Project Report (BT-3074)

on

Traffic Sign Recognition Using OpenCV: A driver assistance system

Submitted in partial fulfillment of

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degree of

Bachelors of Technology (Computer Science)

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Under The Supervision of

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SCHOOL OF COMPUTING SCIENCE AND ENGINEERING
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CANDIDATE'S DECLARATION

We hereby certify that the work which is being presented in the project, entitled "**TRAFFIC SIGN RECOGNITION USING OpenCV**" in partial fulfillment of the requirements for the award of the **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING** submitted in the School of Computing Science and Engineering of Galgotias University, Greater Noida, is an original work carried out during the period of **JULY-2021 to DECEMBER-2021**, under the supervision of **Mr. A. Arul Prakash Associate Professor, Department of Computer Science and Engineering** of School of Computing Science and Engineering , Galgotias University, Greater Noida

The matter presented in the thesis/project/dissertation has not been submitted by us for the award of any other degree of this or any other places.

19SCSE1010363 – SYED UMAR HUSAIN

19SCSE1010538 – SOMDUTT VASHISHTHA

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

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CERTIFICATE

The Final Thesis/Project/ Dissertation Viva-Voce examination of **SYED UMAR HUSAIN-19SCSE1010363, SOMDUTT VASHISHTHA-19SCSE1010538** has been held on __________________ and his/her work is recommended for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING**

Signature of Examiner(s) **Signature of Supervisor(s)**

Signature of Project Coordinator **Signature of Dean**

Date: December, 2021

Place: Greater Noida

ABSTRACT

Traffic sign recognition (TSR) is one amongst the foremost necessary background analysis topics for enabling autonomous vehicle driving systems. Autonomous driving systems need special handling of input data: there's no time for advanced transformations or subtle image process techniques, they have a solid and period of time analysis of a scenario. This challenge gets harder to meeting a town like atmosphere wherever multiple traffic signs, ads, parking vehicles, pedestrians, and different moving or background objects create the popularity way more troublesome. whereas varied solutions are printed, solutions area unit tested on car ways in which, rural area, or at a awfully low speed. during this paper, we tend to provides a short summary on main issues and well-known methods to unravel these issues, and that we provides a general resolution to tackle period of time problems in urban traffic sign recognition.

Keywords — Autonomous Driving, Traffic sign recognition, Driver.

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Acronyms

AVDS	Autonomous vehicle driving systems
CMOS	Complementary metal-oxide semiconductor
CCD	Charged coupled device
TRS	Traffic sign detection
BLOB	Binary Large Object
PY	Python

CHAPTER-1

I.INTRODUCTION

Autonomous vehicle driving systems acknowledge potential dangers, threats, driving limitations and potentialities. in an exceedingly amongst in every of the key factors for a no-hit AVDS development is to spot acceptable traffic rules valid on an exact road sector or in a junction. Such a visible recognition helps motorcar navigation or navigation aiding systems to be more safe, as a result of the foremost of automotive accidents occur thanks to lack of concentration and failures to note necessary traffic signs. several traffic sign recognition systems are developed since the 1980's. 1st solutions were that specialize in optical based mostly micro-programmed hardware to avoid machine quality and different modern mobile computing connected limitations [1]. Later, software-based solutions have emerged with the primary in-car integrations [2] In-car embedding needed period of time image process, still they still used parallel hardware elements for acceleration and extremely low camera resolution and frame rate to lower knowledge size quality. net cameras were obtaining cheaper and high resolution at the center of 2000's[4] that boosted traffic sign recognition analysis in recent years. On the opposite hand, that's why high preciseness period of time traffic sign recognition continues to be thought of to be a tough task, as a result of knowledge size increment is quadratic by victimization high resolution cameras whereas machine power will increase linearly.

According to Moore's law. machine power limits applications even additional in mobile environments. during this paper, we tend to propose a completely unique approach to tackle with time period issues in high resolution video streams.

In recent years there is increase in computing power have brought computer vision to consumer-grade applications. As computers offer more and more processing power, the goal of real-time traffic sign detection and recognition is becoming feasible.In traffic environments, Traffic Sign Recognition is used to regulate traffic signs, warn the driver, and command or prohibit certain actions.
A fast real-time and robust automatic traffic sign detection and recognition can support and disburden the driver, andthus, significantly increase driving safety and comfort.

In traffic environments, Traffic Sign Recognition (TSR) is used to regulate traffic signs, warn the driver, and command or prohibit certain actions. A fast real-time and robust automatic traffic sign detection and recognition can support and disburden the driver, and thus, significantly increase driving safety and comfort. Generally, traffic signs provide the driver various information for safe and efficient navigation. Automatic recognition of traffic signs is, therefore, important for automated intelligent driving vehicle or driver assistance systems. However, identification of traffic signs with respect to various natural background viewing conditions still remains challenging tasks. The Traffic Sign

Recognition Systems usually have developed into two specific phases. The first is normally related to the detection of traffic signs in a video sequence or image using image processing. The second one is related to recognition of these detected signs, which is deal with the interest of performance in artificial neural network. The detection algorithms normally based on shape or color segmentation. The segmented potential regions are extracted to be input in recognition stage. The efficiency and speed of the detection play important role in the system. To recognize traffic signs, various methods for automatic traffic sign identification have been developed and shown promising results.Neural Networks precisely represents a technology that used in traffic sign recognition.

I.I Disadvantages of current system

- Cost – Current system are very expensive in price. These system are only available in posh cars .
- Video source (video camera) – recognition depends on quality of an image sensor (CMOS/CCD chips) and output format of an image. It can be used color or gray cameras with various resolutions, settings, compression rates etc. Is-sues can arise not only by settings of a camera but also if the camera is not correct fixed in a vehicle so vibration and blurring can be appeared on the video sequences. Another problem is causing by autofocus. We can therefore recom-mend autofocus mode switch off and focus set to infinity. Lighting conditions – there are differences in acquiring images by daylight and night, or by influencing of source of light. Thus shade of colors of objects can be seen differently by the illumination changes. Issues cause also a reflection from any light source such as sun in daylight or street light- ing in night. Shape based approach for traffic sign detection seems to be a good choice for solving this problem.
- Blurring and vibration by a moving vehicle, therefore the camera must be fixed properly.
- Weather conditions – captured image is influenced by rain-ing, snowing or occurrence of a fog. For example, traffic signs can be shrouded by snow or

be poorly visible in a fog. Occlusion – any kind of objects that block face of traffic signs, for example by trees, vehicles, pedestrians, poles or any objects on the road. Another specific occlusion can be caused by shadows. Then traffic sign can change its mean-ing, e.g. shadow from power line on the priority road sign can be observed as the end of priority road.Faded color – color of traffic signs will be faded over time by the influence of the sun and condition weather.

- Damage – traffic signs can be damaged not only by sun-shine, but also by vandalism or weather over time (strong breeze, storm, raining). They can be then dirty, scribbled over, tilted, rusty etc.
- Scene complexity – multiple traffic signs can appear on the traffic scene to be recognized in an image impacts to in-crease computational complexity and so decline real time processing. • Cascade of traffic signs – it is similar problem like in com-plex scene. Moreover in case of lower image resolution the multiple traffic signs are very close placed side by side hence they will be appeared as one traffic sign.
- Similarity – some of objects in traffic scene are similar to traffic signs, especially on the advertisements placed around the road.
- Incorrect placed or signs similar to real traffic signs – traffic signs are incorrect placed sometime such as wrongly rotated or flipped so their meanings tend to be different, or no meaning. Special cases are signs that

are having the characteristics of traffic signs but they do not valid for a driver.

- Variable size of traffic signs – size of traffic signs are different. In addition size is changing by getting closer to a traffic sign of the moving vehicle.

I.II Formulation of Problem

The aim of the traffic sign recognition system operating on board of a vehicle is to detect and track the sign instances over time and to correctly interpret their pictograms, so that the driver can react properly to the encountered traffic situation. The input to a TSR system is a live video stream captured by an in-vehicle camera/cameras and its output are the desired-form signals providing a human-understandable interpretation of the detected and recognised signs. Such a system can be conceptually visualised using a block diagram with three main components,as shown in Figure 1.1. The arrows between each pair of components are drawn by default in both directions. However, depending on the actual system architecture, certain interactions may be unidirectional, or may not exist at all. This diagram will be presented in more detail in the following sections. Consider a single front-looking camera mounted on board of a vehicle in front of the windscreen. Whenever a relevant traffic sign is detected within the field of view of the camera, as shown in Figure 1.2a, the TSR system should analyse the sign's

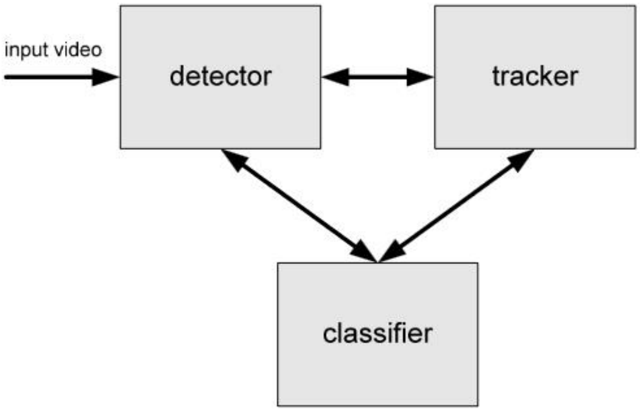
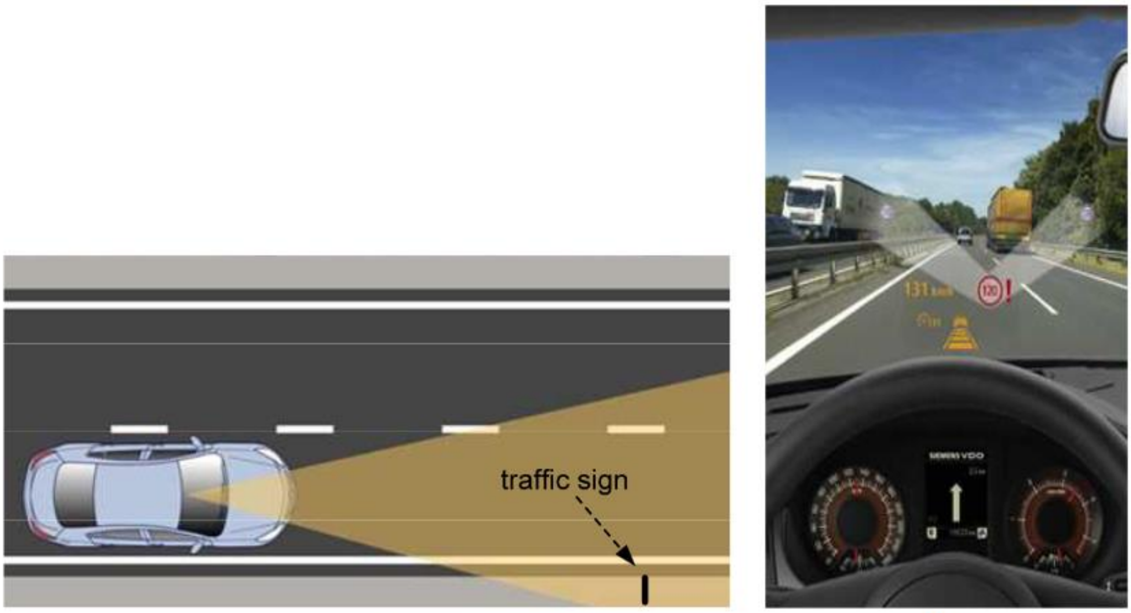


Figure 1.1: Block diagram of traffic sign recognition system operating on board of a vehicle.



(a) (b)

Figure 1.2: Usage scenario of a traffic sign recognition system: a) schematic depiction of a vehicle approaching a traffic sign, b) an example way of presenting the

I.II.I Required tools/technology

The requirement of tools is quite straightforward. we just need a latop installed with latest version of OpenCV, python, and a webcam which we can use from laptop.

- Python (version>3.0)
- OpenCV
- Numoy
- Imutils

Hardware requirements pc with webcam or other external device.

Sign recognition should be first performed in order to Color and edge. Therefore, system which we are going to make uses a webcam to recognize traffic sign through webcam, a portable webcam would be very good for this good so that we can Stick it to the dash board of the car or we can use micro camera hidden in stuff toys and put it to the dash board facing it to the driver. The system is going to be based on purely program coding in laptop, so it is necessary to have a laptop with latest version of OpenCV, python,. Not most needed but it is good to have a fast-processing laptop so that it does crash while running such huge program.

Chapter-2

LITERATURE SURVEY

The first research on traffic sign recognition can be traced back to 1987; Akatsuka and Imai [2] attempted to make an early traffic sign recognition system. A system capable of automatic recognition of traffic sign could be used as assistance for drivers, alerting them about the presence of some specific sign (e.g. a one-way street) or some risky situation (e.g. driving at a higher speed than the maximum speed allowed). [10] It also can be used to provide the autonomous unmanned some specific-designed signs. Generally, the procedure of a traffic sign recognition system can be roughly divided oftwo stages namely detection and classification.

In general, traffic sign recognition mainly includes two stages: the first stage is traffic sign detection, which concerns the location and size of the traffic signs in the traffic scene images, and the second stage of the process is traffic sign recognition, which pays close attention to the classification of what exact class the traffic signs belong to. Traffic sign detection is usually based on the shape and color attributes of traffic signs, and [8] traffic sign recognition is often used with classifiers, such as convolutional neural networks (CNNs) and SVM with discriminative features.

IV.METHDOLOGY

Traffic sign recognition algorithm using image processing technique has been developed by combining several methods such as binarization, ROI and pixel matching. Binarization is an early process applied to the traffic sign image. The binarization method ensure the image is in good condition before the implementation of ROI technique.

3.1.Binarization

At the first stage, all images are transformed from RGB color space into black and white color space.
Hence, the red regions of each image are detected by the black and white saturation values of pixels. Figure 2 shows the converted image from RGB (Red, Green, and Blue) color into the black and white pixels by using image processing toolbox.

Figure 2(a)

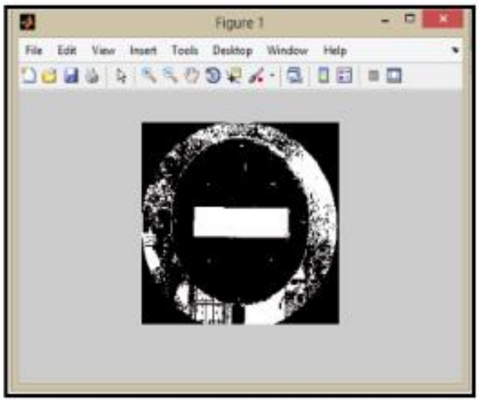


Figure 2(b)

3.2Region of interest (ROI) method

Region of interest (ROI) method locates the traffic sign in the image frame. Using ROI method, large portion of the image can be ignored by declaring other pixel as background. Circle shape traffic sign is the most common shape used in traffic symbol. Therefore, circle shape is been the first sign for preliminary reduction of the search space, followed by the geometrical edge and corner. The algorithm of ROI is formulated as equation 1.

ROI = poly2mask(r*cos (t) +c (1), r*sin (t) +c (2) equation 1 t=Approximate circle with 50 points r=radius c=[X-axis, Y-axis] Figure 3 shows the different level of circle shape of ROI based on various radius of the circle. Figure 3(a), (b) and (c) show the original image of no entry sign, circle cropped method with 70 points and circle cropped method with 100 points respectively. The cropped circle is converted from RGB to binary image.

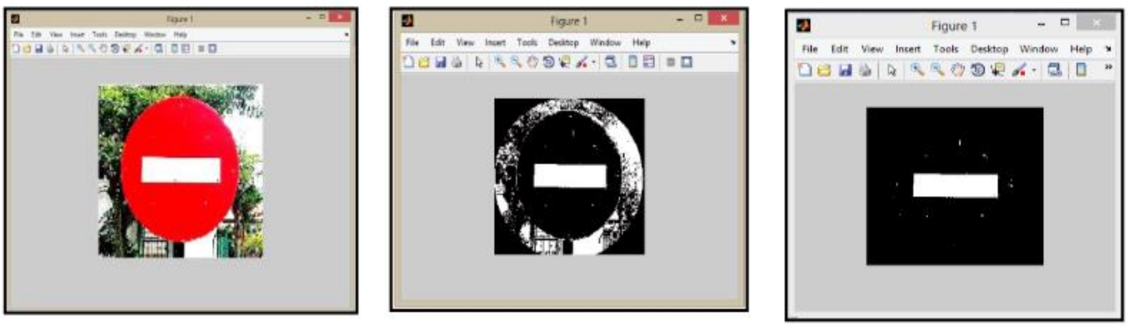


Figure 3(a): *No entry sign* **(b):** *ROI with 70 points* **(c):** *ROI with 100 points*

Autonomous vehicle driving systems (AVDS) acknowledge potential dangers, threats, driving limitations and potentialities. in an exceedingly amongst in every of the key factors for a no-hit AVDS development is to spot acceptable traffic rules valid on an exact road sector or in a junction. Such a visible recognition helps motorcar navigation or navigation aiding systems to be more safe, as a result of the foremost of automotive accidents occur thanks to lack of concentration and failures to note necessary traffic signs. several traffic sign recognition systems are developed since the 1980’s. 1st solutions were that specialize in optical based mostly micro-programmed hardware to avoid machine quality and different modern mobile computing connected limitations [1]. Later, software-based solutions have emerged with the primary in-car integrations [2] In-car embedding needed period of time image process, still they still used parallel hardware elements for acceleration and extremely low camera resolution and frame rate to lower knowledge size quality. net cameras were obtaining cheaper and high resolution at the center of 2000’s that boosted traffic sign recognition analysis in recent years. On the opposite hand, that's why high preciseness period of time traffic sign recognition continues to be thought of to be a tough task, as a result of knowledge size increment is quadratic by victimization high resolution cameras whereas machine power will increase linearly.

According to Moore’s law. machine power limits applications even additional in mobile environments. during this paper, we tend to propose a completely unique approach to tackle with time period issues in high resolution video streams. The paper is organized as follows: Section II shows by example situations the foremost vital issues to be resolved for realtime traffic.

Sign recognition systems. a close discussion on previous works is summarized in describes a completely unique model that deals with high resolution information in poor machine power environments. Finally, Section V discusses traffic sign recognition system performance.

II. Project Design

We propose a generic system majorly based on coding basic hardware which might be utilized in each personal and mobile pc environments supported a high

[11] quality internet camera video stream. internet camera outputs a encoded MPEG4 video at 1600x1200 frame resolution with 25fps. two million pixels to be processed in 40ms needs all algorithms to be linear or a minimum of similar linear. the fundamental plan behind our design was to cut back the general interval by prefiltering all regions, candidate objects, and color schemes that area unit positively not traffic signs. Obviously, if the matter house is little enough, even long operations will apply for real time video process.

Fig. 2. The detection algorithm should detect the traffic signs and be identified in bounding boxes discussed earlier.

The objective of the project is to identify traffic sign via camera to inform the driver about it.

The basic concept of this project is -

- **To convert the input image to HSV format to extract the binary image.**
- **Remove the noise from binary image using morphological operations.**
- **Then contours are used to segment out the region of interest and further the region is analysed to get the final result**

II.IICode

```
import cv2

import numpy as np

from scipy.stats import itemfreq

def get_dominant_color(image, n_colors):

    pixels = np.float32(image).reshape((-1, 3))

    criteria = (cv2.TERM_CRITERIA_EPS +

cv2.TERM_CRITERIA_MAX_ITER, 200, .1)

    flags = cv2.KMEANS_RANDOM_CENTERS

    flags, labels, centroids = cv2.kmeans(

        pixels, n_colors, None, criteria, 10, flags)

    palette = np.uint8(centroids)

    return palette[np.argmax(itemfreq(labels)[:, -1])]


clicked = False

def onMouse(event, x, y, flags, param):

    global clicked

    if event == cv2.EVENT_LBUTTONUP:

        clicked = True
```

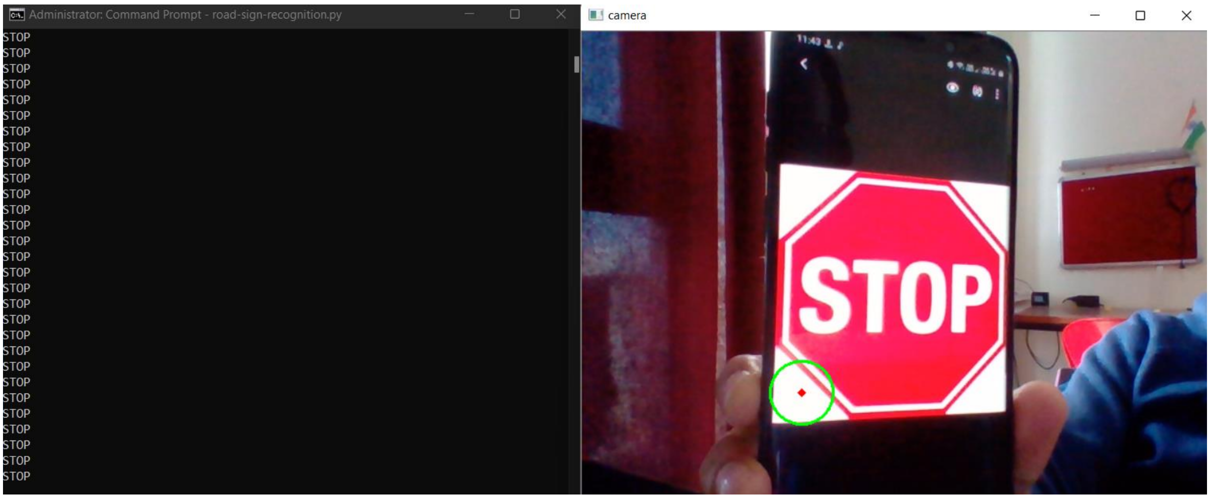
```
cameraCapture = cv2.VideoCapture(0)
cv2.namedWindow('camera')
cv2.setMouseCallback('camera', onMouse)

success, frame = cameraCapture.read()


while success and not clicked:
    cv2.waitKey(1)
    success, frame = cameraCapture.read()

    gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
    img = cv2.medianBlur(gray, 37)
    circles = cv2.HoughCircles(img, cv2.HOUGH_GRADIENT,
                               1, 50, param1=120, param2=40)

    if not circles is None:
        circles = np.uint16(np.around(circles))
        max_r, max_i = 0, 0
        for i in range(len(circles[:, :, 2][0])):
            if circles[:, :, 2][0][i] > 50 and circles[:, :, 2][0][i] > max_r:
                max_i = i
```

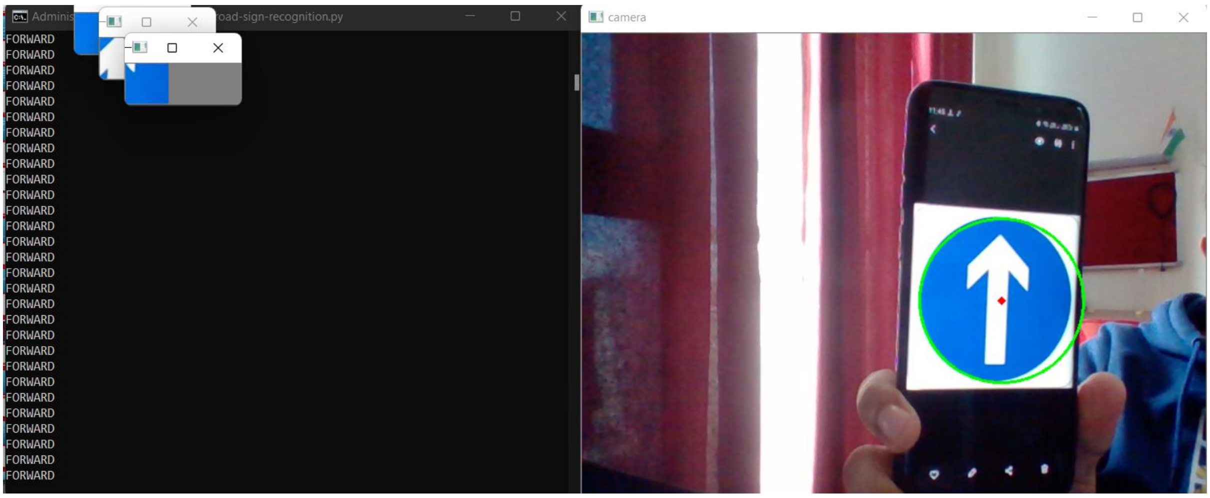
```
        max_r = circles[:, :, 2][0][i]
x, y, r = circles[:, :, :][0][max_i]
if y > r and x > r:
    square = frame[y-r:y+r, x-r:x+r]

    dominant_color = get_dominant_color(square, 2)
    if dominant_color[2] > 100:
        print("STOP")
    elif dominant_color[0] > 80:
        zone_0 = square[square.shape[0]*3//8:square.shape[0]
                        * 5//8, square.shape[1]*1//8:square.shape[1]*3//8]
        cv2.imshow('Zone0', zone_0)
        zone_0_color = get_dominant_color(zone_0, 1)

        zone_1 = square[square.shape[0]*1//8:square.shape[0]
                        * 3//8, square.shape[1]*3//8:square.shape[1]*5//8]
        cv2.imshow('Zone1', zone_1)
        zone_1_color = get_dominant_color(zone_1, 1)

        zone_2 = square[square.shape[0]*3//8:square.shape[0]
                        * 5//8, square.shape[1]*5//8:square.shape[1]*7//8]
        cv2.imshow('Zone2', zone_2)
```

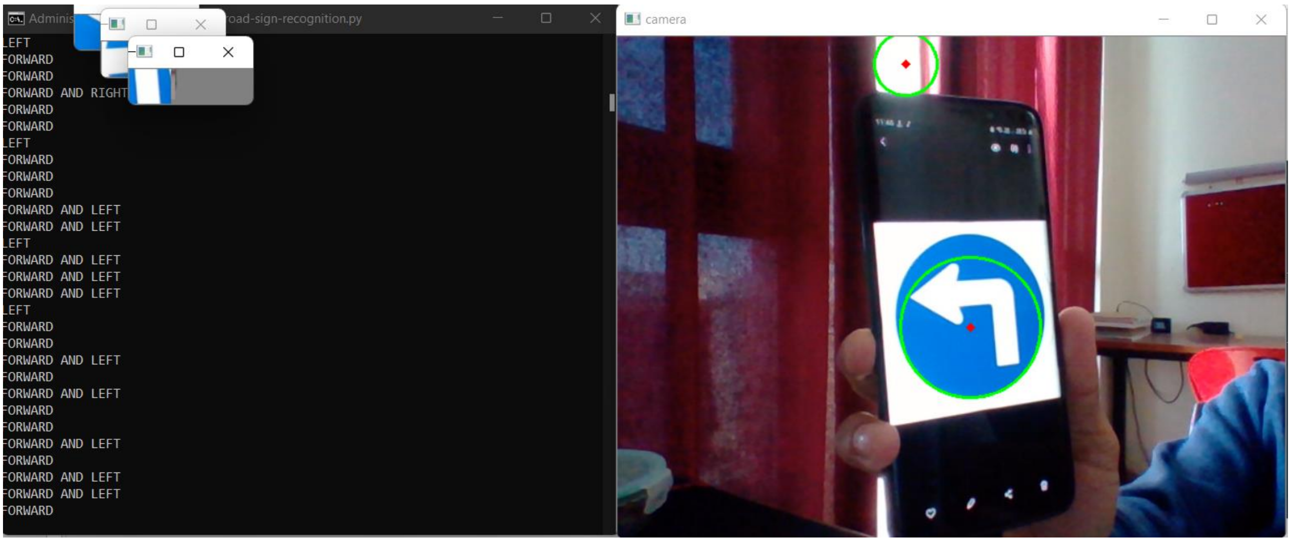
```
            zone_2_color = get_dominant_color(zone_2, 1)


            if zone_1_color[2] < 60:
                if sum(zone_0_color) > sum(zone_2_color):
                    print("LEFT")
                else:
                    print("RIGHT")
            else:
                if sum(zone_1_color) > sum(zone_0_color) and sum(zone_1_color)
> sum(zone_2_color):
                    print("FORWARD")
                elif sum(zone_0_color) > sum(zone_2_color):
                    print("FORWARD AND LEFT")
                else:
                    print("FORWARD AND RIGHT")
        else:
            print("N/A")


    for i in circles[0, :]:
        cv2.circle(frame, (i[0], i[1]), i[2], (0, 255, 0), 2)
        cv2.circle(frame, (i[0], i[1]), 2, (0, 0, 255), 3)
  cv2.imshow('camera', frame)
```

```
cv2.destroyAllWindows()

cameraCapture.release()
```

Output






road-sign-recognition.py
camera
LEFT
FORWARD
FORWARD
FORWARD AND RIGHT
FORWARD
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LEFT
FORWARD
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FORWARD AND LEFT
FORWARD AND LEFT
LEFT
FORWARD AND LEFT
FORWARD AND LEFT
FORWARD AND LEFT
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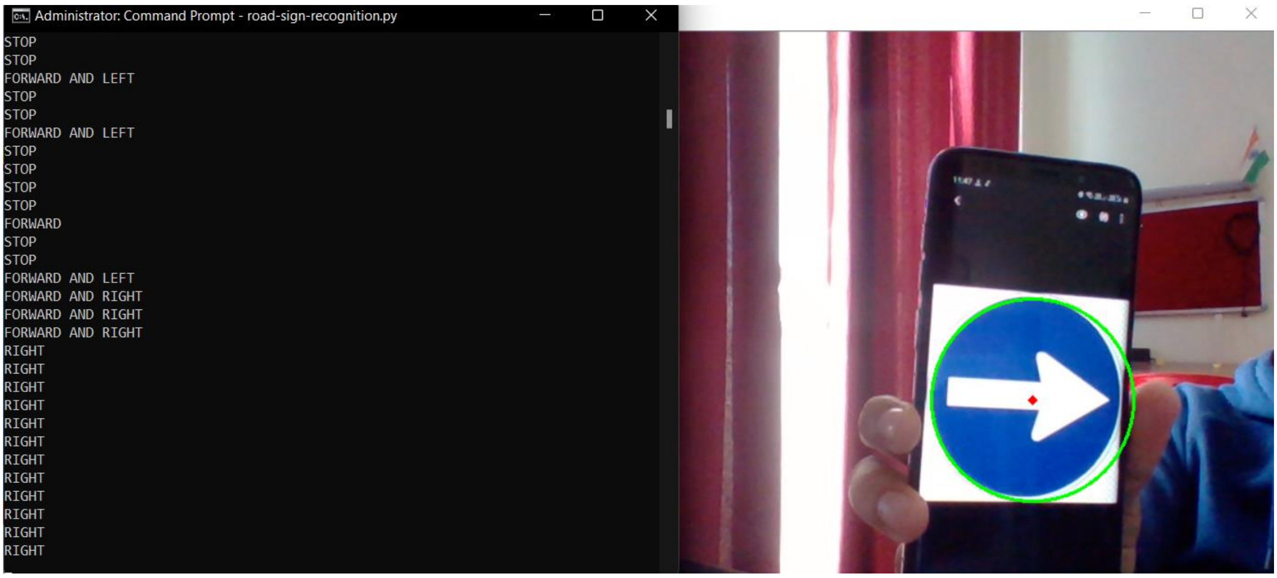
Administrator: Command Prompt - road-sign-recognition.py
STOP
STOP
FORWARD AND LEFT
STOP
STOP
FORWARD AND LEFT
STOP
STOP
STOP
STOP
FORWARD
STOP
STOP
FORWARD AND LEFT
FORWARD AND RIGHT
FORWARD AND RIGHT
FORWARD AND RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT
RIGHT

Working of Project

The objective of the project is to identify traffic sign via

camera to inform the driver about it.

The basic concept of this project is -

- To convert the input image to HSV format to extract the binary image.
- Remove the noise from binary image using morphological operations.
- Then contours are used to segment out the region of interest and further the region is analysed to get the final result

In the world of Artificial Intelligence and advancement in technologies, many researchers and big companies like Tesla, Uber, Google, Mercedes-Benz, Toyota, Ford, Audi, etc are working on autonomous vehicles and self-driving cars. So, for achieving accuracy in this technology, the vehicles should be able to interpret traffic signs and make decisions accordingly.

and sporadically refresh fascinating color values. Note that, applied mathematics image analysis doesn't filter regions with none express information what colors area unit in traffic signs, i.e., fascinating color values area unit assumed to be superset of traffic sign colors. Secondly, applied mathematics image analysis provides data for color standardization that is incredibly helpful e.g., in several climate, or to make your mind up whether or not we tend to area unit in town or country-side. If fascinating colors of the main focus zone don't seem in alternative regions, then we tend to eliminate non relevant areas by cropping. Crop could be a quick operation that dramatically decreases the matter house, and makes the slow color segmentation even quicker. we tend to use internet camera as data input device optimized for human vision.

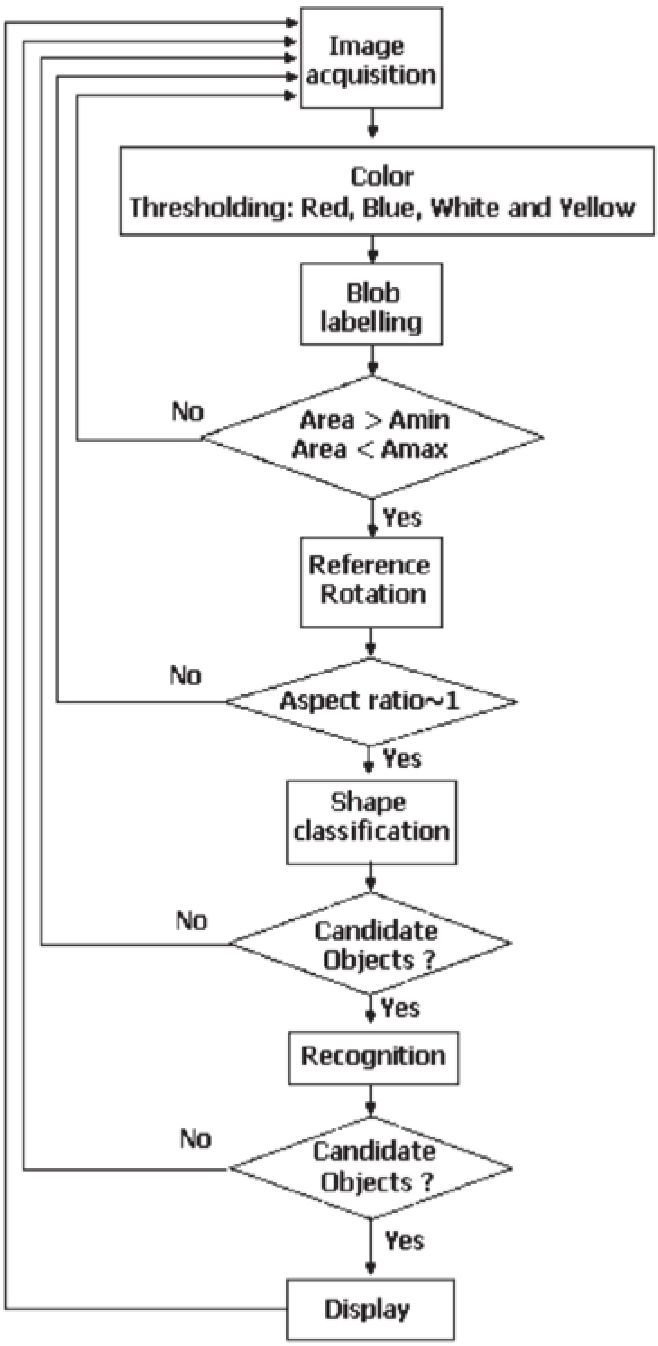
Image acquisition
Color
Thresholding: Red, Blue, White and Yellow
Blob labelling
No
Area > Amin
Area < Amax
Yes
Reference Rotation
No
Aspect ratio~1
Yes
Shape classification
No
Candidate Objects ?
Yes
Recognition
No
Candidate Objects ?
Yes
Display

Flowchart

Filtering Regions the foremost common colors belong to the surroundings, e.g., at the center on the right-hand facet of pictures referred to as focus zone, inexperienced patches area unit sometimes trees or grass outside a city, whereas mass gray values area unit nearly always buildings in a very town like surroundings. Traffic signs don't seem to be common, however, they're rather more frequent and regular than ad panels, phone boxes, or alternative background objects. Tail analysis indicates [12] that the 12-22 most frequent colors area unit traffic sign colors. Since color values vary in weather, distance, and even in several seasons, we tend to introduce a applied mathematics image analysis element that examines image color distributions in specific areas, and sporadically refresh fascinating color values. Note that, applied mathematics image analysis doesn't filter regions with none express information what colors area unit in traffic signs, i.e., fascinating color values area unit assumed to be superset of traffic sign colors. Secondly, applied mathematics image analysis provides data for color standardization that is incredibly helpful e.g., in several climate, or to make your mind up whether or not we tend to area unit in town or country-side. If fascinating colors of the main focus zone don't seem in alternative regions, then we tend to eliminate non relevant areas by cropping. Crop could be a quick operation that dramatically decreases the matter house, and makes the slow color segmentation even quicker. we tend to use internet camera as data input device optimized for human vision.

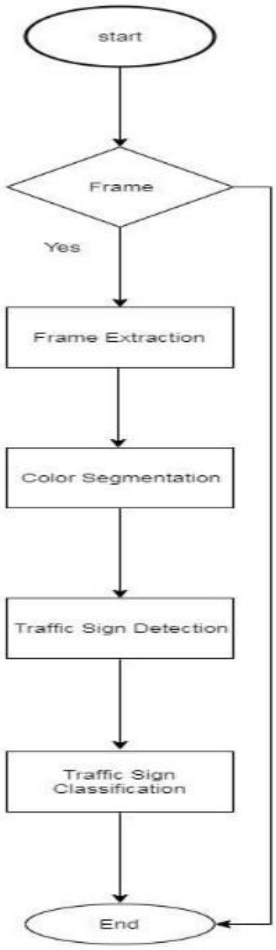

Fig. 3. System Process Flowchart

As a consequence, throughout YUV420 encoded video color segmentation we tend to should take under consideration that addition of adjacent pel colors is perceived otherwise by human eyes . we tend to create a color resampling for input pictures victimisation Associate in Nursing MLP neural network, and values area unit remodeled into CIELAB color house used for color filtering. color filtering provides output pictures with colors seem solely in traffic signs. whereas the primary image clearly shows a red traffic sign for human eyes, one will see however color data changes by magnification. Naturally, Hough-like rework for correct determination of bounding boxes could be a good selection if preciseness is that the solely parameter to be taken under consideration. though drawback house is dramatically reduced in our approach still any well-known shape-based filter consumes a minimum of 15ms interval on a dual-core mobile processor primarily based laptop computer that isn't acceptable for real time applications.

DISCUSSION AND FUTURE

Various approaches for TSD are given within the previous sections. Here, a performance comparison of these strategies and future directions of analysis in TSD ar given.The identification of traffic signs among scene im-ages is dispensed by 2 main stages: detection, and recognition. several analysis teams integrate a track-ing stage to influence ordered [3] frames of scene im-ages (Moutarde et al., 2007) (Gonz´alez et al., 2011)(Meuter et al., 2011) (Ruta et al., 2011) (Keller et al.,2008).[2] every detected traffic sign is caterpillar-tracked over time by predicting its position within the next frame. Track-ing method is dispensed typically victimization Kalman fil-ter (Ruta et al., 2010) (Ruta et al., 2008) (Fang et al.,2003). It strengthens TSDR systems since the detection and recognition use multiple pictures for an equivalent traffic sign. what is more, the search area within the next frame is reduced, therefore, the memory and therefore the exe-cution time ar reduced (Fang et al., 2003). However, we solely concentrate on the detection and recognition modules, going away the chase for future works. The detection step is dispensed victimization color, shape, or each property. color is a vital con-kept in TSD systems, since it will considerably cut back the amount of the region made by low-level image process operation. However, color segmentation is influenced by several conditions like weather daytime, orientation of signs in regard to the sun, etc. Furthermore, there ar alternative objects with an equivalent colors as traffic signs within the street. The segmentation method may be ameliorated by integration pre-processing steps for color correction, enhancing the target colours, or choosing Associate in Nursing optimum color area or a combination of the many. On the opposite hand, the basic drawback of the shape-base strategies is that the range of false positives made by these strategies. This is thanks to the deficiency in color info (Boume-diene et al., 2013). Therefore, the employment of each cues (color and shapes) ends up in best result.

Performance of Image Preprocessing

For saving the storage capacity and reducing the computational complexity, the original images are scaled down into 250 × 250 pixels. In the proposed approach, after the image acquisition process described in Section 2, the image preprocessing is performed by the RGB segmentation approach. In the proposed approach, a filter is applied on each channel threshold field to select just those regions of the image where values of the pixels are in the range of the target object. The region of interest (ROI) is actually the logical sum of the three filtered channels of R, G, and B, as shown in Figure 4. The median filter is applied for image smoothing and filling the smaller regions of the image, which is shown in Figure 4(f).

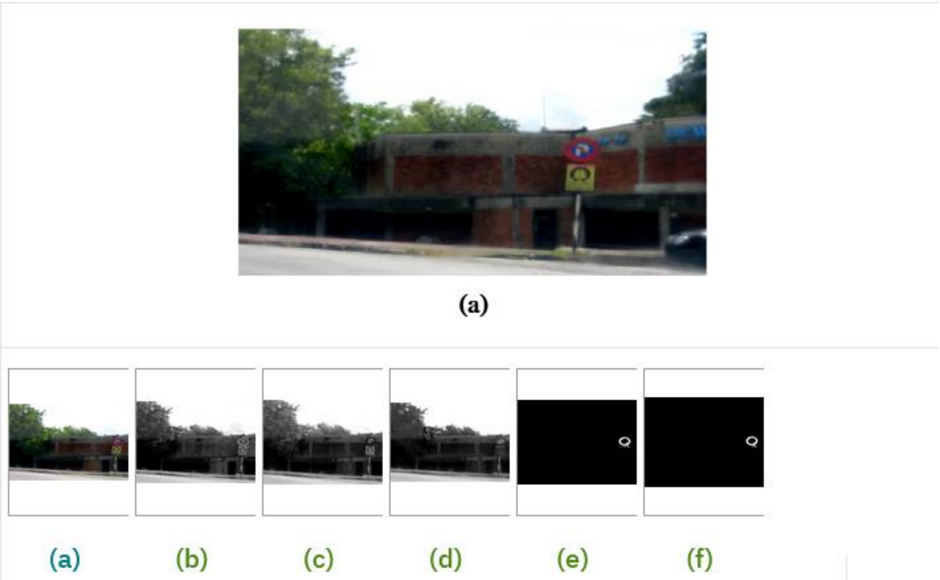

Figure 4_

Colour processing for traffic sign detection: (a) original image, (b) R channel after threshold, (c) G channel after threshold, (d) B channel after threshold, (e) logical sum of three channels, and (f) ROI after filtering and smoothing.

4.2. Performance of Traffic Sign Detection

The final selected candidates such as range of pixel values, area, and shape are drawn on the image by using extracted data (centre and area) of each of them. In the proposed method, only consider those traffic signs containing red colours. After applying shape-matching technique for the images containing the nontraffic signs, the output is given that “no road sign is detected.” The result has been classified into four sections. False positive (FP) is where the sign is not detected correctly. For the false negative (FN), the sign is detected as a nonsign region. True positive (TP) is defined as the sign is correctly detected and in the true negative (TN), a nonsign region is correctly recognised as a nonsign region. The contingency matrix of the detection performance is given in Table 2.

Table 2

Contingency matrix of the RGB segmentation and shape matching sign detection method.

From Table 4, the sensitivity and specificity values are calculated. Sensitivity is defined as the ability of identifying a condition correctly whereas specificity is defined as the ability of excluding a condition correctly:(i)Sensitivity or recall =

= 83.4%.(ii)Specificity = = %100.(iii)Accuracy = = 94.85%.In the tests, it has been concluded that several problems affected the detection performance. Variant lighting conditions, occultation, and illumination of traffic signs are the main reasons of the false detection. The outcome of the proposed detection method shows that the red colour of the traffic sign is segmented and unswervingly illuminated by the sun. This happens because of the property of the colour segmentation using RGB model involved in comparing the RGB values. In the developed system, the computational time is around 0.25 s and the accuracy rate is 94.85%. Figure 4 shows the detection steps of the traffic sign detection system. The result of our detected traffic sign is given in Figures 5 and 6. In Figure 5, first and second columns show the true positives and true negatives, respectively. Third column shows the false negatives.

(a) Normal daylight

(b) High illumination

(c) Shade

(d) Evening

(e) Daylight

(f) Shade

(g) Daylight

(h) Daylight

(i) Shade

Figure 5

Examples of TP in variant lighting conditions (a), (b), and (c); example of TN in variant lighting conditions (d), (e), and (f); and examples of false detection (g), (h), and (i).

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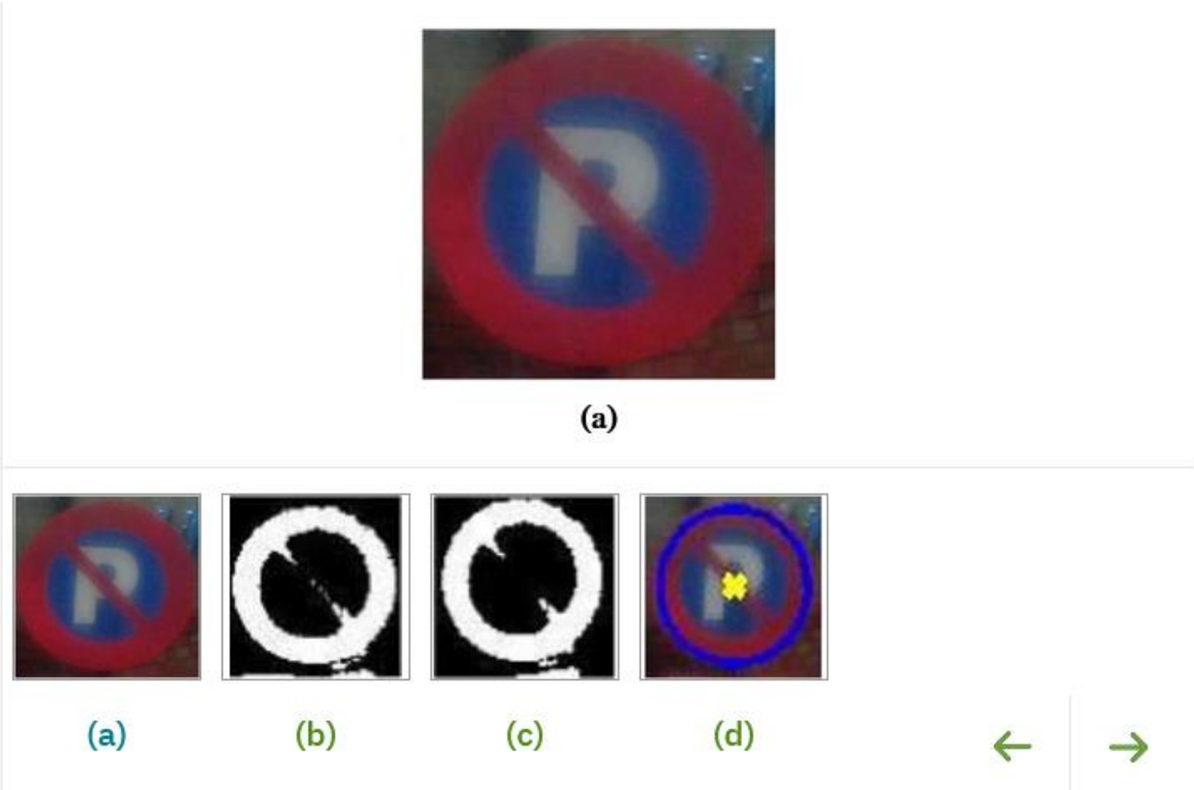

Figure 6_

Final detection: (a) sample traffic sign, (b) closed curve obtained by colour thresholding, (c) after filtering and smoothing cadidates.

RESULT

The program is able to detect and recognise traffic signs and display them.

We performed an in depth benchmarking on the on top of delineated system supported hours of traffic sign images material:[8] • taken in urban (66%) and country-side (33%) environments together with road and expressway traffics, • two of 388x260 and eight of 800x600 and a pair of 1600x1200 frame resolution at 25fps, • the least bit four seasons (spring, summer, autumn, winter), and every one styles of weather, within the initial experimental setup we tend to evaluated the system. we tend to 2x10 minutes images by writing the image info wherever traffic sign look is frequent. victimization these videos we tend to engineered up the traffic sign example info by labelling frames. [9] every example is extracted victimization 1-7 distinct coaching samples, not tally cross-frame appearances. The take a look at information contained a one hour labelled image that failed to seem in coaching set. Experimental results square measure summarized . within the second experimental setup associate analysis was created on the full ten hours image info victimization a similar coaching information. Finally,. when the modifications, and ever-changing running setting to a substantial lower performance laptop we tend to had eighteen frames processed in every second that was stipendiary by following algorithms, i.e. if we tend to acknowledge a traffic sign, we tend to don't arrange to re-recognize it once more. we tend to tested our answer on mobile phones furthermore, we've got got one.4fps time interval.

CONCLUSION

We have design, Traffic sign detection, and recognition system. The system integrates color, shape, and motion information. it's designed on three main elements, a wide illustrious color acquisition framework. So, all of the on top of delineate algorithms OpenCV sturdy Features}, Convolutional Neural Networks, traditional mathematician Classifier contribute to the analysis drained development of this software: a extremely correct with quick response and strong Road Signs Detection and Recognition. the applying was designed in humanoid studio with the assistance of OpenCV library programmed by Java language. we've got used the Region of Interest (ROI) with Speed Up strong Feature (SURF) for visual perception. And Red inexperienced Blue model, Hue Saturation worth model for color segmentation throughout day light-weight and dark severally. The results achieved from the experimentation cited above prove that our system may be a period of time video/image process code once exposed to a image sequence rather than to a regular approach of traffic sign detection in static pictures.Associate in Nursing accelerated Hough-like rework based totally ROI identification, and a country freelance recognition module. Our results indicate a lower accuracy to those disclosed at intervals the literature, withal, they are direct consequence of the extra thorough field testing in multiple countries, climate, seasons, and various environmental setups.

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