SMART TRAFFIC LIGHT CONTROL SYSTEM BASED ON VEHICLE INTENSITY MEASUREMENT

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Abstract: Vehicles growth leads to a big problem over the world including in crowded cities. The Intelligent traffic control algorithm is implemented to introduce many parameters, such as the crowded roads, the emergency vehicles and the intersection of roads. Intelligent cameras are connected for capturing real-time traffic flow images of each direction. The control system can automatically adjust the traffic light control parameters according to the changes of traffic flow in different directions, thereby increasing the traffic efficiency of intersection of roads and achieving a best control for traffic. This work needs a study of traffic control over the city that will be implemented.

Key Words: Intelligent traffic control system, traffic control system, traffic management system, vehicles control system, traffic congestion

I. INTRODUCTION

Millions of vehicles pass via roads and cities every day. Various economic, social and cultural factors affect growth of traffic congestion. The amount of traffic congestion has major impacts on accidents, loss of time, cost of money, delay of emergency, etc. Due to traffic congestions there is a loss in productivity from workers, people lose time, trade opportunities are lost, delivery gets delay, and thereby the costs goes on increasing. To solve these congestion problems it is better to build new facilities and infrastructure but at the same time make it smart. Many traffic light systems operate on a timing mechanism that changes the lights after a given interval. An intelligent traffic light system senses the presence or absence of vehicles and reacts accordingly. The idea behind intelligent traffic systems is that drivers will not spend unnecessary time waiting for the traffic lights to change. An intelligent traffic system detects traffic in many different ways. The older system uses weight as a trigger mechanism. Current traffic systems react to motion to trigger the light changes. Once the infrared object detector picks up the presence of a car, a switch causes the lights to change. In order to accomplish this, algorithms are used to govern the actions of the traffic system. While there are many different programming languages today, some programming concepts are universal in Boolean Logic.

II. LITERATURE REVIEW

The field of traffic control plays an important part in our life so many papers and researches are published to solve the traffic problems. Some of these papers are explained below:

A. Albagul designed and implemented a suitable algorithm and its simulation for an intelligent traffic signal simulator. The system developed is able to sense the presence or absence of vehicles within certain range by setting the appropriate duration for the traffic signals to react accordingly [1].

Mahmoud Taghizadeh et al. presented a generalized framework for integrating simulator and a vehicle traffic simulator for rapid prototyping and evaluation of dedicated short rang communication based on vehicular communication protocols and their applications in the context of intelligent transport system. The resulting integrated simulator is utilized to investigate the performance of the collision avoidance applications [2].

Ayad M. Turky et al. described the design of an intelligent traffic light control based on genetic algorithm. The developed algorithm is used to simulate the situation of an isolated intersection based on this technology. Then the performance of the genetic algorithm controller was compared with the conventional fixed time controller [3].

Khalid A. S. Al-Khateeb et al. explained traffic congestion and tidal flow management as major problems in urban areas, which have caused much frustration and loss of man hours. An intelligent radio frequency identification traffic control system has been developed to solve the congestion problems. RFID technology with appreciate algorithm and data base were applied to provide an efficient time management scheme [4].

Shwe Yi Aye demonstrated car traffic control system using LAN networking. The obtained results showed reduction in normal recurring, significantly enhanced operational tools congestion to effectively manage traffic incident, reduced pollution, and faster response, improve public transport, reduction in emergency response time [5].

Visit Hirankitti et al. proposed a Multi agent approach for intelligent traffic light control that consist of agents and their world (cars, networks, traffic lights ...etc). Each of these agents controls all traffic lights at one road junction by an observe-think-act cycle. This approach showed that a complicated problem of traffic light control on a large road network can be solved elegantly by the rule based multi agent approach [6].

Ta-Hsiang et al., utilized Timed Colored Petri Net (TCPN) as a visual formalism for the modeling of a urban traffic light system. A new design tool is proposed to state and solve the problem of traffic signal timing plans. Then a supervisor of the traffic light system is completed whose operation flow is modeled by TCPN models. The intended advantage of this module is that designers can extend the module to meet complex traffic light systems [7].

Lawrence Y. Deng et al. improved the video surveillance and self-adaptive urban traffic signal control system to achieve the development trend in intelligent transportation system. The proposed system performed the vision-based methodologies to know well the real time measurements in urban road [8].

Danko A. Rosemond et al. focused on the applicability of autonomous intelligent agents within urban traffic light control system. An adaptive traffic control units are built based on intelligent agent technology that pro-act upon changes (short and long term) in traffic in real time. This system can provide balanced, coordinated, and optimal setting of the signal control scheme during operation [9].

Martin Molina et al. proposed a system to help traffic engineers in the selection of the state of traffic control devices on real time using data recorded by traffic detector on motorways. The system flows an advanced knowledge-based approach that implements an abstract generic problem-solving method [10].

III. LITERATURE SURVEY

SR. NO	Name of the paper	Methodology used	Authors	Limitations & Solution
1.	Real-time Vehicle Detection and Tracking (IEEE – 2016)	Computer vision, Morphological operation	K.V. Arya, Shailendra Tiwari	Dilation & Erosion, Shape Detection
2.	Smart Traffic Light Control System Based on Vehicle Intensity Measurement (2015)	Image Processing, Object Identification	Muzhir Shaban Al, Khattab Alheeti	Could only detect vehicles and not num plates. (HQC)
3.	Vehicle Detection & Counting For Traffic Surveillance System Using Raspberry-Pi (IJMTER - 2015)	Background elimination, Noise Cancellation	Mr. Majeti V N Hemanth Kumar, Mr. B.Vasanth	Slows down the process by elimination, Use noise free cameras
4.	Review on Vehicle Detection Techniques (IJSETR - 2017)	-	Gopal Manne , Neetesh Raghuvanshi	-

IV. SMART TRAFFIC LIGHT CONTROL SYSTEM

In crowded cities, it is difficult to implement a normal traffic control system, because of the variation of flow of roads vehicles during different period of time. Many parameters must be considered to develop a certain traffic control system. These parameters are concentrated on flow of vehicles, the emergency vehicles, the rush hours, the accidents, the important persons and the closing of any incoming road. The proposed system consists of many subsystems working together under certain roles in order to increase the overall system efficiency. These subsystems are shown in figure and are defined as below:

- The main control subsystem, which is responsible of the original traffic control including traffic period for each section of traffic lights.
- Intelligent sensors subsystem, which is responsible to give priority to the emergency vehicles passing through the
- First Level intelligent cameras subsystem, which is responsible of the vehicles passing through the interring roads to the intersection.

An important issue can be considered here that this work needs an extended study of traffic control over a long time at the selected city, in order to understand all the factors that may be affected the flow of vehicles and traffic control, and this study can be used as a foundation to develop the traffic control system.

The proposed intelligent traffic control system as shown in figure (3) depends on the vehicles image intensity of the road in which we distinct approximately the time period of the traffic light that must be opened. The road normally is black colored, so the vehicles areas are related to other colors. These illuminated areas of vehicles are calculated with respect to the rest of the road area. Vehicles area = Sum of the illuminated areas / Total road area

A certain threshold is calculated depends on a flow of vehicles in each incoming road. Then depending on this threshold the main control system transmit a signal to increment or decrement the time period for intersection circle. In addition the emergency vehicles must take the first priority which included as an additional factor of the control system.

V. OPEN CV

Open CV is an open source project an important part of the library as the implementation of those crafty data structures and algorithms you can find in Open CV. Therefore, the source codes for the tutorials are part of the library. Computer vision is a rapidly growing field, partly as a result of both cheaper and more capable cameras, partly because of affordable processing power, and partly because vision algorithms are starting to mature. Open CV itself has played a role in the growth of computer vision by enabling thousands of people to do more productive work in vision. With its focus on real-time vision, Open CV helps students and professionals efficiently implement projects and jump-start research by providing them with a computer vision and machine learning infrastructure that was previously available only in a few mature research labs.

VI. VEHICLE DETECTION

Adaptive background subtraction uses the current frame and the reference image. Difference between the current frame and the reference frame is above the threshold is considered as moving vehicle. Optical flow method can detect the moving vehicle even when the camera moves, but it needs more time for its computational complexity, and it is very sensitive to the noise. The motion area usually appears quite noisy in real images and optical flow estimation involves only local computation. So the optical flow method cannot detect the exact contour of the moving vehicle.

VII. RESULTS AND ANALYSIS

Different types of images are captured during different periods per day, these images are known as empty, normal system is designed and implemented according to the previous measurements that happen to specify the time periods for each road intersection. Then secondly, traffic can be classified in three levels, according to the number of vehicles present at the captured road. The computational complexity of our algorithm is linear in the size of a video frame and the number of vehicles detected. As we have considered traffic on highways there is no question of shadow of any cast such as trees but sometimes due to occlusions two vehicles are merged together and treated as a single entity.

(a) Empty traffic street image and its histogram

(b) Full traffic street image and its histogram

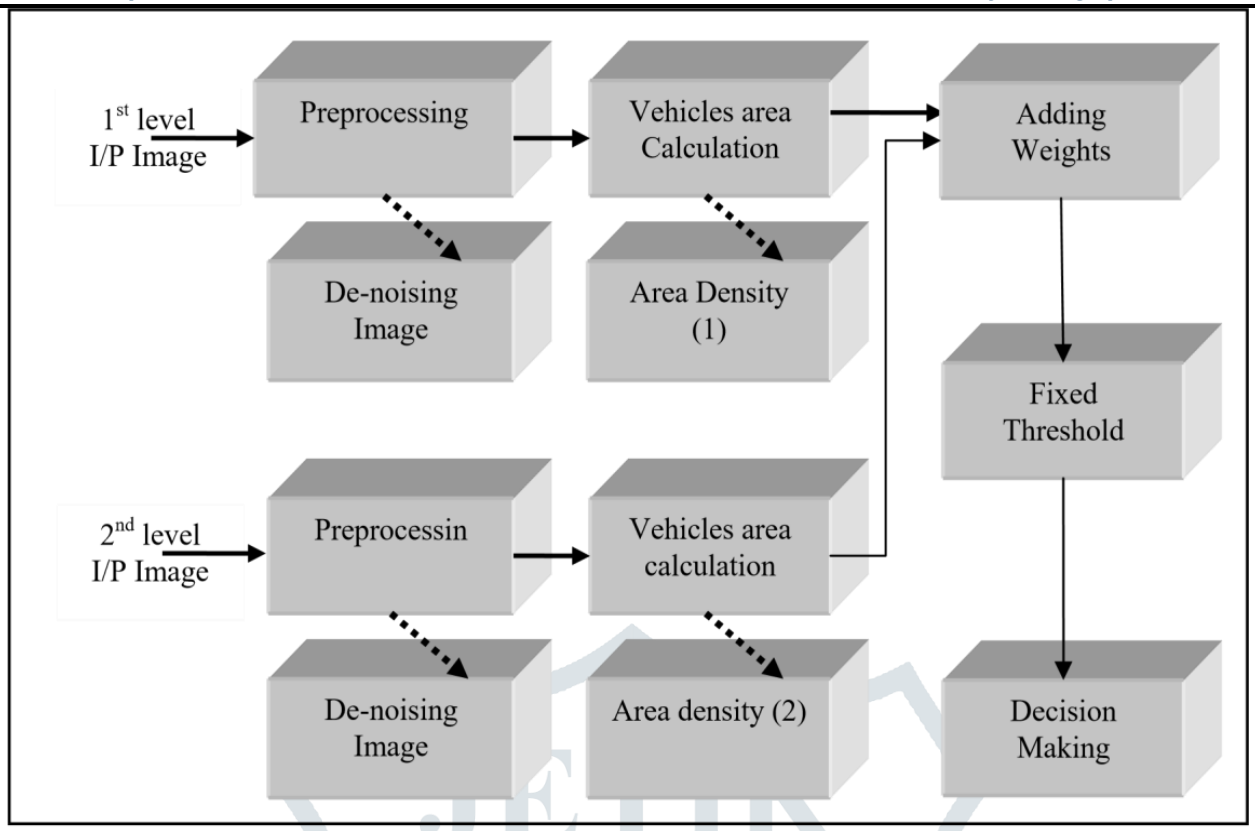
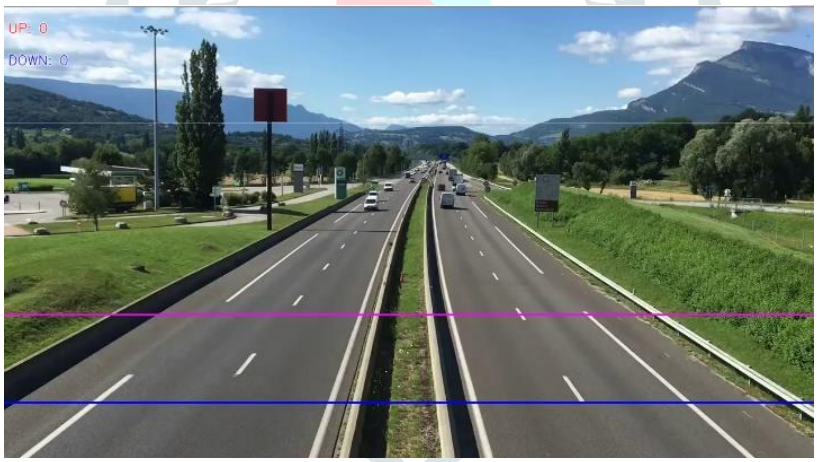


Figure (3) Proposed intelligent traffic control system

VIII. OUTPUT



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KSE-100 index is used as proxy of market risk. KSE-100 index contains top 100 firms which are selected on the bases of their market capitalization. Beta is the measure of systematic risk and has alinear relationship with return (Horn, 1993). High risk is associated with high return (Basu, 1977, Reiganum, 1981 and Gibbons, 1982). Fama and MacBeth (1973) suggested the existence of a significant linear positive relation between realized return and systematic risk as measured by β. But on the other side some empirical results showed that high risk is not associated with high return (Michailidis et al. 2006, Hanif, 2009). Mollah and Jamil (2003) suggested thatrisk-return relationship is notlinear perhaps due to high volatility.

IX. CONCLUSION

Traffic congestion and tidal flow management are recognized as major problems in urban areas. The proposed intelligent traffic control algorithm is implemented to recover all the traffic changes during the day. In the proposed system the illuminated areas of the vehicles are calculated with respect to the rest of the road area. This system is flexible to maneuver between the three supported levels. The proposed system offers many advantages such as: minimizing the traveling time for vehicles and passengers that minimizing pollution, minimizing the traffic congestion as possible that save energy and reduction in emergency response time. A system has been developed to detect and count dynamic vehicles on highways efficiently. The system effectively combines simple domain knowledge about vehicle classes with time domain statistical measures to identify target vehicles in the presence of partial occlusions and ambiguous poses, and the background clutter is effectively rejected. The experimental results show that the accuracy of counting vehicles was 96%, although the vehicle detection was 100% which is attributed towards partial occlusions.

X. ACKNOWLEDGEMENT

In 2016, Sundaresh Ram et al. [10] proposed an automated method for detecting vehicles of varying sizes in low-resolution aerial imagery. First, they develop a new vehicle enhancement filter involving multiscale Hessian analysis. After thresholding, they refine the candidate vehicle detections based on analysis of bilateral symmetry. They shows that the proposed method provides improved detection accuracy compared with existing vehicle detection algorithms for various low-resolution aerial images. In 2010, Isha Jain et al.[11] developed an algorithmic approach to vehicle detection and classification using fuzzy logic. This not only reduces the complexity of the system but enhances its use in the areas which are too difficult to be detected by normal means.

Further, it is proposed that after detection objects can be classified using techniques like neuro-fuzzy etc. so as supervised and unsupervised learning can be used to train the system. This algorithm can be applied on real time projects. They had taken the images of moving and still vehicles and an algorithm is used for vehicle detection. In 2015, A. Shakin Banu et al. [12] proposed morphological operations and Histogram of Gradient (HOG) feature extraction for detection of vehicle.By finding the common pixels in the detected edge and the ROI regions,we can obtain the gradient.The algorithm (HOG) is an efficient feature extraction for detecting the vehicles whose result is extremely helpful for traffic analysis, management and surveillance.

By identifying the vehicle size,the future work can be improved and the size of identified object is belongs to truck or car could be found by comparing indentified size with threshold value. The a success rate of around 83% of accuracy is achieved in vehicle detection using proposed method.

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