors used to represent a binary image. The object(s) in the image uses the foreground color while the rest of the image uses the background color. In the document-scanning industry, this can be often mentioned as “bi-tonal”.

Binary images are also mentioned as bi-level or two-level. This describes that every pixel is stored as a single bit. The colors black and white (B&W), monochrome are frequently used for the binary image concept, but may also allow any kind of images that have only one sample per pixel, such as grayscale images.

A binary image is the one that has a picture as the same in "Bitmap" mode in Photoshop. Binary images frequently arise in digital image processing in the form of masks or as a result of certain processes such as segmentation, threshold and dithering. Some input and output devices namely laser printers, fax machines and bi-level computer displays can only manage bi-level images.

A binary image can be saved in memory as a bitmap which is known as a packed array of bits. A 640×480 picture needs 37.5 KB of storage. Because of the small size of the picture files, fax machine and document management solutions generally use this format. Most of the binary images compress well with the simple run-length compression schemes.

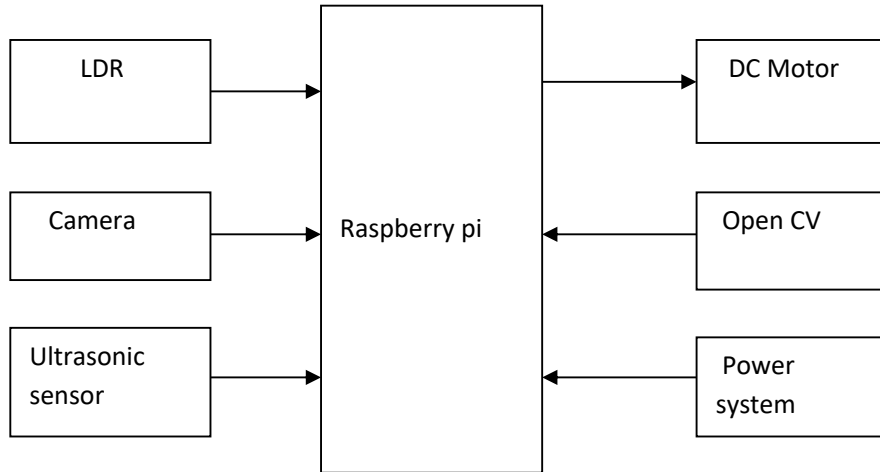
Binary images are developed from color images by the process of segmentation. Segmentation is the process of distributing each pixel in the source image to two or more classes. If there are more than two classes then the usual outcome is several binary images.

The Otsu's method is probably the simplest form of segmentation which creates pixels to foreground or background based on the grayscale intensity. The other method is the watershed algorithm. Edge detection often generates a binary image with few pixels assigned to edge pixels, and it also operates as the first step in further segmentation.



**V. PROPOSED SYSTEM**

**5.1 block diagram of hardware setup**



**Figure 5.1Block diagram of hardware setup**

**5.2 Road sign detection and recognition system**

Raspberry pi is capturing the road signs using web camera module. The captured signs are processed by a JPEG encoder which result gives the resized signs suitable for image processing results the captured sign is processed.

- I. Mandatory signs: These types of signs are always available in a round shaped with red border.
- II. Cautionary signs: These types of signs are always available in triangular shape with red border.
- III. Information signs: These types of signs are always available in square shape with blue border.
- IV. Additional signs: All the signs except for the above types of codes known as additional signs.

Which is suitable for above for classification of signs. It is co incident for mandatory, additional signs and information signs it. Which means the system given the warning signal to driver or otherwise the sign co-incidents with the cautionary means immediately applying the Automatic Braking System (ABS) to reduce the speed of the vehicle up to notified value. After crossing the restricted area, the automatic braking system can be released their force to help increasing the speed of the vehicle. When the vehicle entering into the restricted zone immediately the automatic braking system can easily trigger into ON state at the same time the driver can be operated at the manual braking system is also possible. The edge detection technique is used to detect the signs and converted into binary format. Here canny edge detection system is guided by the sign detection system.

The Adaboost algorithm gives the supervised pattern recognizing system to enhance the input recognition procedure to weak classified detected signs. In most of the road sign image quality is improved by the open-source optical character recognition engine.

### **5.3 . Automatic headlight switching system**

The sensing network (LDR) is fixed in front of the vehicles and this network are connected with the headlight switching circuit to LDR. When the vehicles are coming in the opposite direction to give the high illumination (high beam) to our vehicle during running time at the same time LDR detect the high beam signal and it gives to the switching network. This network can be switched the signal in high beam to low beam.

### **5.4 Vehicle collision avoidance system**

The ultrasonic sensors are worked with in 2cm to 3m . It is like a transducer to convert the sound wave into electrical signal. These sensor networks are fixed in front of the vehicle. When the sensor detects the obstacle in front of our vehicle at the time sensor get the sound waves. This signal is converted into an electrical signal after that the signal is given into the microcontroller circuit. The processor is triggered to automatic braking system.

### **5.5 Light beam controller**

Modern automotive vehicles include a variety of different lamps to provide illumination under different operating conditions. Headlamps are typically controlled to alternately generate low beams and high beams. Low beams provide less illumination and are used at night to illuminate the forward path when other vehicles are present. High beams provide significantly lighter and are used to illuminate the vehicle's forward path when other vehicles are not present. Daylight running lights have also begun to experience wide- spread acceptance.

High beam is used for illuminating a road doesn't have very much traffic on it. By that way the driver can see further ahead for any road obstructions. High beam is also used when a driver is one an unfamiliar road and if there isn't much in the way of lighting such as street lamps.

Automatic high beam, as explained is opposite beam detector. An- other probable application of automatic high beam is our high beam response due to another high beam and automatically our high beam becoming low. Now a day there are many accidents that cause from the beam light. Our work proposes an effective automatic control of the vehicle headlamps based on the detection of head lights and tail lights under night time road conditions. This project is about to control high/low beam automatically. This project will make sure that the con- summer will save their time and energy also for those who have the illness of nervous. This project will not be disturbing any manual function of the beam.

### **5.5 Open CV**

OpenCV (Open-Source Computer Vision Library) is an Application Programming Interface (API) developed by Intel which can be used for many image processing and computer vision applications. OpenCV officially launched in 1999 and the project was initially an Intel Research initiative to advance CPU-intensive applications. OpenCV library is a collection of algorithms and C/C++



functions and a few classes that implement some Image processing and computer vision algorithms. There is active development on interfaces for C, C++, Python, Ruby, MATLAB and other languages. OpenCV was designed for computational efficiency and with a strong focus on real time applications. OpenCV is written in optimised C and can take advantage of multicore processors

### 5.6 Raspberry pi

The Raspberry pi is a single computer board with credit card size that can be used for many tasks that your computer does, like games, word processing, spreadsheets and also to play HD video. It was established by the Raspberry pi foundation from the UK. It has been ready for public consumption since 2012 with the idea of making a low-cost educational microcomputer for students and children. The main purpose of designing the raspberry pi board is, to encourage learning, experimentation and innovation for school level students. The raspberry pi board is a portable and low cost.

### 5.7 Ultrasonic sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e., the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target). In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is  $D = \frac{1}{2} T \times C$  (where D is the distance, T is the time, and C is the speed of sound) Ultrasonic sensors are used primarily as proximity sensors. They can be found in automobile self-parking technology and anti-collision safety systems. Ultrasonic sensors are also used in robotic obstacle detection systems, as well as manufacturing technology.

### 5.8 Camera

Cameras for image processing systems are categorized either as industrial/machine vision (MV) or network/IP (Internet Protocol) cameras. Network cameras record videos. They are frequently used in classical surveillance applications and in combination with industrial cameras. Some of their typical characteristics: often placed within robust casings designed to be resistant to jolts and harsh weather, making them suited for use indoors or out.

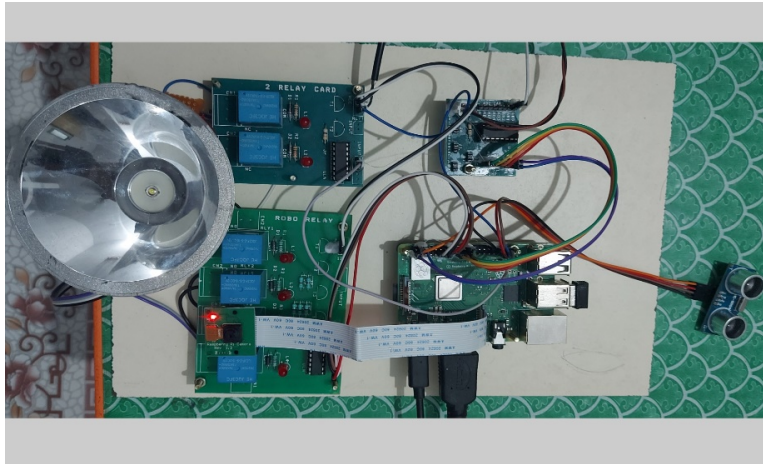
a variety of functions such as day/night modes and special infrared filters deliver outstanding image quality even under extremely poor lighting and weather conditions they compress the images they record. This reduces the volume of data to such a degree that it can be stored in the camera. By connecting to a network, a theoretically unlimited number of users can also access the camera. Industrial cameras, by contrast, send the images as uncompressed ('raw') data directly to the PC; The PC is then responsible for processing the relatively large volume of data. The benefit of this method is that no image information is lost. Industrial cameras comprise two technologies: area and line scan cameras. They capture images differently, which is relevant to the type of vision application.





## VI.RESULTS AND DISCUSSION

In this section we have presented the results of the experiments conducted with the proposed hardware design.



**Figure 6.1 Hardware setup**

The figure 6.1 consist of raspberry pi , raspberry pi camera , dc motor,head light, ultrasonic sensor, 4 channel and 2 channel 5v relay modules .

In this system we have introduced road sign recognition based on raspberry pi and automatic headlight dimming system with vechile collision avoidance using image processing



**Figure 6.2 road signs of school zone and hospital zone**

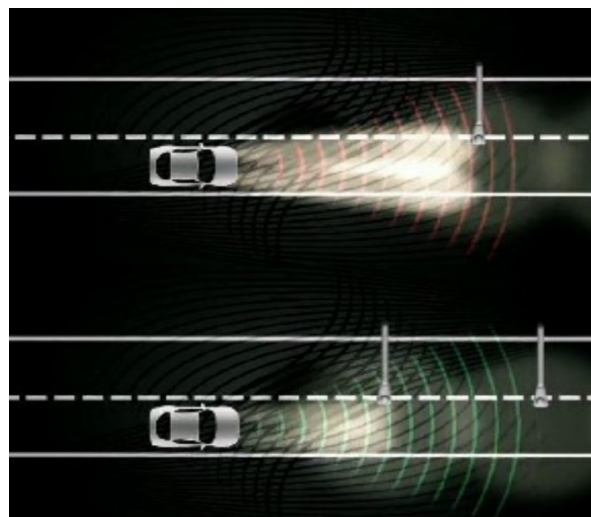
From the figure 6.2 shows the road sign these signs are captured by the raspberry pi camera . The captured signs are processed by a JPEG encoder which result gives the resized signs suitable for image processing results

```

pi@raspberrypi: ~/rpi-vision
File Edit Tabs Help
[9]
[[0.00025409 0.00066142 0.0003752 0.00032472 0.00045395 0.0003387
0.00029221 0.00039464 0.0010434 0.99435586 0.00014347 0.00019741
0.00116496]]
Ldr=0.0341963849535909
Hospital Zone
Measured Distance = 187.6 cm
Current Speed= 62.5
[9]
[[0.00496637 0.2388243 0.00515308 0.12436305 0.07441363 0.05706912
0.00621979 0.03241638 0.00693726 0.04122328 0.18146631 0.023249
0.2036983 ]]
Ldr=0.02442598925256556
No Right Turn
Measured Distance = 20.0 cm
Current Speed= 6.7
[1]
[[0.00025837 0.00069499 0.00080244 0.00100543 0.00097753 0.0009088
0.00387594 0.980022 0.00345256 0.00454018 0.000424 0.00136849
0.00166922]]
Ldr=0.02442598925256556
Speed Limit 50
Current Speed= 50
    
```

**Figure 6.3 road sign recognition**

The figure 6.3 shows how the process runs using raspberry pi . the system given the warning signal to driver or otherwise the sign co-incident with the cautionary means immediately applying the Automatic Breaking System(ABS) to reduce the speed of the vehicle up to notified value. After crossing the restricted area the automatic breaking system can be released their force to help increasing the speed of the vehicle.

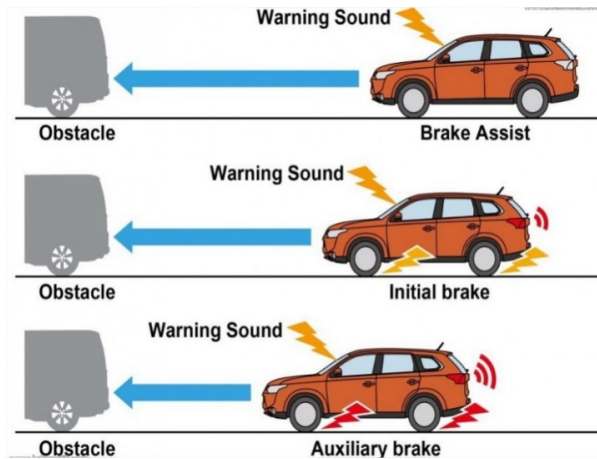


**Figure 6.4 automatic headlight switching**

The figure 6.4 shows how the head light switching is done. The sensing network (LDR) is fixed in front of the vehicles and this network are connected with the headlight switching circuit to LDR. When the vehicles are coming in the opposite direction to give the high illumination (high beam) to



our vehicle during running time at the same time LDR detect the high beam signal and it gives to the switching network. This network can be switched the signal in high beam to low beam.



**Figure 6.5 collision avoidance**

The ultrasonic sensors are worked with in 2cm to 3m it is shown in Figure 6.5. It likes a transducer to convert the sound wave into electrical signal. These sensor networks are fixed in front of the vehicle. When the sensor detects the obstacle in front of our vehicle at the time sensor get the sound waves. This signal is converted into an electrical signal after that the signal is given into the microcontroller circuit. The processor is triggered to automatic breaking system

**VII.CONCLUSION AND FUTURESCOPE**

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 signal detection, there were many different techniques used such as genetic algorithms, artificial neural networks, and Hough transforms based algorithms.

The system designed focused on real-time signal processing, however, for future work the system can find 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. The Raspberry pi processor implemented focused on real-time video processing, however, for future work, the use of car's dynamics (direction, trajectory, speed changes etc.) The video capturing mode is activated by a raspberry pi processor itself it should be replaced the LTE based design is also acceptable for the basic road sign video mode capturing with good colour enhancement algorithms.

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