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TRAFFIC SIGN RECOGNATION WITH VIDEO PROCESSING TECHNIQUE

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Abstract: *In this study, traffic signs are aimed to be recognized and identified from a video image which is taken through a video camera. To accomplish our aim, a traffic sign recognition program has been developed in MATLAB/Simulink environment. The target traffic sign are recognized in the video image with the developed program.*

Key Words: *Vıdeo Processing, Pixel Labeling, Template Matching*

1. INTRODUCTION

Video is succesive moving images in a specified period of time [1]. By devoloping technology, video processing techniques provide two dimensional evolution of the signal. Making changes on the video signals from a digital camera and obtaining better quality structural features are possible by video processing. Computer vision, face recognition, medical imaging, remote sensing systems are some application examples related to video processing.[2] Following the movement of a three dimensional moving object in the time domain by utilizing sequentiol angular and lineal position in space is important for analysing video signals. One of the cornerstones of the video processing is moving objects become important for identify the size and visibility distance of traffic sign an in many areas. Especially since mid nineties, traffic sign identification has become research subject in academia and industry. Mueller built up computer aided visual object detection system,[3]. Piccioli applied cross correlation technique on image and constituted a sign detection system from location information [4]. Yuille improved a system which regulates shining of environment for stop sign [5]. De La Escalare developed triangle, rectangular and circular signal following system by using color matching technique [6]. In this work we have converted the video signals to RGB space. Then we aimed to compare and define traffic signs which are grouped and labeled in terms of color and color tone with a traffic signs library.

2. PROGRAM

Pattern recognition by video processing technique is taking video signals as an input and finding interested object. Then it has to be specified. *Figure 1* shows our flow chart of

traffic sign recognition system in Matlab/Simulink program.

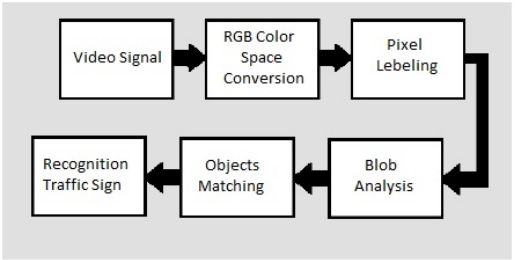

Figure 1 Flow Chart of Program

2.1. Video Signal

In this part, video signal are taken by a digital video camera, we have used image acquisition toolbox of Matlab/Simulink program.

2.2. RGB Colour Space Coversion

An RGB image involves three colours and intensity values of each pixels are in the range of 0-255 [7]. These colour scale define three colours, red, green, blue. In our study, orginal video signals are converted to RGB colour space by using colour space conversion toolbox of Matlab/Simulink program.

2.3. Pixel Labeling

A video signal involves several moving or stationary objects. In general, traffic signs has fixed colors.

Figure 1 Traffic Sign Examples

Figure 2 shows some example of traffic signs in different colors. In this study we primed to recognize the traffic signs in the video and this signs has spesific colors. In a video frame, color tone volves of each pixel are determined by pixel labeling method. A matrix is established which is some with video frame. After this part these two matrix is matched with desired values for each pixel. Following equations shows the algorithm of this process. (1),(2),(3).

$$\text{If } (R>77) \text{ and } (R-G>17) \text{ and } (R-B>17) \quad (1)$$

$$\text{If } (R>108) \text{ and } (G>108) \text{ and } (B>108) \quad (2)$$

$$\text{If } (R<122) \text{ and } (G<122) \text{ and } (B<122) \quad (3)$$

For this equations;
R: Represents the “red” in RGB color space.
G: Represents the “green” in RGB color space.
B: Represents the “blue” in RGB color space.
Equation 1 shows the conditions for red pixel. If the conditions in the first equation are satisfied, this means the pixel color is red equation 2 and 3 shows the condition of white and black respectivly [8]. In this part, pixel of video frame are labeled whoch are expressed with we defined as numer. Also the other pixels in video frame are assigned fixed numerical values. In this way, the traffic sign is marked in video frame. Normal video capture is shown in Figure 3.

Figure 2 Normal video capture

Labeled pixel valves of video frame is shown Figure 4.

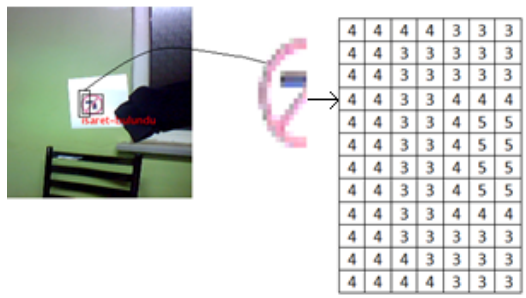

Figure 3 Labeled video frame

Numerical represents of labled pixel in the video frame are showed in Figure 4. Here while “4” values, show the pixels which can become white, “3” and “5” show red and black

consecutively. All pixel values except red, white and black are fixed to "0".

2.4. Blob Analysis

In the area of computer vision, blob detection refers to visual modules that are aimed at detecting points and/or regions in the image that differ in properties like brightness or color compared to the surrounding. [9]. Table 1 shows blob analysis's properties matrix.

Table 1 The location an size information of the object found with method of blob analysis in video.

X	Row information
Y	Column information
H	Height information
W	Width information

In this method, an object in video frames is decided whether is the traffic sign or not. Figure 5 shows, objects are found with blob analsis in video frames.

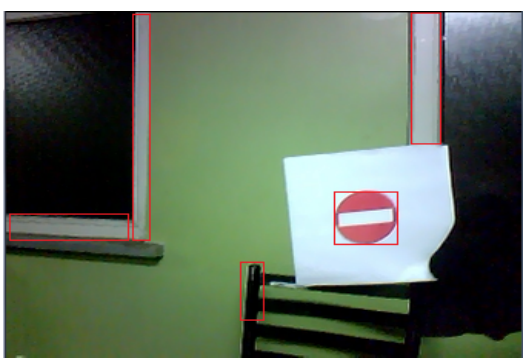

Figure 4 Found objects with blob analysis

Width,height and coordinate information of objects in video frames which are found blob analysis keep in matrix. This information is shown in table 2. Each column in matrix corresponds to the object in the video. Using this information, object in accordance with the requirements will be evaluated.

Table 2 Width,Height and Coordinate Information of Objects.

0	141	0	156	236
170	18	46	56	167
16	24	15	4	8
5	10	14	7	21

2.5. Comparison Objects

After making blob analysis, objects are compared with template library of objects. In our application, an object in video, which is a traffic sign to find the object that has a different pixel values. After that, the ratio of the total pixel value of object is checked. The traffic sign in the video is shown in Figure 6.

Figure 5 Traffic sign.

Dimension of the traffic sign is (32x31) pixel in Figure 6. This traffic sign has 992 total pixels. Using the pixel labeling in this pixels, red pixels are 3(three) number, white color pixels are 4(four) number, black color pixels are 5(five) number which are labeled. If pixel value of this traffic sign count, the number of 3 (three) which is red pixel has 558 pixel and the number of 4(four) which is white pixel has 434 pixel colors in the ratio of traffic sign is shown equation 4. In Figure 6, the object have only red and white colors, hence black color value is 0(zero).

$$\% O = [(\sum R / \sum P) * 100] \quad (4)$$

Equation;

%O = The percent of each color in a traffic sign,
$\sum R$ = The total of color in a traffic sign,
$\sum P$ = The total of pixels number in a traffic sign.
The ratio of pixel color values are %56,25 for red color and %43,75 for white color in traffic sign.

2.6. Traffic Sign Recognition

The process of traffic sign recognition ratio of pixel color values of object in video is obtained from equation 4 after that, results compared with template library. If as a result of comprasion matches with %3 tolerance, object in video is labeled with name of traffic sign in template library.

3. EXPERIMENTAL STUDY

We use Philips's SPC130NC/00 digital camera in our experimental study. Dimension of the video's frame is 240x320 pixels. The video is saved AVI format, because MATLAB/SIMULINK programe give best performance. The traffics sign are selected in video frames and that are saved in template library. Hence, template library consists of a lot of traffic sign feature vector. In figure 7, a traffic sign which captured in video sign compared with all signs in comprarison library and the sign was found as "*no entry*" by application which we developed.

Figure 6 No entry traffic sign

In figure 8, A traffic sign which captured in video sign compared with all signs in comprarison library and the sign was found as "*no left turn*" by application which we developed.

Figure 7 No left turn traffic sign

In figure 9 A traffic sign which captured in video sign compared with all signs in comprarison library and the sign was found as "*no parking*" by application which we developed.

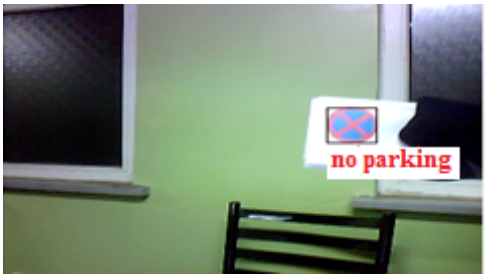

Figure 8 No parking traffic sign

In figure 10, A traffic sign which captured in video sign compared with all signs in comprarison library and the sign was found as "yield" by application which we developed.

Figure 10 Yield traffic sign

4. CONCLUSION

In this study, related signs are highly accurately identified by a traffic signs determination program which we developed in Matlab/Simulink with a video taken by digital camera which includes veriable traffic signs. In the next phase of our study it is thought to develop this program, to determine traffic sign in real time and real enviroment.

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