

# Intelligent Real Time Traffic Controller Using Image Processing – A Survey

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**Abstract:** Extensive number of traffic on roads and improper methods of controls of that traffic creates traffic jam. Bad traffic management leads to wastage of time, person-hour and increase in pollution. The frequent jams require a proper management system for increasing traffic. Existing methods work well in free-flow traffic but in the case of heavy congestion, these methods have to face challenges. Therefore, for better traffic management image processing methods serves as a better option. In this paper, for the vast increase in congestion problem and problems related to existing detectors we are giving an intelligent traffic controller based on the concept of real time image processing. The use of image processing helps in proper management of traffic even in shadows and various lighting conditions and it is also cost effective as the devices it requires like sensors, cameras are cheaper than for other solutions. The information obtained can be used further for the development on a user handy android application, which helps to detect traffic density at a particular location and depending on the results, the desired and more convenient path can be chosen.

**Keywords:** Image processing, edge-detection, traffic management, traffic density, traffic controller.

## 1. Introduction

With the development in many aspects of life traffic congestion is a challenge for all large and growing urban areas and becoming one of the daily concern of all the individuals. Traffic congestion is a condition on road that is caused by slower speeds and increased vehicular queuing. Today, the number of vehicles is increasing to a great extent [1]. However, at the same time road infrastructure cannot be increased which leads to increasing traffic congestion. The use of timers is the basic method for traffic control. Researchers throughout the globe are engaged in exploring different technologies to detect traffic congestion and making congestion management more efficient. Automated traffic detection system is required for smooth and safe running of the civilization, which will lead us towards proper analysis of traffic, distribution of controlling signals and adjustment of control management.

There are a number of technologies that are being used to detect the congestion of traffic. This paper discusses a feature based tracking system, which detects vehicles under challenging conditions. This paper tells about the use of image processing in traffic management in which cameras are continuously monitoring the traffic by capturing the images and the videos. At particular intervals of time the frames are extracted and consecutive frames are compared and based on designated. The results from this can be used for development of an android application, which will be easy, and handy for the user in helping those to select the route to their destination by saving the time, which may have, spend on searching through busy streets. The use of application helps user in knowing the traffic density at the desired location. The use of image processing helps in improving the analysis and performance of road traffic. The system is reliable, effective and flexible.

Traffic control technique, which are currently using, involve magnetic loop detectors buried in the road, infrared and

radar sensors on the roadside. The drawback with this is, the traffic information provided by this is limited and it requires separate systems for traffic counting and surveillance. In contrast to old controlling system for traffic, video-based systems offer many advantages. This system provides more traffic information, combines both surveillance and traffic control technologies, which can be installed easily, and as the image processing technique is progressing this video-based techniques are becoming more scalable. One of the techniques of identifying and locating sharp discontinuities in an image is known as edge detection. These discontinuities in the edges are due to changes in pixel intensity and are important as it characterizes boundaries of objects in a scene [6]. Edge detection and Video-based techniques are the most frequently used techniques in digital image processing [7]. With the use of Edge detection technique benefiting from changes in grey tones in the image. In this paper, we are briefly introducing the concept of detecting the traffic jam and then the work performed till now in the literature survey section. Then we are giving the methods for management of the traffic. Further, we are giving the how processing of traffic images takes place. In next section, we detect the traffic management with image processing system. Finally, we conclude the paper.

## 2. Literature Survey

Vikramaditya Dangi, Amol Parab, Kshitij Pawar & S. SRathod [1]- The comparison of various edge detection algorithms, resulted that Canny Edge Detector technique is the most efficient algorithm.

Khan Muhammad Nafee Mostafa, Quadrat-E-Alahy Ratul [2]- This paper suggested the use of automatic traffic detection system is required for smooth and safe living which directly leads us to proper adjustment and controlling of traffic system.

PejmanNiksaz[5]- This paper shows us the use of image processing in traffic management. The advantages of the method include benefits such as: 1) Non-use of sensors 2) Low cost ,easy setup and relatively good accuracy and speed.

Chandrasekhar. M, Saikrishna. C, Chakradhar. B, Phaneendra Kumar. P & Sasanka. C[6]- In earlier technology more time was wasted by green light on empty roads. This problem can be solved by using image processing based intelligent controller.

Prof. Uma Nagaraj, JinendraRathod, PrachiPatil, Sayali Thakur, Utsav Sharma [3]-from this paper we can suggest that the analysis can be improved with the use of multiple sequential cameras along a highway which along with localized congestion control, analyzes the congestion build up from the start to the end point.

P.Srinivas, Y.L.,Malathilatha,Dr.M.V.N.K. Prasad[4]- The analysis and comparison of various contour tracing and object counting methods inferred that the Moore neighborhood technique is best compared to the other methods . The paper shows that image processing is an efficient method of traffic control technique.

VismayPandit1, JineshDoshi2, DhruvMehta3, AshayMhatre4 and AbhilashJanardhan[7]- This paper shows that image processing helps in reducing the traffic congestion and avoids the wastage of time by a green light on an empty road. It is more accurate in detecting vehicle presence because of the use of actual traffic images. The system is good but improvements need to be made in order to achieve a hundred percent accuracy.

### 3. Methods Used for Traffic Management

There have been drastic changes in management of traffic jam compared to old methods.

#### 1. Manual Controlling-

The simple and basic approach is to employ a person at important areas to control traffic according to different countries and states. The traffic police possess signboard, sign light and whistle to control the traffic. In order to control the traffic they wear specific uniforms. But as the amount of traffic is so increasing that police persons have to face many difficulties in controlling the traffic manually and avoids frauds done by people.

#### 2. Automatic Controlling-

Timers and electrical sensors do automatic controlling of traffic light/signals. A constant numerical value is loaded in the timer for each phase. Depending on the changes in timer values , the light automatically gets OFF and ON. The availability of the vehicle and signals on each phase are captured by the sensors and depending on the signal the lights automatically gets switch ON and OFF. This gets somewhat helps to control heavy traffic based on timing attributes.

#### 3. Magnetic Loop Detectors (MLD)–

Magnetic loop detectors are used to count the number of vehicles on the road using magnetic properties. We use Current traffic management techniques like magnetic loop detectors which are buried in the road, radar and infrared sensors on the side of roads provide limited traffic information. It shows the requirement of separate systems for proper counting of traffic and correct supervision.

#### 4. Inductive loop detectors –

This method provides a cost-effective solution for traffic controlling but along with this it is also true that their failure rate is high when they are installed in poor road surfaces, leading to fall in pavement life. At the time of maintenance and repair it obstructs the traffic.

#### 5. Use of light beams-

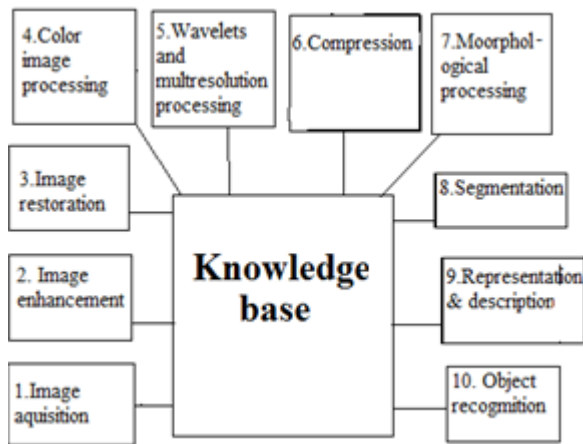
Light beams like infrared rays, LASER etc can also be used for controlling functioning of traffic. But, in this method the light beams are obstructed as traffic flows causing improper results.

#### 6. Use of image processing-

To meet the specific requirements any automated systems require interaction with the computer. Traffic jam can be easily detected by human eyes. The human brain comes within a second with a decision of whether a jam has occurred or not by processing the image, detecting and analysing objects. Computers can only process binary data. The picture on the road is actually a binary data, which needs to be represented as a digital image. It is used as a primary input. The image when captured is unformatted and raw. For the efficient processing programmers need to process that raw image and extract useful information from them. Several fields like image processing object recognition, computer vision, etc. have emerged due to need of extracting information from images.

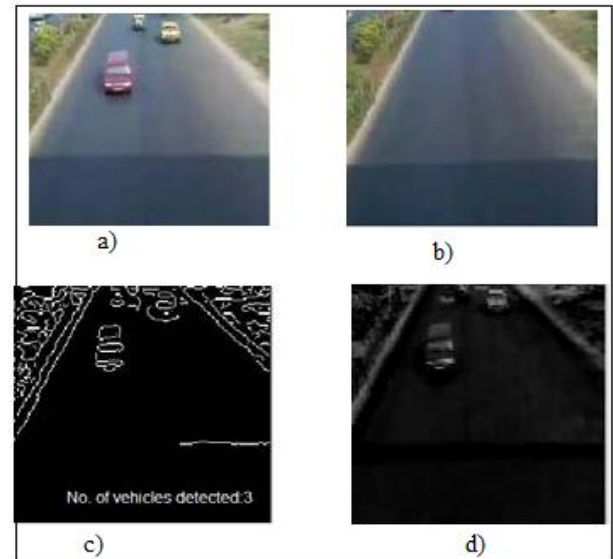
### 4. Processing of Traffic Images

An image consists of two-dimensional function  $f(x,y)$  where  $x$  and  $y$  are co-ordinates of the 2-D plane. The amplitude of any pair of co-ordinates  $(x,y)$  at a point is called intensity or gray level of the image at that point. A digital image has finite, discrete values for  $x$ ,  $y$ , amplitude. An image is composed of finite number of picture elements or image elements or pixels each of which has a particular value and location. Processing of an image involves the following steps-



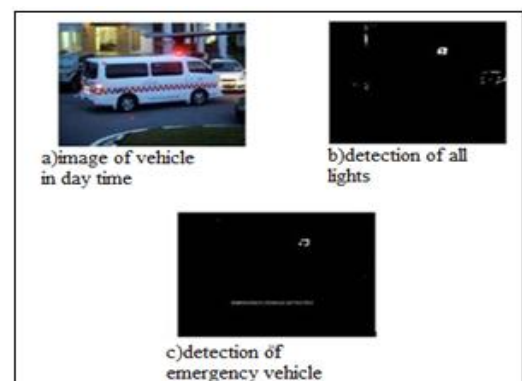
**Figure 1:** [9]. Steps involved in controlling traffic with image processing

- Image acquisition can be as simple as an image already given in digital form. It is done with the use of web camera. When there is no traffic on the road, the image of the road is captured, which is saved as reference image at a particular location specified. The acquired image is first converted into gray scale and then converted to a binary image.
- Image enhancement techniques bring out detail that is indistinct, or it simply highlights certain features of interest in an image. Image enhancement involves operations like brightening, blurring, edge enhancement and sharpening.
- Improving the appearance of an image is done by using image restoration. Its purpose is to undo defects in an image, which degrades an image.
- Light of many wavelengths produce “color”. Color is characterised by attaching names to different stimuli example gray, green, red, blue.
- The representation of images in various degrees of resolution is done using wavelets.
- Reducing the storage required to save an image and transmit it is studied under compression techniques.
- Morphological operations generate an output image by applying structuring element to an input image. It involves two basic operations Erosion and Dilation. Erosion shrinks an object size by removing small anomalies, reducing the brightness. Dilation expands the size of objects by filling in broken areas and holes.
- Segmentation deals with partitioning of an image into its constituent objects. It is one of the most difficult tasks. The output of segmentation stage which is raw pixel data is served to representation and description phase.
- Description, also known as feature selection, deals with the basic for differentiating one class of objects from another.
- The process that assigns a label (e.g. “vehicle”) to an object based on its descriptors is known as recognition. Once a vehicle is detected the two profiles are compared to find the difference. The difference tells us whether there is a motion or displacement. The difference between two profiles is greater in case of motion. A traffic scene mostly contains vehicles or people. To separate person and vehicle we use ratio of height/width of each bounding box. This value should be less than 1.0 for a vehicle and must be greater than 1.5 for a person.



**Figure 2:** (a) Real-time image (b) Background image (c) Subtracted image (d) No. of vehicles = 3

It is used to analyze a real time traffic scene of a road (Fig 2 (a)). The adaptive background that is updated from the scenes is shown in Fig. 2(b). The subtracted image then contains only the objects (vehicles) as seen in Fig 2(c). Using image processing algorithms (Fig 2(d)), the number of vehicles in the lane can be detected. In this case, the number of vehicles is 3.



**Figure 3:** Detection of emergency vehicle [4]

The presence of an emergency vehicle can also be detected using the processing of traffic images. This can be detected, by density of their flashing red lights as in the case of Ambulance. Once it is detected, it can be given priority over other vehicles in the case of heavy traffic on the road of the cities. The detection of this emergency vehicle is done as shown in the fig. 3 [4] above.

#### A. Deciding the Appropriate Methods

The comparison of various edge detection algorithms shows that Canny Edge detector is the best. It gives about 93.47% accuracy.

**Table 1:** Comparison of edge detection techniques [6]

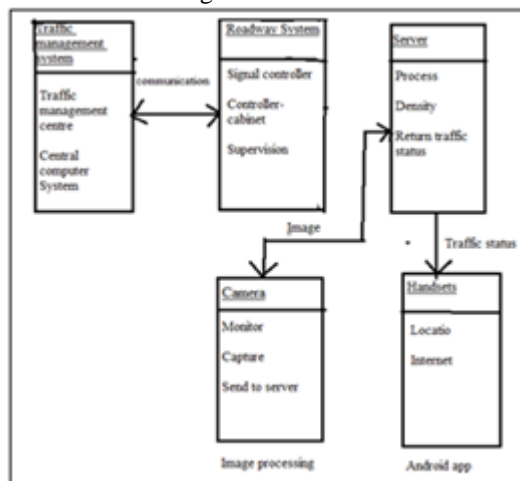
Image	Actual no	Boolean	Marr-Hildreth	Sobel	Prewitt	Canny
1	4	2	6	2	2	4
2	3	0	4	1	1	2

3	4	2	3	2	3	4
4	5	2	3	2	3	6
5	5	2	3	3	3	5
6	7	3	5	3	2	6
7	4	1	5	1	1	4
8	5	2	5	3	2	5
9	3	0	3	0	1	2
10	6	4	3	2	3	6
Accuracy		39.13	84.78	41.30	45.65	93.47

The study shows that canny edge detector uses two thresholds, which makes it less distorted by noise and other environment disturbances. The use of this method along with Moore-neighborhood to count vehicles marking is useful.

### B. Use of image processing in traffic management

For properly managing the traffic, it can be continuously monitored using cameras. Video recorded is extracted into frames which are then sent to the server. The server further processes the frame with different activities i.e. performs brightening, blurring, sharpening etc. Then the concurrent frames are compared and depending on their results the server updates status as high or medium or low traffic based on the count of vehicles in the frame. If someone is using the Android application on the road where traffic is jam, a new application user will have to first register themselves and then login into the application using the login form. Once the user logs in, the server will return various locations that are present in the database to the user along with their traffic status. The information provided by the server can then be used by the user to choose a path to the destination. The process is as shown in fig.4.



**Figure 4:** Use of image processing

## 5. Conclusion

The study infers that image processing is an efficient and effective method of controlling traffic jam compared to other traditional methods of controlling traffic jam. It works much better and is more consistent compared to systems, which depend on detection of vehicles metal content because it uses actual traffic frames. The use of multiple sequential cameras will help to increase the analysis of traffic jam at the local region. The use of image processing is good for traffic management but it still requires much improvement. The use of image processing may help to identify vehicles as they pass and priority can be given to

emergency vehicles and help in supervision on a reasonably large scale.

## References

- [1] VikramadityaDangi, AmolParab, KshitijPawar&S.SRathod,"Image Processing Based Intelligent Traffic Controller,"Undergraduate Academic Research Journal (UARJ), ISSN : 2278 – 1129, Volume-1, Issue-1, 2012
- [2] Khan Muhammad NafeeMostafa, Qudrat-E-AlahyRatul, "Traffic Jam Detection System," pp 1-4.
- [3] Prof. Uma Nagaraj, JinendraRathod, PrachiPatil, Sayali Thakur, Utsav Sharma / "International Journal of Engineering Research and Applications" (IJERA) ISSN: 2248-9622 Vol. 3, Issue 2, March -April 2013, pp.1087-1091 1087
- [4] P.Srinivas,Y.L.Malathilatha,Dr.M.V.N.KPrasad,"Image Processing Edge Detection Technique used for Traffic Control Problem",International Journal of Computer Science and Information Technologies, Vol4(1),2013,17-20
- [5] N.R.Vikram,S.Sivaraman,R.Balamurugan,"Controlling Traffic Jam using Feature Detection and Object Detection Technique",IOSR Journal of Mechanical and Civil Engineering,e-ISSN:2278-1684,p-2320-334XPP 07-13.
- [6] Chandrasekhar. M, Saikrishna. C, " Traffic Control Using Digital Image Processing", International Journal of Advanced Electrical and Electronics Engineering, (IJAE), ISSN (Print): 2278-8948, Volume-2, Issue-5, 2013
- [7] VismayPandit1, JineshDoshi2, DhruvMehta3, AshayMhatre4 and AbhilashJanardhan, " Smart Traffic Control System Using Image Processing," International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)ISSN 2278-6856 Volume 3, Issue 1, January – February 2014.
- [8] "Digital Image Processing guide", Unit 1. Pdf.