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UNIVERSAL LIBRARY DEVELOPMENT FOR INTELLIGENT TRANSPORTATION SYSTEM

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***Abstract*—Traffic sign detection is gaining lots of importance due to its application in Intelligent Transportation System, driver safety and driver assistance system. Lot of research has been done on the field of traffic sign detection. Universal library development for traffic sign detection will be essential for efficient TSD system. Proposed system is divided in the two steps. First is universal library development for all traffic signs and second is algorithm design and development for traffic sign detection and recognition. In the present work universal library is developed for traffic sign detection. The system is divided into two parts hardware part and software part. Matlab is used for development of library and algorithm to detect traffic signs.**

Keywords—Intelligent transportation system, Traffic sign detection (TSD).

I. INTRODUCTION

Traffic sign recognition and detection is gaining lots of importance due to its application in advanced driver assistance system and intelligent transportation system. Driver and passenger safety are important aspects of transportation system. Lot of research has been done in the field of traffic sign detection and recognition. Many traffic sign detection methods are based on color and shape basis. Various parameters need to be considered while traffic sign detection in image processing such as sign board condition, intensity of light distance from which images are captured, occlusion of sign board etc. Universal library for intelligent transportation system means a unique data of all traffic signs which can be considered as a standard with which all test images can be considered. It can also be called as universal dataset of traffic signs. The proposed system for traffic sign detection is divided into two main parts first is universal library development and second is algorithm design and development for traffic sign detection and recognition. Universal library for 63 images is created by taking row mean data and column mean data. Each sign is unique as the plots of row mean data and column mean data are unique. For developing library mean data of each image is taken into consideration. Universal Library for Traffic Sign Detection (ULTSD) consists of id, name and mean pixel value data of each traffic sign image. Further ULTSD can be divided into three parts depending on the shape of traffic signs for reducing the processing time. Traffic

Signs are divided into three categories i.e. circular, rectangular and triangular. After library development next task is algorithm design and development for traffic sign detection. Algorithm design steps are input image, image pre-processing, ROI extraction, mean pixel value calculation then comparison with ULTSD and final result. For variable environmental conditions tolerance of 5% is considered.

II. LITERATURE REVIEW

Rihab Hmida, Abdessalem Ben Abdelali, Abdellatif Mtibaa[1] have presented their work in Springer Journal of real time image processing in March, 2017 on"Hardware implementation and validation of a traffic road sign detection and identification system". Authors proposed the traffic sign detection method with lighting condition's consideration, use of a region of search and use of a shape identification step before the classification. Also an algorithm based on linear operations was proposed for shape identification. The XSG tool was used for the system development.

Yawar Rehman, Irfan Riaz, Xue Fan, Hyunchul Shin[2]have proposed in IET computer vision journal June 2017 in "D-patches: effective traffic sign detection with occlusion handling" a new method called discriminative patches (d-patches), which is a traffic sign detection (TSD) framework with occlusion handling capability. They have also formulated a voting and penalization mechanism that reduces the number of FP hypothesis by 50% in KTSD dataset. Their proposed method achieved 100% detection accuracy on German TSD benchmark and achieves 4.0% better detection accuracy, when compared with other well-known methods on KTSD dataset.

Andreas Møgelmose, Dongran Liu, and Mohan M. Trivedi[3] presented in IEEE Transactions on Intelligent Transportation System in 2015 "Detection of US traffic signs" a comprehensive extension to the publicly available LISA-TS traffic sign dataset, almost doubling its size, with HD-quality footage. The extension was made with testing of tracking sign detection systems in mind, providing videos of traffic sign passes. They applied the Integral Channel Features and Aggregate Channel Features detection methods to US traffic signs and show performance numbers outperforming all previous research on US signs.

III. PROPOSED SYSTEM:

Universal library for 63 traffic signs is developed using Matlab which includes name, id and mean pixel value of the traffic sign. Then algorithm for detection and recognition of traffic sign is developed. Below figure shows the basic block diagram of the presented work. Work is divided into two parts hardware part and software part. Hardware part consists of computational engine, peripherals and camera interface. Zynq 7000 is selected computational engine for the given system.

Software part is represented as a three layered architecture. Bottom layer is the firmware, middle level is Universal library which includes system program and the top layer is the application model.

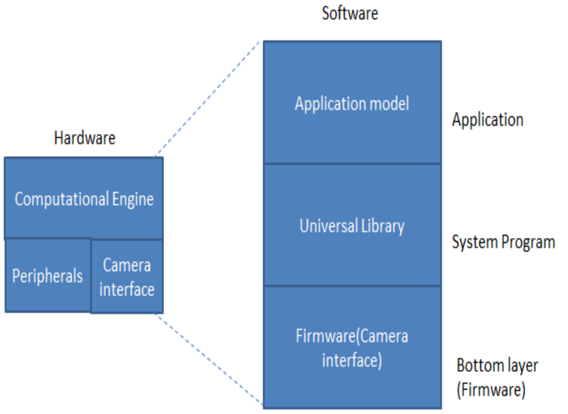


Fig 1. Block diagram of the proposed system.

IV. METHODOLOGY:

For universal library development 63 images of traffic signs are taken. Following image shows the traffic sign images. Each image is of size 125x125.

Fig 2. Sample traffic signs

First, the RGB images are converted to gray scale image. Row mean and column mean of the image is calculated then row mean and column mean data is concatenated. This mean data value of size 250x1 is stored in the structure created. The structure represents ULTSD i.e. Universal Library for Traffic Sign Detection. ULTSD contains id, name and mean data of the traffic sign. Universal library data for each image contains id, name and mean row and column data of traffic sign. ULTSD structure is shown in below figure:

Algorithm development consists of following steps:

- Image preprocessing
- ROI extraction
- Row and column mean calculation
- Comparison with ULTSD
- Output

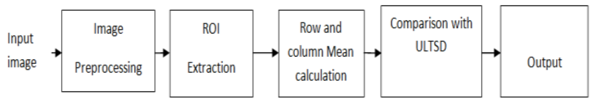


Fig 3. Block diagram for algorithm for TSD

Image pre-processing operations include:

- image resizing
- gray level conversion

The input image is resized to 125x125 sizes. Resized image is then converted to grayscale image. Brightness and contrast of image are adjusted. Filtering operation is performed to remove the noise in the image and for getting clear image. Median filtering is used for filtering operation. After image pre-processing ROI(Region of Extraction) is performed. Only sign is extracted from the image removing the rest background of the test image. Once ROI is extracted the row and column mean of ROI is calculated and concatenated. That mean data is compared with ULSTD mean data based on shape of traffic sign. The mean percentage difference is calculated between test image mean and ULSTD mean. If the percentage plot difference between them is less than 5 then name of traffic sign will be displayed.

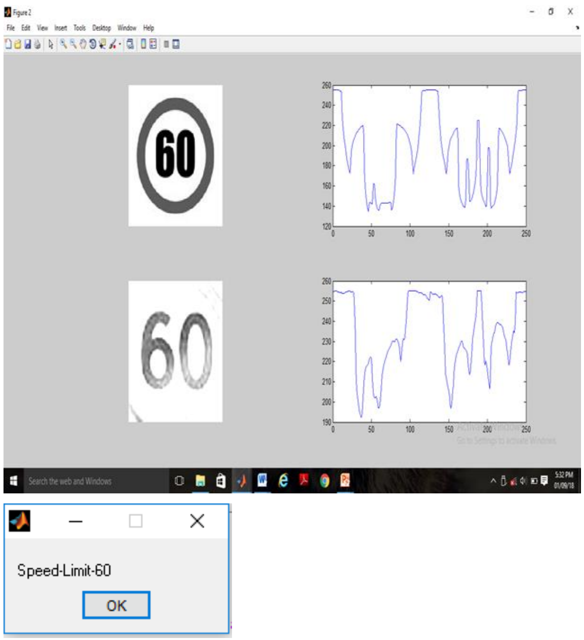


Fig 4. Results for speed limit traffic sign

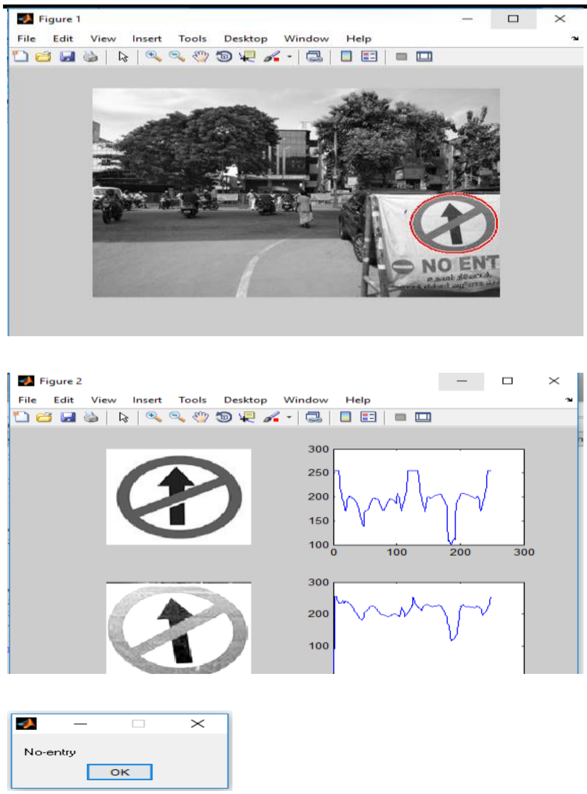
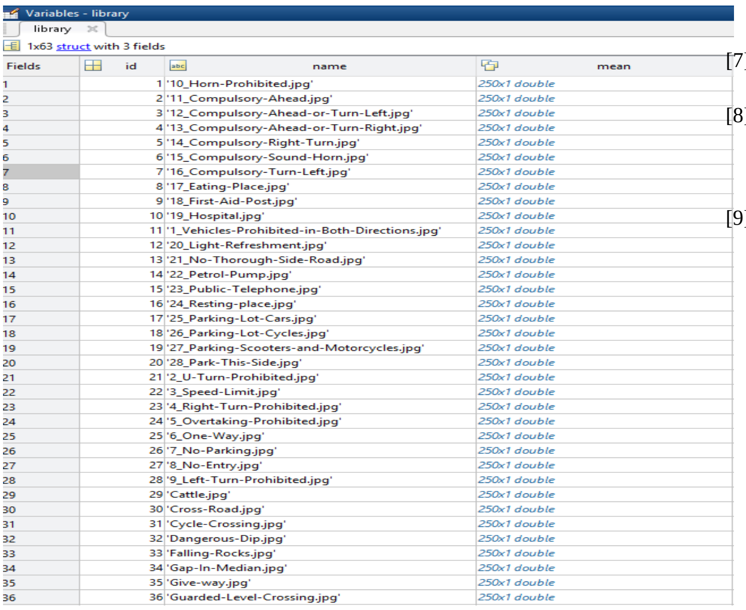


Fig 5. Results for No-entry traffic sign



Variables - library
1x63 struct with 3 fields

Fields	id	name	mean
1	1	'10_Horn-Prohibited.jpg'	250x1 double
2	2	'11_Compulsory-Ahead.jpg'	250x1 double
3	3	'12_Compulsory-Ahead-or-Turn-Left.jpg'	250x1 double
4	4	'13_Compulsory-Ahead-or-Turn-Right.jpg'	250x1 double
5	5	'14_Compulsory-Right-Turn.jpg'	250x1 double
6	6	'15_Compulsory-Sound-Horn.jpg'	250x1 double
7	7	'16_Compulsory-Turn-Left.jpg'	250x1 double
8	8	'17_Eating-Place.jpg'	250x1 double
9	9	'18_First-Aid-Post.jpg'	250x1 double
10	10	'19_Hospital.jpg'	250x1 double
11	11	'1_Vehicles-Prohibited-in-Both-Directions.jpg'	250x1 double
12	12	'20_Light-Refreshment.jpg'	250x1 double
13	13	'21_No-Thorough-Side-Road.jpg'	250x1 double
14	14	'22_Petrol-Pump.jpg'	250x1 double
15	15	'23_Public-Telephone.jpg'	250x1 double
16	16	'24_Resting-place.jpg'	250x1 double
17	17	'25_Parking-Lot-Cars.jpg'	250x1 double
18	18	'26_Parking-Lot-Cycles.jpg'	250x1 double
19	19	'27_Parking-Scooters-and-Motorcycles.jpg'	250x1 double
20	20	'28_Park-This-Side.jpg'	250x1 double
21	21	'2_U-Turn-Prohibited.jpg'	250x1 double
22	22	'3_Speed-Limit.jpg'	250x1 double
23	23	'4_Right-Turn-Prohibited.jpg'	250x1 double
24	24	'5_Overtaking-Prohibited.jpg'	250x1 double
25	25	'6_One-Way.jpg'	250x1 double
26	26	'7_No-Parking.jpg'	250x1 double
27	27	'8_No-Entry.jpg'	250x1 double
28	28	'9_Left-Turn-Prohibited.jpg'	250x1 double
29	29	'Cattle.jpg'	250x1 double
30	30	'Cross-Road.jpg'	250x1 double
31	31	'Cycle-Crossing.jpg'	250x1 double
32	32	'Dangerous-Dip.jpg'	250x1 double
33	33	'Falling-Rocks.jpg'	250x1 double
34	34	'Gap-In-Median.jpg'	250x1 double
35	35	'Give-way.jpg'	250x1 double
36	36	'Guarded-Level-Crossing.jpg'	250x1 double

Fig 6. Stucture of Universal library for TSD.

V. CONCLUSION:

In this paper method using mean pixel values of traffic sign is used for detection and recognition of traffic signs. Universal library is developed for 63 traffic sign images which contain name, id and traffic sign's mean pixel values of 1x250 matrix size. This data is then used for comparing the traffic sign got from ROI extraction. The sign with lowest difference is displayed in message box.

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