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# Traffic Density Measurement using Image Processing: An SVM approach

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**ABSTRACT**:Now a day's traffic jam is a major problem in daily life in urban areas. Increasing number of vehicles is causing more traffic jam day by day. One method to overcome the traffic problem is to develop an intelligent traffic detection system. So we are proposing "Traffic Density Measurement using image processing: An SVM approach" which is based on the measurement of traffic density on the road using camera and image processing techniques. A web camera will be placed in each road of the city that will capture the still images of the roads. After processing the input image, the density of vehicles will be measured and provide us information if any road is blocked by traffic. The main goal of this method is to detect if there is high traffic density or low so that we can choose alternative road to use. Through the image processing technique we can measure the no of vehicles and using Support Vector Machine (SVM) we analysed our result. We set a threshold value to compare between high and low traffic density
.

**KEYWORDS**:Image analysis, dilation, erosion, noise reduction and SVM classifier.

## I. INTRODUCTION

Traffic system plays a very important role in our daily life. Increasing number of vehicles and improper control create traffic jam. Due to traffic congestions there is also an increasing cost of transportation because of wastage of time and extra fuel consumption [1]. Not only that it also hampers and stagnate schedule, business, and commerce sectors of a country [2-4].
Through our system after calculating the density of vehicles our system will decide which road is suitable. We use here cameras which are fixed and capturing the images continuously. Using this system we can determine whether there is a high traffic density or low. This system is cost-effective compared to existing systems and also very flexible and reliable.

In this system after loading the image of the road will be converted into gray and then binary scale. Here gray and binary scale images give better result than RGB images. Because in image processing technique binary and gray scale images take less time than RGB and also cost effective. RGB images contain more color pixels and pre-processing overhead. So the binary and gray scale image is much efficient to use in this system. After that Erosion and Dilation [5] will be applied on the binary image. Erosion will decrease the size of objects and remove disturbances in the image and this technique is called Noise reduction. Dilation will increase the size of objects by filling the holes and broken areas in the image by connecting them. After completing all those process it will be easier to detect and count the total number of objects from the image. A threshold value will be set. If the total number of vehicles is greater than the threshold value then it should be defined as high traffic density otherwise low traffic density. This traffic detection technique will give us a proper analysis of traffic in the road [6].

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## II. BACKGROUND STUDY

Traffic lights at most road intersections operate on a fixed timing schedule that leads to suboptimal traffic management, with unnecessary delays, higher fuel consumption, and higher emissions[7-10]. Traffic management can be improved by installing inductive loops; however, installation involves temporary road closures and high maintenance costs, especially if there is normally a lot of heavy traffic on the road. We present vehicle detection [11-13] and counting system based on digital image-processing techniques [14-17]. These images can be taken by digital cameras installed at the top of existing traffic lights. By using the proposed approach, it is possible to detect the number of vehicles waiting on each side of the intersection, hence, providing the necessary information for optimal traffic management. Hence, the system is equivalent to install multiple inductive loops in all the streets of the intersection, but with lower installation and maintenance costs. After integrating the proposed algorithms into a traffic-management system, it was possible to reduce fuel and $CO_2$ emissions by half compared to the standard fixed-time schedule. There are some existing methods for this application like-

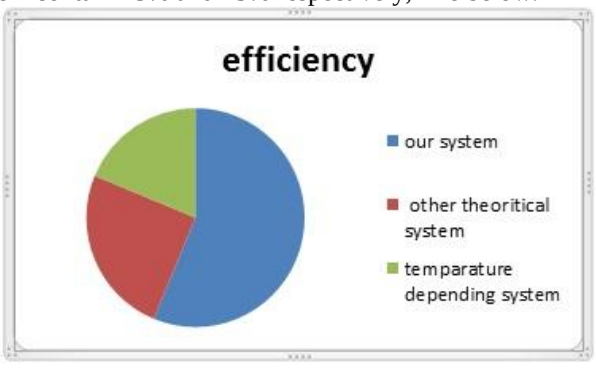
- Magnetic loop detectors are used to count number of vehicles.
- Inductive loop detectors are used.
- Light beams like IR, LASER are used [18-20].

But they have some drawbacks like –

- These detectors need separate system for traffic detection and surveillance [21].
- Fails in different climatic conditions.

## III. APPLICATION

Our main concern is to show people the density of traffic in required road areas. As now a days the traffic jam became an unwanted major problem in our country the system will help them to know the current traffic situation. This will provide the mango people low risk of accident and low time consuming life. High traffic density is a condition on road that occurs when traffic increases and is characterized by slower speeds, longer trip times, and increased vehicular queuing. Our proposed system is more efficient for traffic density measurement other than some existing systems. We can see a graphical representation, where our system contains of efficiency 60%, other theoretical system and temperature depending system contain 25% and 15% respectively, like below:




High traffic density contained roads can be seen as an example of the tragedy of the common people. Because roads in most places are free at the point of usage, there is little financial incentive for drivers not to over-use them, up to the point where traffic collapses into a jam and then demand becomes limited by cost.

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## IV. FLOW CHART AND WORKING STEPS

Our proposed system is shown in a flow chart diagram in figure 1-

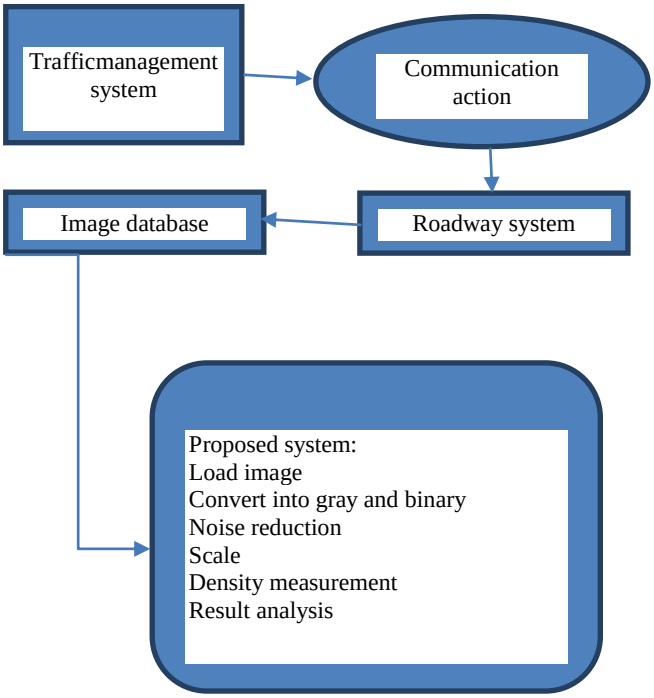


**Fig1:flow chart diagram**

**Working steps-**

- Image loading
- Convert into gray and binary scale
- Noise reduction
- Dilation
- Object detection
- Object count
- Result representation

## V. OUR PROPOSED SYSTEM

**Our system consists of 4 components-**

- Traffic management system
- Road way system
- MATLAB
- SVM classifier algorithm

So our proposed system needs the traffic management system, the roadway system. In our country there can be used some web cameras in the roads. The camera will take the images of the current state of the traffic in roads. The images will be sent to be processed through server. Then the images will go through our proposed systems to detect the traffic density. The SVM classifier will be used to classify data. We can define these processes as three phases.
First one is the image analysis part, second is the object detecting and counting part and the final part is the result representation using SVM classification algorithm.

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**Feature extraction-**
An *M*-by-*N* numeric matrix of image features, where *M* is the number of features and *N* is the length of each feature vector.The feature length, *N*, must be greater than zero and be the same for all images processed during the process. If you cannot extract features from an image, supply an empty feature matrix and an empty feature metrics vector. Use the empty matrix and vector if, for example, you did not find any key points for feature extraction. Feature should be numeric, real and no sparse.

**Pseudo code-**
Step 1: Load image
Step 2: Convert into gray and binary scale
Step 3: Reduce noise
Step 4: Dilate image
Step 5: Set threshold_value
Step 6: Fill holes
Step 7: Detect object
Step 8:Count the number of object

```
If  threshold_value < number_of_object
  result: high traffic density
else
  result: low traffic density
```

**First phase-**
In image analysis phase the image is selected from a camera which may be used in the roadsides. The image should be collected to be analysed as much as perfectly it could be.The distortion, overlapping, hazy image should be forbidden. Then the image should be loaded in the machine (computer) using matlab tools. The loading of image is done by the imread() function in matlab. The image should be in jpg file format in this case.

**Fig2: image**

The acquired frame is first converted into gray scale. To convert any colour to a gray scale representation of its luminance, first one must obtain the values of its red, green and blue primaries in linear intensity encoding. Later the gray scale image is converted into binary.

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**Fig3: gray and binary scale image**

Then we should reduce the noises of the image. We use the imnoise() function to reduce the noise. After noise reduction the dilation or filling the holes needed in this process.

**Fig4: noisy image**


**Fig5: noise reduced image and dilated image**

The imdilate() function is used here to rescale the input image. Morphological operations apply a structuring element to an input image and generate an output image. The most basic morphological operations are Erosion and Dilation. These operations have an extensive amount of uses like removing noise, isolation of individual elements and joining disparate elements in an image, detecting intensity bumps or holes in an image. Erosion and dilation produce contrasting results when applied to either gray scale or binary image. Erosion shrinks image objects while dilation expands them. Now we need to bring our image in contrast to background so that proper threshold value may be selected while binary conversion is carried out on the image. Erosion gradually decreases the size of objects and removes small anomalies by subtracting objects which have radius smaller than the structuring element. When the structuring element is passed over the gray scale image, erosion reduces the brightness (and therefore the size) of brightobjects on a dark background by taking the neighbourhood minimum. With binary images, erosion completely removes objects smaller than the structuring element and removes perimeter pixels from larger image objects. Dilation generally increases the size of the

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objects by filling in holes and broken areas, and connecting areas that are separated by spaces smaller than the size of the structuring element. When the structuring element is passed over gray scale images, dilation increases the brightness of objects by taking the neighbourhood maximum. With binary images, dilation connects areas that are separated by spaces smaller than thestructuring element and adds pixels to theperimeter of each image object. By these processes the first phase ends.

**Second phase-**

The main part that is object detection is come in the second phase. We use the matlab codes as well as functions to detect vehicles in the analysed input image. The process of loading, converting into gray and binary, reducing noise and refill the holes are combined here. Then the bwareaopens() function is used to open the area of the image. The bwconncomp() function is used to connected comparison for finding the density of the objects and the final numbers of objects are shown.

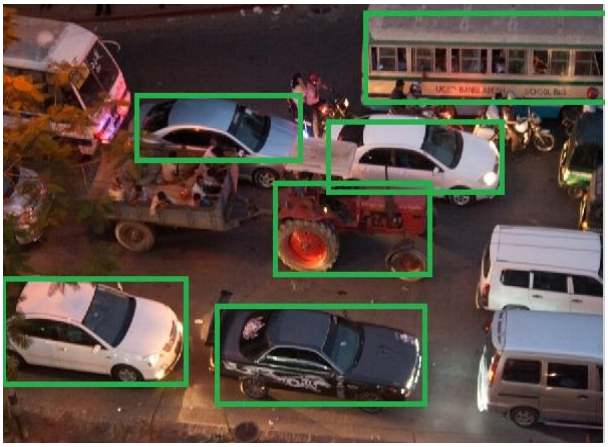

**Fig6: Detecting objects**

**Final phase-**

The result of finding the number of objects are then compared to the threshold value to be known about either there is a high traffic density or low. The result can give you a most approximate measurement about traffic density. The SVM or support vector machine is used here for the binary result of low and high traffic density. There are some test data and when the training data set will come it will produce a graph plot to show for the new class belonging data. Support Vector Machines are supervised learning models with associated learning algorithms that analysed data and recognize patterns, used for classification and regression analysis. Given a set of training examples, each marked as belonging to one of two categories, an SVM training algorithm builds a model that assigns new examples into one category or the other, making it a non-probabilisticbinarylinear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall on.In addition to performing linear classification, SVMs can efficiently perform a non-linear classification using which is called the kernel trick, implicitly mapping their inputs into high-dimensional feature spaces. Here 100 numbers of data are plotted. It may be increased to 1000 data as well.

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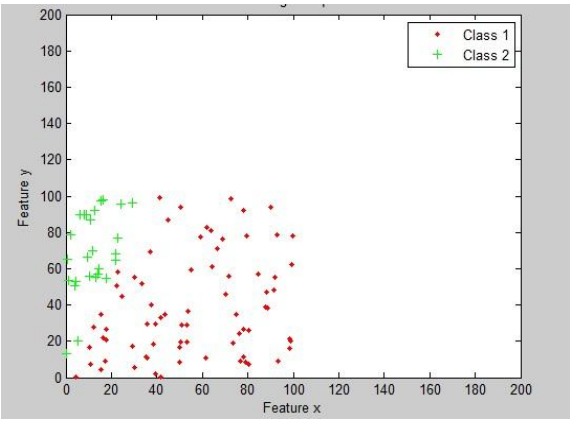


**Fig7: Result representation**

In object detection we may get 96-97% accuracy using the MATLAB tools. On the other hand SVM classifier may give us 80-90% of accuracy. By increasing the number of input data higher accuracy can be gained.

## VI. CONCLUSION AND FUTURE WORK

The study showed that image processing is a better technique to control traffic jam. It is also more consistent in detecting vehicle presence because it uses actual traffic frames. It visualizes the reality so it functions much better than those systems that rely on the detection of vehicles metal content. This work can be enhanced further by proposing a system for controlling the traffic density. That will reduce our major problem of daily life, traffic jam. Overall, the system is good but it still needs improvement to achieve hundred percent accuracy.

The idea of traffic density measurement can be extended in future. We want to develop an android mobile application to search the traffic density in the areas of Dhaka city, which will help to choose the suitable road to go. It will reduce the waste of time due to traffic jam. People can reach anywhere in due time.

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