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Vehicle Classification for BRTS Lanes using Image Processing

#1Patil Prachita, #2Thorat Nisha, #3Worlikar Sayali, #4Prof.Tushar Kafare

2nishathorat9@gmail.com,
3worlikarsayali@gmail.com

#123Student, of E&TC Department,
#4Prof. of E&TC Department

JSPM's
Bhivarabai Sawant Institute of Technology and Research,
Wagholi, Pune, India

ABSTRACT

Bus Rapid Transit (BRT) has become an attractive urban transit alternative in many Asian developing cities due to its cost-effective and flexible implementation. This permanent system uses buses or specialized vehicles on roadways and dedicated lanes to quickly and efficiently transport passengers to their destinations, while offering the flexibility to meet transit demand. There are various problems related with public transport such that massive increase in number of accidents, Environmental degradation, Congestion, Overcrowding due to lacking resources to meet a task system, Frequency of service and schedule is not strictly adhered. The problem of pollution, safety and inefficiency have reached at a alarming level in most of the major cities in India due to relentless growth of its population both of people and motor vehicles, combined with inefficient public transport system and poor enforcement of environmental laws etc. Thus, there is most important to ensure clean, efficient, affordable, effective and safe public transportation system and for this Bus Rapid Transit System could become an appropriate solution. Bus Rapid Transit (BRT) Systems have become as one of the important mode of public transport. A 'Bus Rapid Transit (BRT) system, appeared as an alternative to the problem of transport in the City.

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I. INTRODUCTION

The increasing need for urban mass transit flexibility is now being addressed by various cities in India, following the best practices in the world. The Jawaharlal Nehru national urban renewal mission (jnnurm) which aims to encourage rehabilitate and fast track planned development in 63 cities does consider projects in the field of urban, public transport. In India, roads are often designed with a restraint on number of users per hour per direction. A service which delivers passengers from their desired origins to their desired destinations should be conceived while designing roadways. In this case, BRTS comes for exploit, a single dedicated lane of which could carry 20,000 passengers per hour per direction. The bus rapid transit system (brts) system project is contracted to reduce traffic on roads while improving service at no extra cost to commuters.

II. PROBLEM STATEMENT

The greater the volume of traffic on a road, the stronger is the case for public transport. In India, the low–cost /low–quality public buses are now not preferred by the upwardly mobile strata. Rail-based systems are very expensive to build & maintain & will therefore, not have extensive reach for a long time to come for example metro. No city has ever been able to build its way out of the problem. A new, faster & cost efficient system is required for quality alert groups, over & above the existing low quality bus network. BRTS fulfils these requirements & is possibly, the only available alternative worth exploring. In addition, many suburban cities exceed the aggregate assignment base of many urban city CBDs but do not currently have the focus and consistency to make rail-based rapid transit a cost effective investment. BRTS can be the most cost-effective means of serving a broad variety of urban and suburban environments. BRTS vehicles, whether driver-control or electronically

guided, can operate on streets, in freeway medians, on railroad rights-of way, on aerial structures, and underground.

III. DESIGN DEVELOPMENT

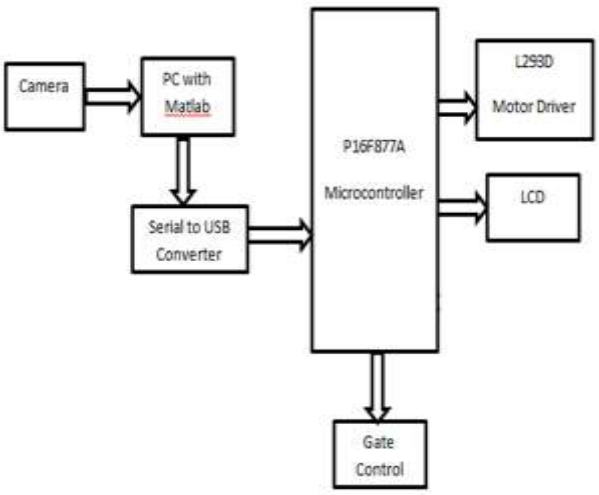
Development of the project is including following phases. We will include following applications in our Project:

1. Image Acquisition
2. Vehicle classification
3. Traffic Control

IV. PROPOSED SYSTEM

The system is designed using PIC Microcontroller P16F877A. A video camera is used to acquire images of vehicles passing through BRT Bus Lane. Depending on the area occupied by the vehicle, classification of vehicle is done. Further this information is passed to the PIC Microcontroller which is having web server set up on it. When microcontroller comes to know the vehicle, according to the type of the vehicle, system will take necessary actions.

System overview:



A. Camera (I-Ball Robo K20):

In our project we are using camera I-Ball Robo K20 for capturing face and hand gestures. The camera has Maximum Image Resolution of 5500 x 3640 pixels. Its Frame Rate is 18 frames per second and also has Built-in JPEG Compression. It has 4 LEDs for night vision, with brightness control.

B. MATLAB:

MATLAB is a high level technical computing language and associated environment for algorithm development, data visualization, data analysis and numeric computation. Using the MATLAB product, solving technical computing problems faster than with programming languages, such as C, C++ and FORTRAN. MATLAB is an integrated technical computing environment that combines numeric computation, advanced graphics and visualization and high level programming language.

C. Serial to USB Converter

A USB adapter is a type of protocol convert which is used for converting USB data signals to and from other communications standards, usually USB adapters are used to convert USB data to standard serial port data and vice versa. Most commonly the USB data signals are converted to RS232, RS485, RS422 or TTL serial data. The older serial RS423 protocol is exceptionally used anymore, so USB to RS423 adapters are less common.

D. PIC Microcontroller (P16F877A):

PIC is a family of microcontrollers made by Microchip Technology, derived from the PIC1650. The 16F877A is one of the most popular PIC microcontrollers and it's easy to see why - it comes in a 40 pin. DIP pinout and it has many internal peripherals. The 16F877A is a capable microcontroller that can do many tasks because it has a large enough programming memory (large in terms of sensor and control projects) 8k words and 368 Bytes of RAM.

These devices feature a 14-bit wide code memory, and an improved 8-level deep call stack. The instruction set differs very little from the baseline devices, but the two more opcode bits allow 128 registers and 2048 words of code to be directly addressed. There are a few additional miscellaneous instructions, and two additional 8-bit actual instructions, add and subtract. The mid-range core is available in the majority of devices described PIC12 and PIC16.

E. LCD

LCD is an electronic showcase module and fined an extensive variety of uses. A 16x2 LCD presentation is extremely fundamental module and is generally utilized as a part of different gadgets and circuits. These modules are favored more than seven segments and other multi portion LEDs. The reasons being: LCDs are sparing; effortlessly programmable; have no impediment of showing uncommon even custom characters (dissimilar to in seven portions), movements etc. A 16x2 LCD implies it can show 16 characters for every line and there are 2 such lines. In this LCD every character is shown in 5x7 pixel network. This LCD has two registers, in particular, Command and Data. The charge register stores the summon guidelines given to the LCD. A charge is a direction given to LCD to do a predefined assignment like instating it, clearing its screen, setting the cursor position, controlling presentation and so on. The information register stores the information to be shown on the LCD. The information is the ASCII estimation of the character to be shown on the LCD.

F. Image processing:

Image taken by camera is processed in MATLAB. It passes through various blocks

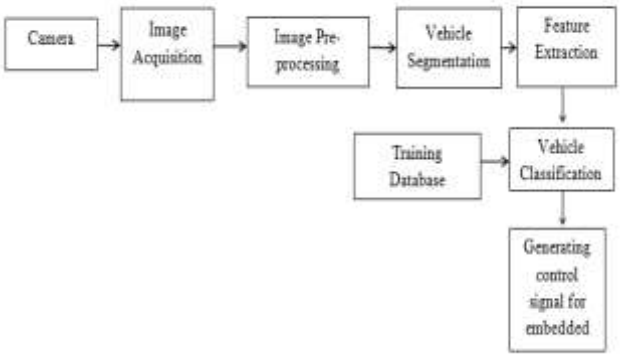


Fig:-Block diagram of image processing

We get control signals for the microcontroller which drives the barrier gate.

1. *Image Acquisition*

Image acquisition is first step of image processing. The image is acquired by camera.

2. *Image Preprocessing*

Preprocessing helps to improve the quality of the image that further helps in better analysis of the image and traffic density calculation also. After acquisition of image some preprocessing is done on acquired image. Preprocessing includes noise filtering using median filter.

A. Noise Filtering: Noises in the image will degrade the accuracy of image. In our project 'paper and Salt Noise' is removed by using Median Filter.

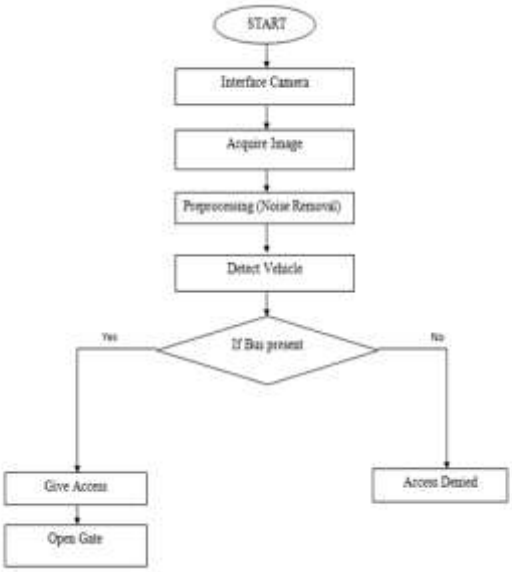
B. Median Filtering: Median filtering is used to reduce "salt and pepper" noise. The Median Filter replaces the central estimation of M-by-N neighborhood with its middle value. On the off chance that the area has a middle component, the square places the middle quality there

Median filtering can be done easily by using 'medfilt2' function in MATLAB.

3. *Feature Extraction:*

Feature extraction is related to dimensionality reduction. When the input data to an algorithm is too large to be processed and it is conceived to be redundant then it can be transformed into abbreviated set of features. This process is called feature selection. The selected features are expected to contain the correlated information from the input data, so that the desired task can be performed by using this abbreviated representation instead of the complete initial data. Feature extraction a type of dimensionality reduction that conveniently represents interesting parts of an image as a compressed feature vector. This approach is useful when image sizes are large and a reduced feature representation is required to immediately complete tasks such as image matching and retrieval.

V. WORK FLOW



In the current paper flow chart represents the systematic flow of data in our project. It gives step by step representation of system work. Overall chart of suggested method is depicted in below figure.

In the first stage of projected method vehicle detection is done. After extracting particular region and noise removal respective application is performed according to user's need.

VI. WORK SIMULATION

Following fig shows a snapshot of original video taken as an input.

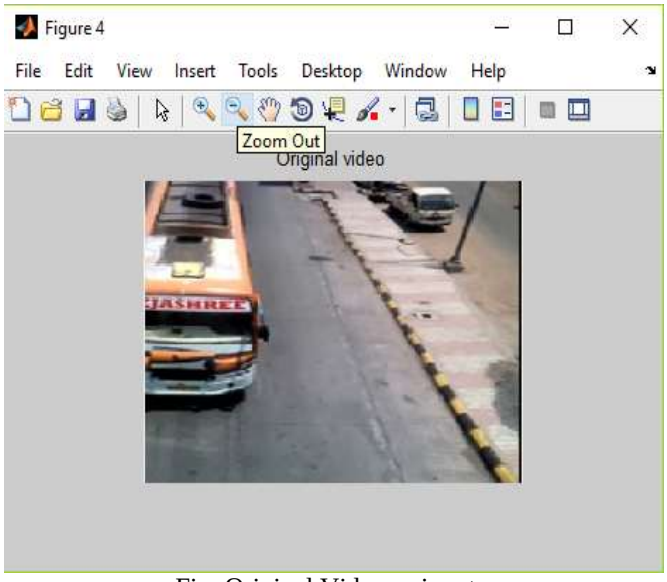


Fig: Original Video as input.

To remove the noise from input image, we are using Gaussian Filter, Average Filter.

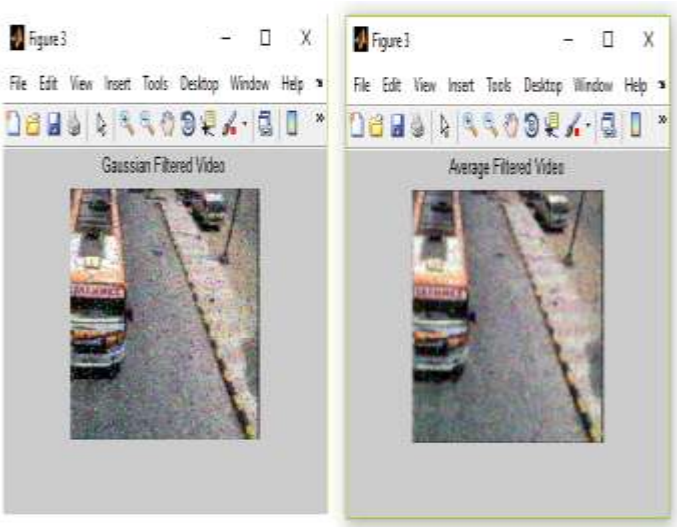


Fig: Gaussian filter and Average filter output

As compared to Gaussian Filter and Average Filter, the result obtained after removing noise is better in Median Filter as shown in Fig.

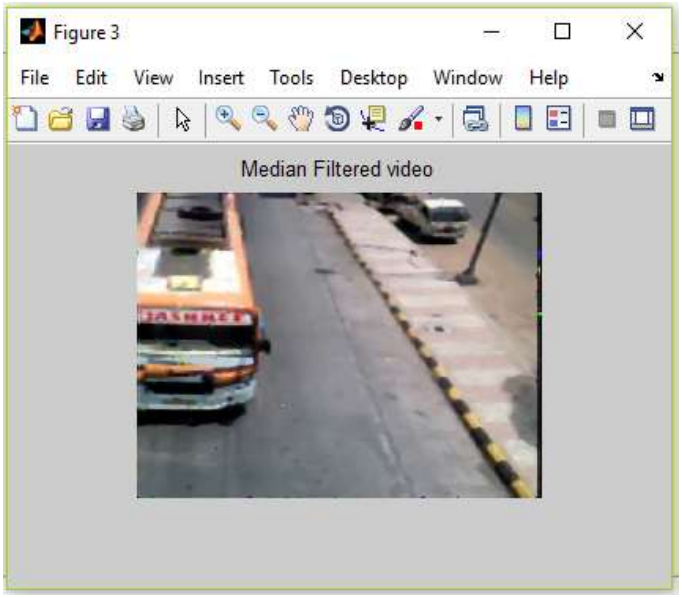


Fig: Median filter output.

I. Performance Parameters

1) PSNR (Peak Signal to Noise Ratio):
   PSNR=10 log(R^2/MSE) dB

Where,
R=255 for Image (Mask value is always 255)

2) MSE (Mean Square Error):

MSE=∑|(I-If)|^2/(M*N)
Where,
I: Original image.
If: Filtered image.
M&N: rows & columns of image.

PSNR Results:
Table 6.1: PSNR Result for various filters

Sr. No.	Filters	PSNR Values	
		Noisy image	Filtered image
1	Gaussian Filter	15.27	18.78
2	Average Filter	15.30	20.66
3	Median Filter	15.32	22.16

Since Median Filter gives highest PSNR values as compared to Gaussian and Average filter, we are using Median Filter to remove noise.

Vehicle Detection:
Vehicle is detected from video using MATLAB.

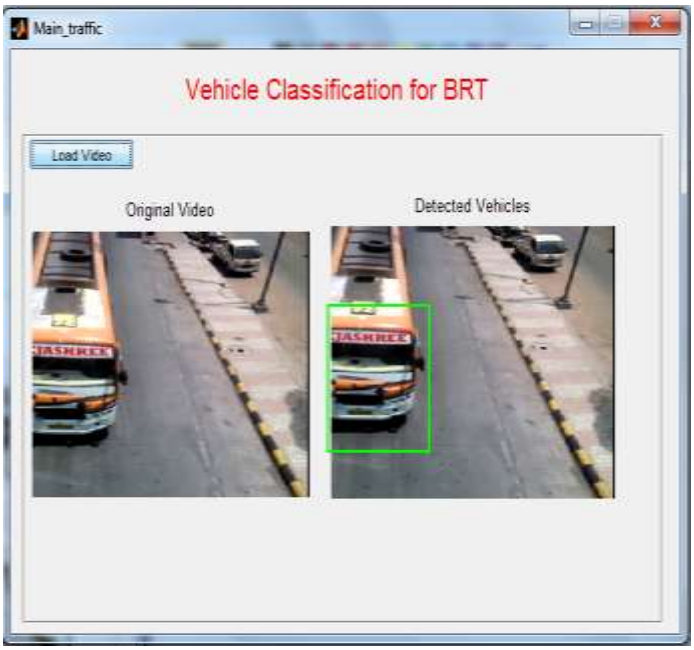


Fig: Vehicle Detection

VII. CONCLUSION

Due to traffic jams, there is chance of accidents because of poor traffic management. To eliminate road accidents and to save precious human life it is essential to find proper solution for traffic jams which is a global problem. In our project we have tried to reduce this problem by avoiding other vehicles except BRTS bus to pass through BRTS lanes, thus reducing traffic on roads while improving service - at no extra cost to commuters.
Till now we completed preprocessing part using median filter and vehicle detection. Vehicle detection is done using the MATLAB software and I-Ball Camera (Robo K20). The remaining part of project that is Vehicle classification, generating control signal for embedded hardware and all function will be done in upcoming semester.

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