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INTELLIGENT TRAFFIC LIGHT CONTROL SYSTEM BASED IMAGE INTENSITY MEASURMENT

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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. LITRETURE REVIEWS

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. Roozemond 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 provides balanced, co-ordinated, 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. TRAFFIC LIGHT CONTROL SYSTEM

The traditional traffic light control system of the intersection roads is shown in figure (1). The vehicles entering the intersection are denoted by red color, but the vehicles which are leaving the intersection are denoted by blue color. Any vehicle has the priority to enter the intersection; it has the priority to cross any road via the intersection. Each red vehicle entering the intersection can take place any blue vehicle leaving the intersection.

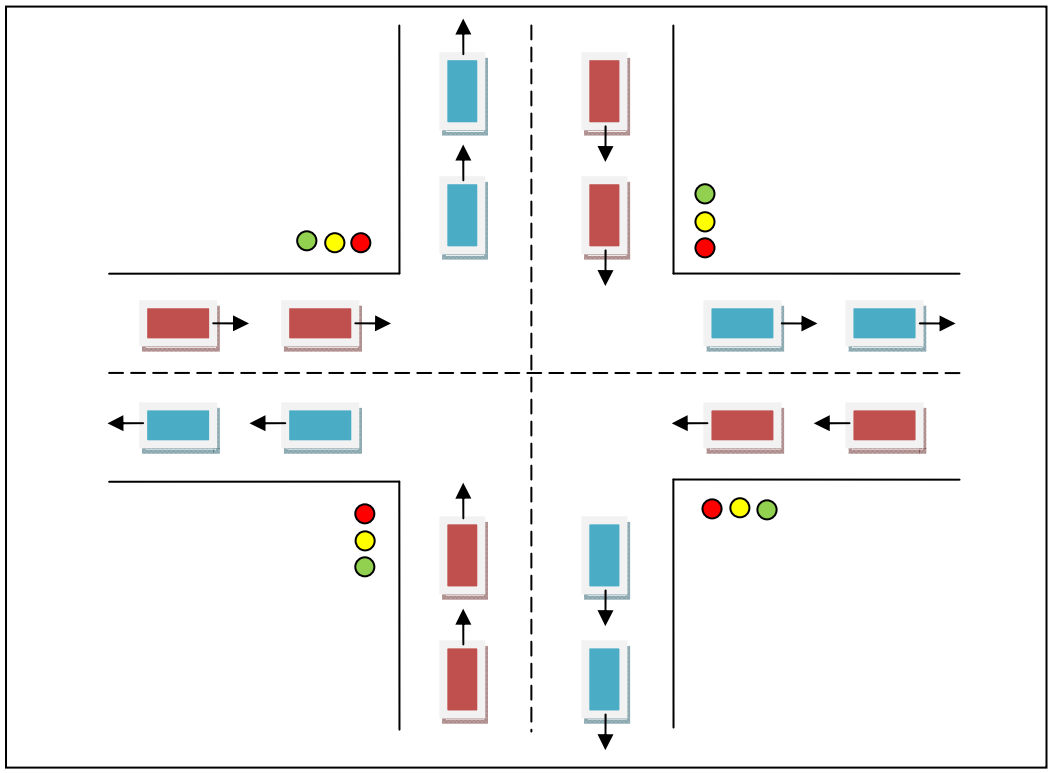


Figure (1) the subsystems of the intelligent traffic control system

IV. INTELLIGENT 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 (2) 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 interring roads to the intersection.

- First Level intelligent cameras subsystem, which is responsible of the vehicles passing through the interring roads to the intersection.
- Second Level intelligent cameras subsystem, which is responsible of the vehicles passing through next roads to the intersection.

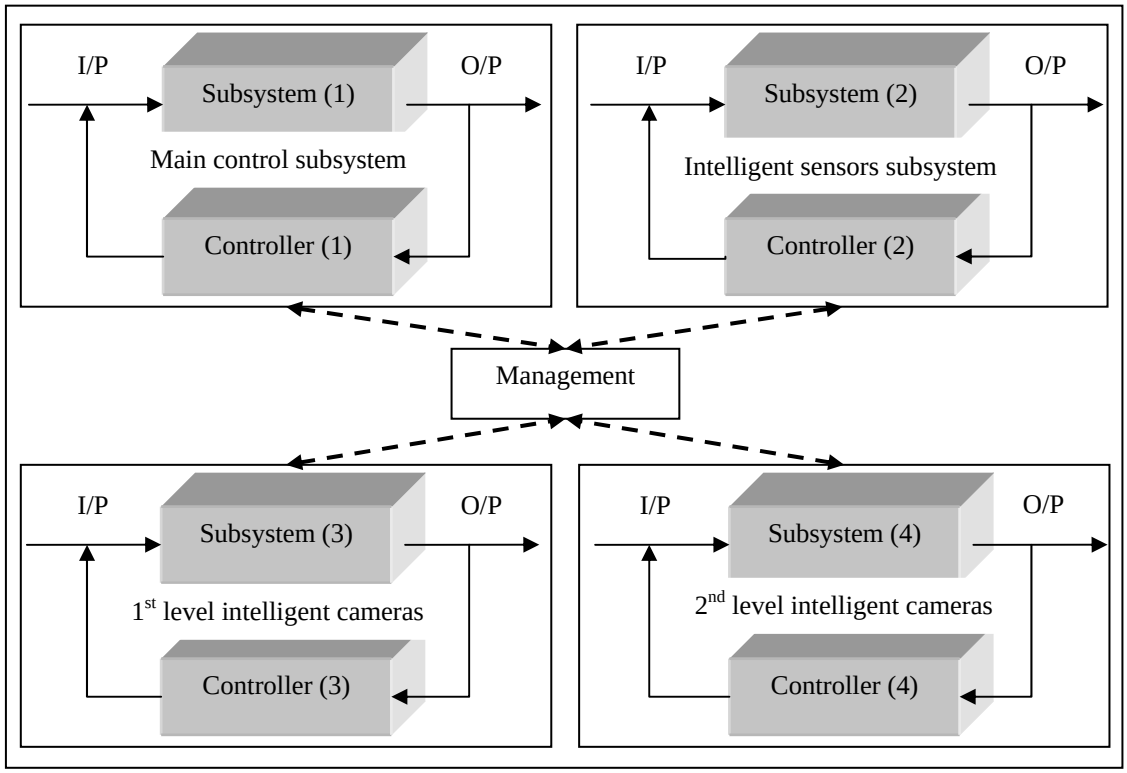


Figure (2) the subsystems of the intelligent traffic control system

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.

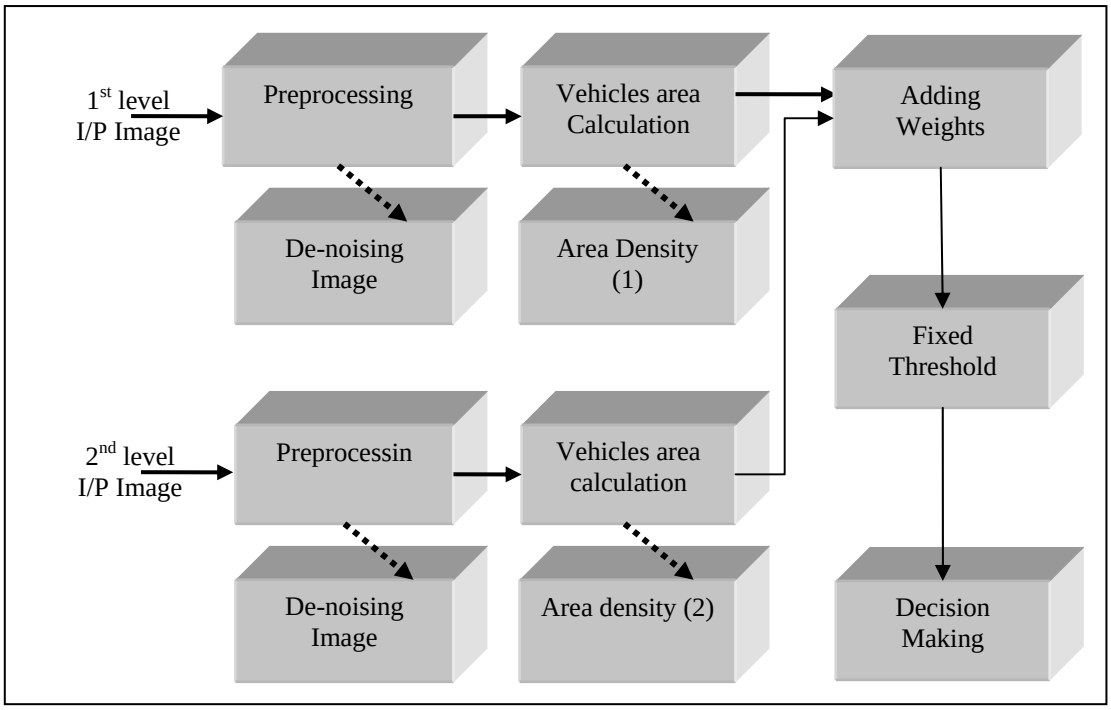
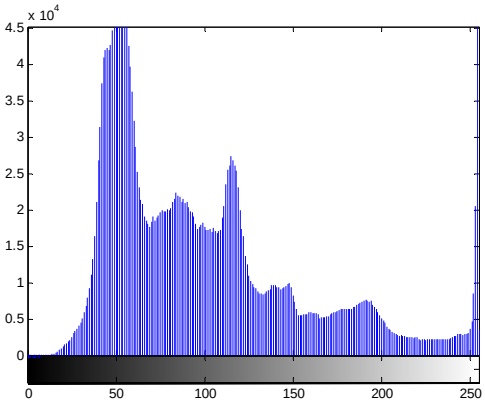


Figure (3) Proposed intelligent traffic control system

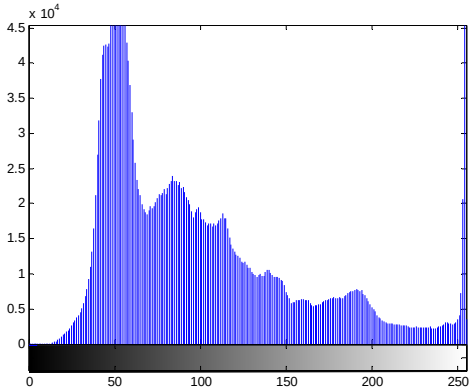
V. RESULTS AND ANALYSIS

Different types of images are captured during different periods per day, these images are known as empty, normal and full traffic as shown in figure (4). Firstly the control 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:

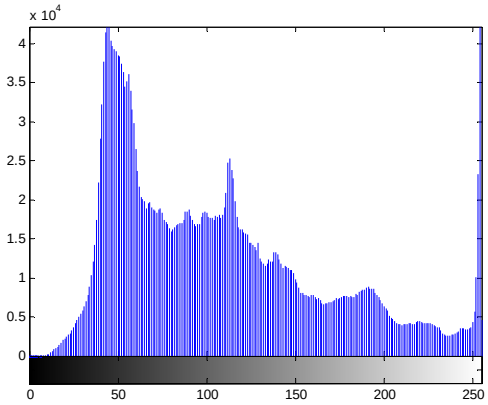
- First level indicates a small number of vehicles present, in which the control system passed to the normal position and there is no increment in any time period.
- Second level indicates a medium number of vehicles present, in which the control system passed to the congestion position so an increment of time period is applied (according to the size of congestion) to correct this event.
- Third level indicates an emergency vehicle present, in which the control system passed to the emergency position so a sudden signal allowed giving a priority to this road.



(a) Empty traffic street image and its histogram



(b) Normal traffic street image and its histogram



(c) Full traffic street image and its histogram

Figure (4) Different types of traffic captions

VI. CONCLUSIONS

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.

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