

# Vehicle Detection in Night Time using Background Model in Urban Traffic Environment

U Pavan Kumar, Bharathi S H

**Abstract:** In image processing the trendy work is to detect the vehicle in night time; the main aim is to detect the vehicle both in the daytime and the nighttime using the background subtraction model in the urban traffic environment. In this case the image will not be clear in the night time so there have developed an algorithm to resolve this issue and the algorithm used here is head light detection. By using this, we can make to know the night time vehicle is present or not. This is done by two step of detection there are of detect the head light that is bright pixel extraction and the other one is the headlight identification. And then the Saliency Map generation is used to find the foreground object detection in the image and it will provide the better result in the night time video sequences and finally by using the morphological filter they will remove the false positive in the pixel. Experimental result shows a better output than the previous method and the planned work will gives a enhanced result in the Accuracy, Recall and the Execution time when compare to the previous algorithm.

**Index Terms:** Background Subtraction, Head Light Detection, Bright Pixel Extraction, Head Light Identification, Saliency Map Generation, Morphological Filter.

## I. INTRODUCTION

One of the fundamental works in video sequences is to detect the moving object from the static cameras like vehicle in roadside and the visitors in the room. In video surveillance techniques, they concentrate on change detection and motion segmentation in an object [1]. The moving objects in the video scenes are called as the foreground objects. The foreground object aims to obtain the robust detection in the moving object from the background. Since they are many methods have been proposed for the background subtraction (BS) one of the fundamental logic in BS is to detect the moving objects from the difference between the current and the references frame, it is called as the background image and it is also said to be a frame difference method. In this study the main problem still facing is the Illumination Change, Gradual, Sudden changes in the cloud environment, Motion of the Camera oscillation and the High frequency of background objects such as tree branches, Pillars, Traffic sign board are not yet rectified so far in the existing methods [2].

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Background Subtraction is also known as foreground detection. It is one the major step of preprocessing in vision based application. The balanced approach is to detect the moving vehicle and to find the difference between the current and references frame of the image [3]. With the indoor scenes, reflection and the animated images on the screen lead to the background changes. For example take an image of the road without vehicle in this the background subtraction will be easy whereas, if the road is assigned with the vehicle and with the traffic means in that case deduct the new image from the background mask then the foreground object will be alone. In BS is one of the famous techniques for traffic detection. And it is not easy to model this in the real scenario [4].

Detecting vehicle in the daytime will be detected by their color, shape and their typical pattern whereas, the nighttime vehicle detection will be done on the headlight or the tail light which is most reliable to detect the vehicle in night time. There are some application oriented approaches are there for night time vehicle detection there are as driver assistance system and the traffic surveillance. The driver assistance will be easy to use and it will be assure the safety for the drivers [5]. Apart from this they are also affordable for the blind spot information, Pedestrian Collision Warning, Adaptive Front light system. When coming to the traffic surveillance the detection and the tracking of the vehicle will be a traffic flow control, long term motion prediction and Study of the vehicle behavior these are used to improve the road safely to reduce the accidents [6].

The main contribution of this paper is to identify the vehicle in the night time scenario and the accuracy level will be low when compare to the day time. In order to rectify these issues the highlight algorithm is used to overcome this problem and obtain a robust result. The remaining part of this paper is organized into Section II, Discuss about Literature Survey, Section III Explore about the Proposed Work, Section IV Analysis the Experimental Result, Section V Presents the Conclusion

## II. LITERATURE SURVEY

Xin Liu and Chun Qi, 2013 studied a Gaussian Mixture Algorithm is one of the widely used method for Background Subtraction in the moving objects from the Static cameras. When comparing with the



previous approaches the foreground object will be detected from the complex background and the performance will be improved in this type of method. The drawback is the computation is not efficient and the robustness of the background changes and the sensitivity to detect the foreground object can be regularized [7]. Munir Shah, Jeremiah D. Deng, Brendon J. and Woodford, 2014, Suggest an Sapito-Temporal smoothing it is fast and performs significantly better when compare to the traditional noise filters that are been used so far. Here, the computing is inexpensive to detect the shadows and should improve the parallelization of this model to obtain better real time processing [8]. Zezhi Chen, Tim Ellis, 2014 Presented a Self-Adaptive Gaussian Mixture Model to improve the convergences and the accuracy of the Background Subtraction. Ought to improve the combine low level and high level process in order to identify the vehicle that are stationary for long period. Example: Traffic Lights [9]. Juana E. Santoyo-Morales and Rogelio Hasimoto-Beltran, 2014, It Implies the video BS in complex Environment to obtain and improves the Excellent noise removal in the image and the object motion are detected properly. It faces the drawback that high frequency of noise in the environment is not detected correctly and also the dynamic background image such as water waves are not been detected efficiently [10].

Munir Shah, Jeremiah D. Deng, Brendon J. Woodford, 2015, It discuss about the Self-Adaptive Code Book (SACB) to provide the better processing speed than the standard Code Book model it is obtained by the efficient color model and block based model. It should focuses on super pixels for efficiency improvement for better direction of the objects [11]. Martin Hofmann, Philipp Tiefenbacher, Gerhard Rigoll, 2012, Background Segmentation with Pixel based Adaptive Segmenter is presented for the high efficiency background modeling, the vital idea behind this BS is to employ two controllers. The drawback is that it should reduce the number of necessary parameter and also it should improve the explicit shadow modeling [12]. M. Van Droogenbroeck and O. Paquot University of Liège, 2012, There have studied the BS using ViBe that perform well at the object level. It should perform some modifications that are specific to shadows and it is difficult to isolate the effort of each change regarding video sequences [13]. Yonghong Tian, Senior Member, IEEE, Yaowei Wang, Zhipeng Hu, and Tiejun Huang, 2013, discussed about the Eigen Background used in the crowded scenes the objective here to develop this model is that it should be robust in the crowded scenes by doing this the background images in the crowded scenes quality should be improved [14]. Nonaka, Y., Shimada, A., Nagahara, H, 2012, They have been discussed about the Sapito-Temporal features for integrated Background Modeling combing the Pixel-level, Region-Level and the Frame-Level by using this Algorithm the Quality will be improved from the previous studies and it faces the problem in the computation time it take long for the process of the input images [15].

Wang, Y., Jodoin, P.M., Porikli, F., have presented the balanced dataset that have a depicting in various scenarios

that are common in change detection. The drawback is that only one set of the parameter is use for all videos and it performs the lowest performances in the night time scenarios [16]. Yichao Zhao and Yi Su, 2017, they have studied about the Frequency Modulated Continuous Wave which will reduce the interferences caused by the moving foliage. The ambiguity between the range and velocity could not be solved properly [17]. Indrabayu, Rizki Yusliana Bakti, Intan Sari Areni, A. Ais Prayogi, 2016, they have been subjected about the Gaussian Filter and the Kalman Filter to measure the vehicle detection that conducted using GMM. By combing this it achieved the high accuracy in the system detection it must resolve when they is heavy traffic in the road the vehicle are seen clearly so the error detection is not done properly [18].

### III. PROPOSED SYSTEM

In this section, the discussion is about the vehicle detection in the traffic environment and it is found that the scenes appears in the night time is not clear; in this situation there have developed an algorithm to capture the object in the night time scenario. In Fig.1 there are shown that the flow of the daytime with the person captured in the park. The basic flow is carried out for the background subtraction. In the recent cases, the day time objects are captured from the roadside are reliable. In order to improve the quality in the foreground object during night the thermal infrared cameras should be used to resolve this issues even though it results in illumination changes and the blurriness in the image, the accuracy level is low when compare to day time and night time vehicle, and the contrast in the image must be enhanced in this case.

First, the input video (.avi format) is taken then the number of frame are been spitted according to the frame size and followed by this, the preprocessing will be done on each frame in that the unwanted noise with the distortion are eliminated, only the important features will be enhanced from the frame for future processing, and the vehicle are been identified from the feature extraction method and the background and foreground will be separated.

In the second process, from the input frame the background and foreground will be separated in this the background model is first computed, to get the foreground mask deduct the background from the input frame then followed by this process apply the threshold to get the absolute foreground object. The key factor of the thresholding is, the value of the threshold can be selected by the user manually or by using certain algorithm the value can be automatically computed. By computing the threshold value automatically is named as automatic thresholding.

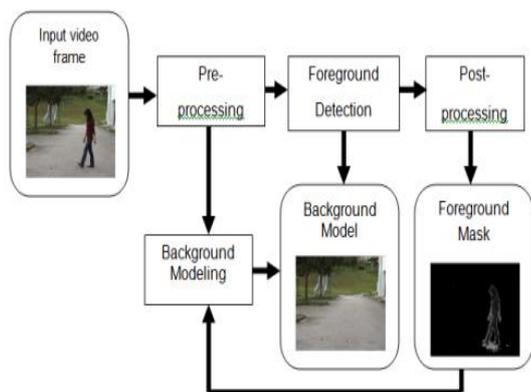


Fig.1. Typical flow diagram of Background Subtraction

In the third process, the night time scenes should be captured, so the headlight algorithm will be used to detect the vehicle in the night time and the workflow of this will be done on these steps: 1.bright pixel extraction and 2. The headlight identification will be done on the vehicle image in this application which is shown on the Fig.2.

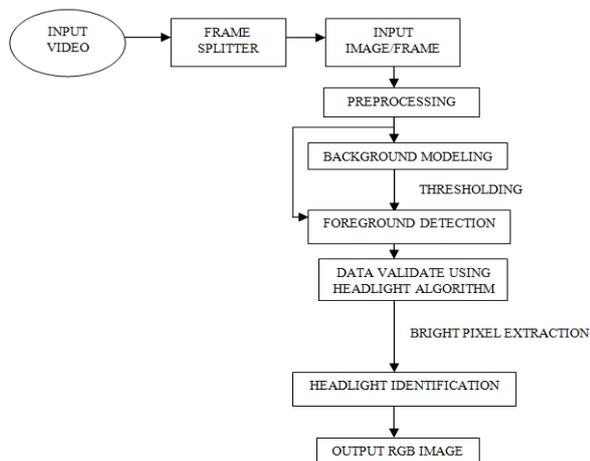


Fig.2. Proposed Work Flow

#### IV. EXPERIMENTAL RESULT

The object detection is the important step in the video analysis in real world traffic scenes the video is taken from the city surveillance camera and the video format will be in the .avi it is considered for both the daytime and the nighttime vehicle detection and here we are testing this with the three approaches such as Sigma-Delta with Confidence (SDC), Vibe, Gaussian mixture model with confidence measurement (GMMCM). When we compare these approaches to our proposed system will be obtaining the better result in the Accuracy, Recall and the Execution. The proposed Head Light detection algorithm is used to improve the night time vehicle detection using the background subtraction.

This will be done by the Saliency map generation which is used to find the foreground of the object and it will be implemented in both the day time and the night time it performs well in the night time scenario. The video format of .avi is taken as a sample and the daytime length of the video

will be 1920 x1080. Whereas, the night time length will be 320x240. The sample images which are provided by the different BS are implemented by these three approaches where the foreground mask will be generated and then the thresholding will be done according to the fixed value of the foreground and the BS and the headlight light algorithm will be validate the vehicle in the night time using the saliency map generation and the morphological filter and the final vehicle will be detected. And the results are consolidated with the proposed system and the performance analysis of the day time vehicle detection and nigh time vehicle detection will be good in the accuracy, Recall and Execution time. And our proposed system shows the better result in the Background subtraction.

TABLE1. COMPARISON METRIC OF VEHICLE IN DAY TIME

| Approaches | Accuracy (%) | Recall (%)   | Execution Time (sec) |
|------------|--------------|--------------|----------------------|
| SDC        | 62.4         | 61.2         | 17.3                 |
| ViBe       | 85.1         | 83.4         | 13.1                 |
| GMMCM      | 93.3         | 92.1         | 10.84                |
| Our Method | <b>96</b>    | <b>95.15</b> | <b>9.14</b>          |

The table 1 shows the comparison of the existing and proposed system of vehicle detection in the day time. Here, the Accuracy will be high of 96 % when comparing to previous three algorithms and the Recall will be high of 95.15% and the execution time will be less of 9.14s. And the table 2 shows the comparison of the night time vehicle detection. There the accuracy will 96.5 % and the Recall will be of 95.75 % and the execution will be 10.79 s.

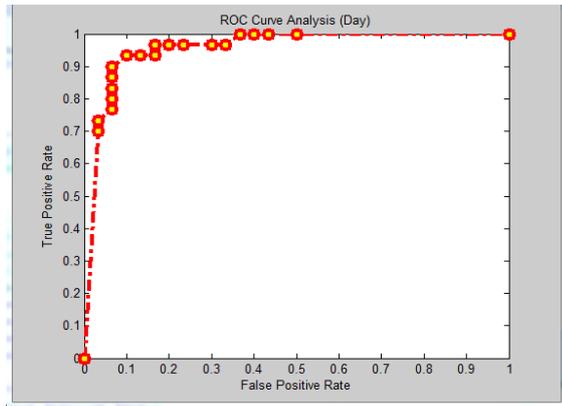
TABLE2. COMPARISON METRIC OF VEHICLE IN NIGHT TIME

| Approaches | Accuracy (%) | Recall (%)   | Execution Time (sec) |
|------------|--------------|--------------|----------------------|
| SDC        | 72.2         | 71.1         | 15.2                 |
| ViBe       | 83.6         | 82           | 14.1                 |
| GMMCM      | 93.1         | 92.7         | 10.81                |
| Our Method | <b>96.5</b>  | <b>95.75</b> | <b>10.79</b>         |

The Receiver operating characteristic (ROC) curve is used to assess the performance idea in complex system in the surveillance. The ROC graph is obtained for both day time and the night time which are represented in the Fig.3 and Fig. 4.

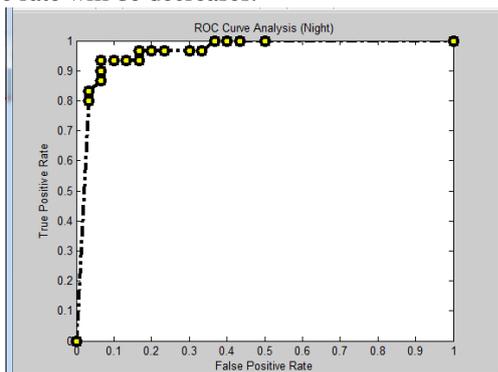


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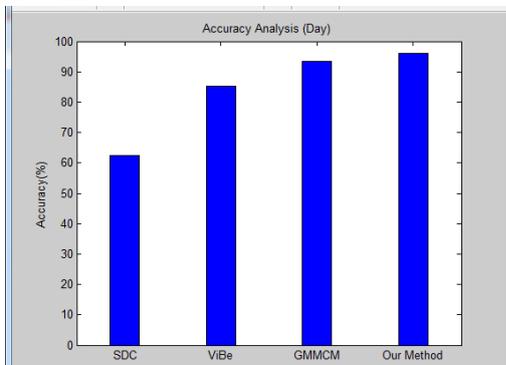
**Fig.3 Daytime ROC curve analysis**

The ROC is used to utilize the radio signal there are used in the number of application like medical diagnostics, computer vision and field radiology. It is mainly used for the effectiveness of the given diagnostic test by sensitivity measurement test. The ROC will be plotting the true positive rate from the false positive rate at dissimilar thresholding. The true positive will be the said to be the Recall and the sensitivity of the object detection. The false positive is also known as the false alarm or fall-out. In the Fig.3 the ROC curve for day time the false positive will be sequentially higher. Whereas, in the night time ROC analysis the false positive rate will be decreases.



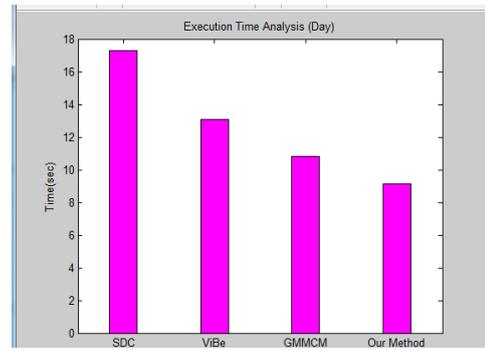
**Fig.4 Night Time ROC curve analysis**

The graph diagram in the Fig.5 and Fig. 6 will represents the day time accuracy and the execution comparison for the three approaches along with the proposed method. It shows that our proposed method will be more reliable than the previous work.



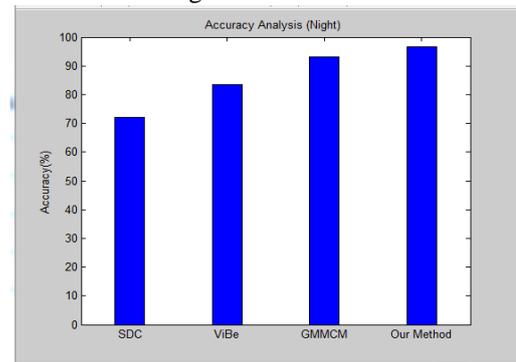
**Fig.5 Accuracy in day time**

The accuracy in the day time will be high in our proposed work when compare to the SDC, ViBe, GMMCM and Fig.6 shows the execution results also shows the better output in the graph representation among the three methods. It is less than the three approaches.

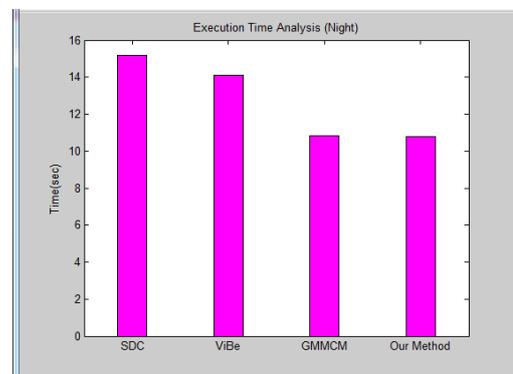


**Fig. 6 Time Execution in day time**

The graph diagram in the Fig.7 and Fig.8 will represents the Night time accuracy and the execution comparison for the three approaches along with the proposed method. It shows that our proposed method will be more reliable than the previous work in the night time detection.



**Fig. 7 Accuracy in night time**

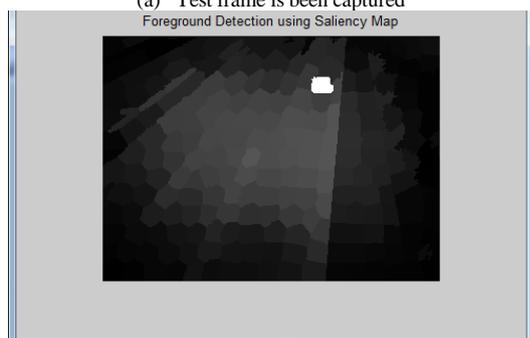


**Fig. 8 Time Execution in night time**

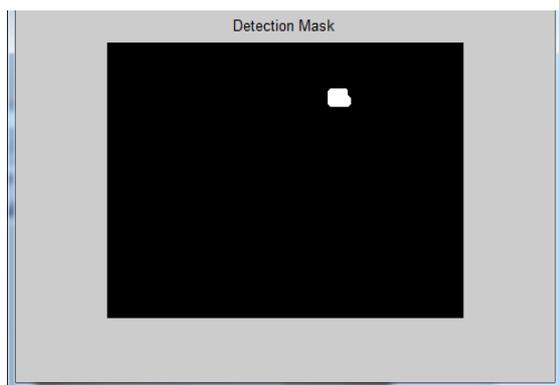
The daytime vehicle detection will be shown in the Fig. 9 where the frame is splitted into 3 and the figure represents that the test frame and then the foreground will be detected by saliency map and the mask will be detected in the image then the final detected vehicle will be highlighted in the red mark thus the vehicle will be identified in the daytime.



(a) Test frame is been captured



b) Foreground detection done by Saliency map



(c) The detection Mask will be detected

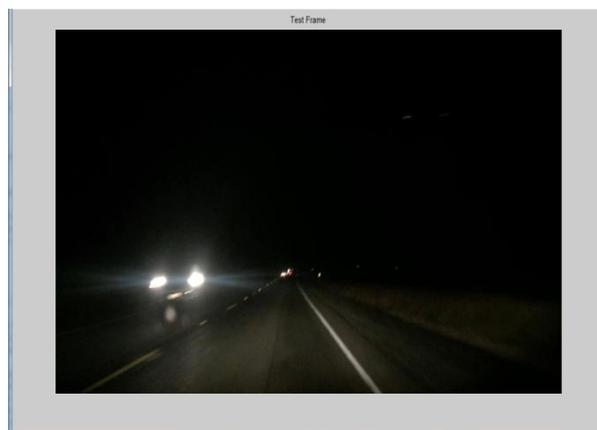


(d) Vehicle is detected using headlight detection

**Fig. 9 Day time Vehicle detection**

The daytime vehicle is achieved by using the headlight detection first test frame is been captured from the .avi format in the third frame and then the saliency map generation is used to identify the foreground object detection and then the detected object will be masked as white where the background will be black and then the vehicle will be

detected using the morphological filter and the vehicle will be detected in the red color shows the vehicle will be detected. The Fig. 10 shows the night time vehicle detection in the frame 65 and the test frame will be captured from the night time in this the saliency map generation will be detected then the foreground will be extracted and the headlight algorithm will be applied using the threshold factor and foreground mask will be detected and finally the vehicle in the night time will be detected and the result shows the detected vehicle will be clear and accurate.



(a) Test frame is captured

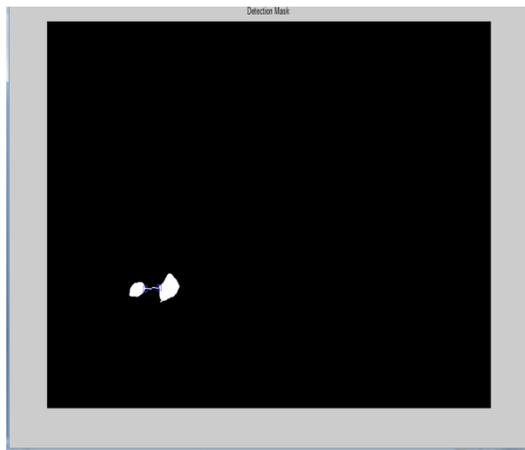


(b) Foreground detected by Saliency map

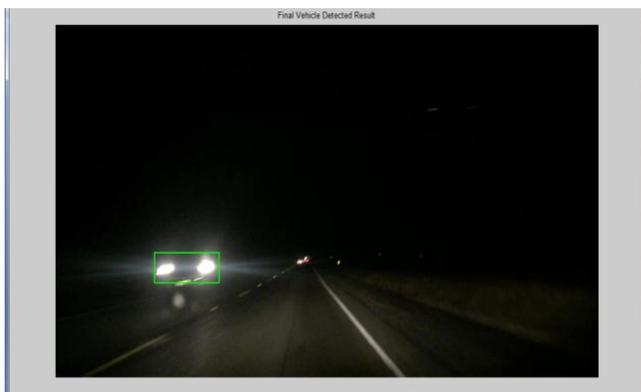


(c) Headlight detection using thresholding

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(d) Detection mask



(e) Final Vehicle detection

Fig.10 Night time Vehicle detection

## V. CONCLUSION

Background Subtraction is one of method that easy resolve the slow-moving or temporarily stop vehicle the detection of the vehicle will be complex in the urban environment. This paper resolves the background subtraction on the vehicle in the night time and daytime using the headlight detection algorithm by using the Saliency Map generation and which is used to detect the foreground object and the vehicle will be detected and the red mark indicated the detection is done and the output of the image will be clear. Experimental results shows that the performance results for the accuracy, recall and the execution time will be detected and the accuracy for day time will be 96 % and night time will be 96.5 % and the Recall for the day time 95.15 % and night time is 95.75 %. The execution time for day time 9.14 s whereas, the night time will be of 10.79 s. And the ROC curve analysis shows that the false positive is more for the daytime when compare to the night time. Our proposed algorithm will outperform the better result in the night time vehicle detection when compare to the three algorithm such as SDC, ViBe, GMMCM. And the night time vehicle will be detected using the background subtraction in urban traffic environment.

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