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Intelligent Traffic Control System Using Interface between Mat lab and Microcontroller

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Abstract: ***Increasing congestion on freeways and problems associated with existing detectors have replaced with new vehicle detection technologies such as video image processing. Video sensors are important in traffic applications because of their fast response, ease in installation, easy in operation and maintenance, and they have ability to monitor in wide areas. There are number of most demanding and widely studied applications related to traffic monitoring, which are automatic lane finding, object detection, vehicle density control and detection in daylight and night condition within their space of interest.***
In this paper we present an overview of image processing and the analyzing tools used for the traffic applications. The image sequences from a camera are captured and analyzed using different methods such as edge detection method and then vehicle counting is done. Depending on that number of vehicles calculated at the intersection is evaluated and traffic is efficiently managed. The paper also presents the implementation of a real-time emergency vehicle detection system. That is In case an emergency vehicle is detected, the lane is given priority over all the others.
Keywords: Traffic Control, Mat lab, Microcontroller, Webcam, Emergency vehicle detection etc.

I. INTRODUCTION

The fixed timing signals are not desirable because they do not take into account the actual road conditions thereby producing the traffic jam problems. The delays introduced by these signals are adversely affecting the quality of life as well as environment. People lose time, miss opportunities and get frustrated. In addition, these traffic congestion problems are having a deep impact on company's production which has led to economic crises in the country.
Conventional traffic control uses timing, which is inefficient due to varying vehicle density at different roads as in [1, 2]. This will cause long wait for the vehicles in the busy roads. There is traffic control techniques involving magnetic loop detectors buried in the road, infra-red and radar sensors on the side provide limited traffic information and require separate systems for traffic counting and for traffic surveillance as in [4]. There is a great need for the introduction of advanced technology and equipment to improve the existing ways of traffic control.
The traffic problems are increasing nowadays due to the growing number of vehicles and the limited resources we are provided by the infrastructures. This leads to the development of an adaptive traffic control system which can monitor traffic conditions and adjust the timing of traffic lights according to the actual road conditions [5, 3]. In this paper we are presenting the most improved system available for traffic control is controlling the traffic light by image processing. It detects vehicle by images instead of using sensors. Image sequences will be captured by a camera placed along with the traffic light and the sequenceInductive loop detectors do provide a cost effective solution, however they are subject to a high failure rate when installed in poor road surfaces, decrease pavement life and obstruct traffic during maintenance and repair shown in[6]. Infrared sensors are affected to a greater degree by fog than video cameras and cannot be used for effective surveillance.
An intelligent traffic control system with detection of vehicle density in each lane is proposed. The proposed system uses a camera to take pictures of the traffic condition. The images are processed to find the number of vehicles in each road. Priority is given to the road with the most vehicle density[3]. The algorithm also makes sure that the vehicles in the less busy roads don't have to wait too long. MATLAB programming environment has been used in simulating and developing the system. This system consists of a hardware module, a software module and an interfacing componentan embedded microcontroller is used to control the lights. The microcontroller interacts with the pc using serial port.

A. Exstiing System

Existing system uses fixed timing signals which do not take into account the actual road conditions. Traffic congestion has been increasing worldwide as a result of increased motorization, urbanization, population growth, and changes in population. Congestion

reduces efficiency of transportation infrastructure and increases travel time, air pollution, and fuel consumption[1].There is a great need for the introduction of advanced technology and equipment to improve the existing ways of traffic control as the problem of urban traffic congestion spreads. The traffic problems are increasing nowadays due to the growing number of vehicles and the limited resources we are provided by the infrastructures[5].

The monitoring and control of city traffic is becoming a major problem in many countries. With the ever increasing number of vehicles on the road, we have to find new ways or measures of overcoming such a problem.

B. Objective

1) Image processing is a better technique as compared to present time controlled system to control the state change of the traffic light.
2) To reduce the traffic congestion and avoid the time being wasted by a green light on an empty road.
3) To give priority to the road with the most vehicle density.
4) To improve existing traffic light system in order to manage the traffic flow in smooth and efficient way.
5) To overcome the problems of the growing traffic with less infrastructure.
6) Signal the traffic light to go red if the maximum time for the green light has elapsed even if there are still vehicles present on the road.

II. PROPOSED SYSTEM

Here in the system that we propose works by analysing the traffic in roads and gives priority to the high traffic density (i.e.) it makes the high traffic to move first. The proposed system uses a digital camera mounted on the top to sense the traffic on the road. Then the decision to open the lane is done after monitoring the traffic load. The heavily loaded side is turned on for a longer time. Thus the system is intelligent because it is not using the fixed time frame. The system also takes into account the emergency vehicles at the intersection. If such a vehicle is detected, the lane is given priority over the others. This system uses MATLAB methodology for the image processing & then processed data is given to the 8051 microcontroller through USB to TTL Port. Microcontroller will take the appropriate action and then depending on the no of vehicle at respective lane LED will turn on for desired time.

A. Block Diagram

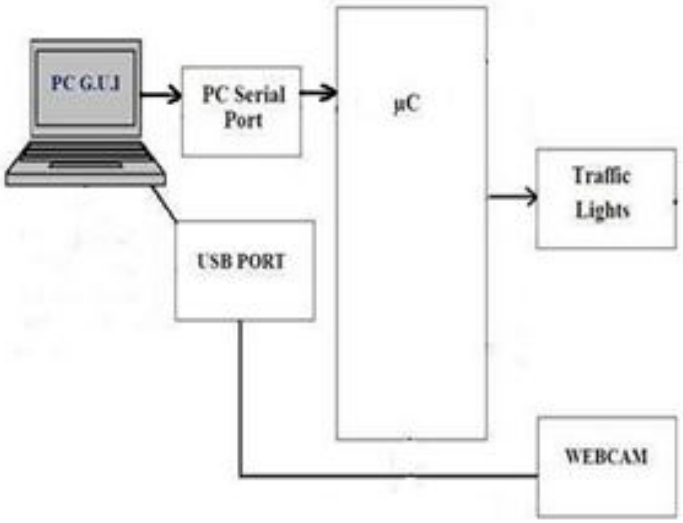

Fig1. Block diagram of traffic system

Initially image acquisition is done with the help of web camera which is mounted on the top to capture the image at particular interval. All this data is given to pc through USB Port. Here MATLAB software is used for the image processing such as using edge detection technique vehicles density calculated and using serial port communication link all the data is given to the PORT of Microcontroller. Depending on the density at each lane signalling action is being taken by the microcontroller. The controller is programmed in such manner thatpriority is set for the roads as per no of vehicle at respective lane & then signal is given to vehicle

with respect to priority. The road which has high vehicle density will open first then remaining I a respective sequence. Then again new image is being captured checked & process repeats

A. Algorithm

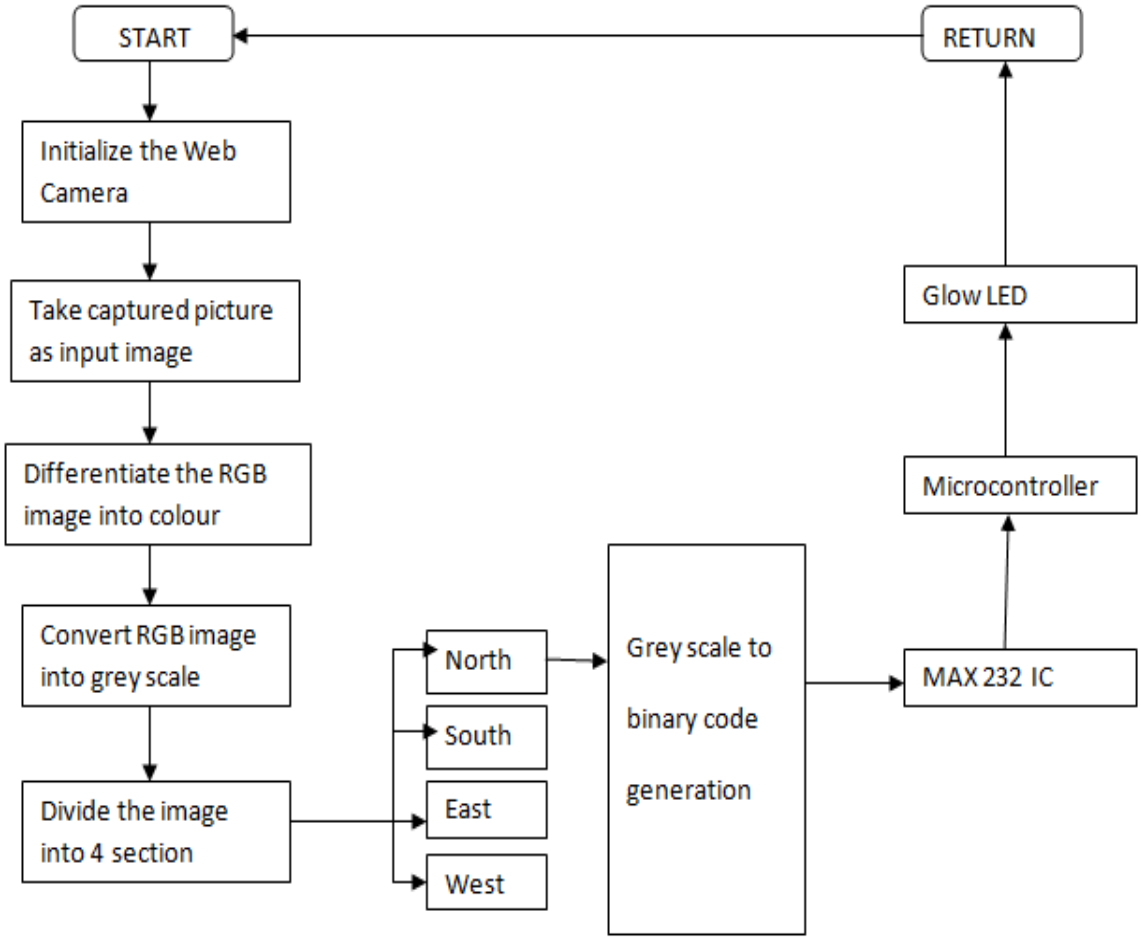

Fig2. System flow chart

Initially image acquisition is done with the help of web camera .First image of the road is captured, when there is no traffic on the road .This empty road's image is saved as reference image at a particular location specified in the program.Then captured image is converted into colour code format. After that RGB to gray conversion is done on the reference image &Edge detection of this reference image is done thereafter with the help of edge detection operator.

Now Images of the road are captured along with the vehicles and RGB to grey conversion is done on the sequences of captured images. Later on gamma correction is done on each of the captured grey image to achieve image enhancement.Edge detection of these real time images of the road is now done with the help of edge detection operator such as blob detection method.

After edge detection procedure both reference and real time images are matched and binary converted data is given to the microcontroller through MAX232 cable which used for communication between PC & microcontroller. And then microcontroller sets the LED traffic signals according to the results processed by PC(i.e. MATLAB). traffic lights can be controlled based on percentage of matching. If the matching is between 0 to 10% - green light is on for 90 seconds. If the matching is between 10 to 50% - green light is on for 60 seconds. If the matching is between 50 to 70% - green light is on for 30 seconds. If the matching is between 70 to 90% - green light is on for 20 seconds. If the matching is between 90 to 100% - red light is on for 60 seconds.After finishing the procedure it will capture new image and same procedure will go on.

B. Emegency Vehicle Detection

In case of normal regulation the image is subjected to adaptive background subtraction, edge detection, and object counting methods. Using this, the number of vehicles is calculated and traffic is regulated as per the congestion in each lane. In case a red beacon is detected, the next step is to identify whether it is from an emergency vehicle or not. This is done by identifying the blinking frequency of red light detected in the image sequence and comparing it to the standard used by the emergency vehicles. If matched, the normal system is overridden and the lane is given priority over all the others. The lane is turned green until the vehicle has passed the intersection.

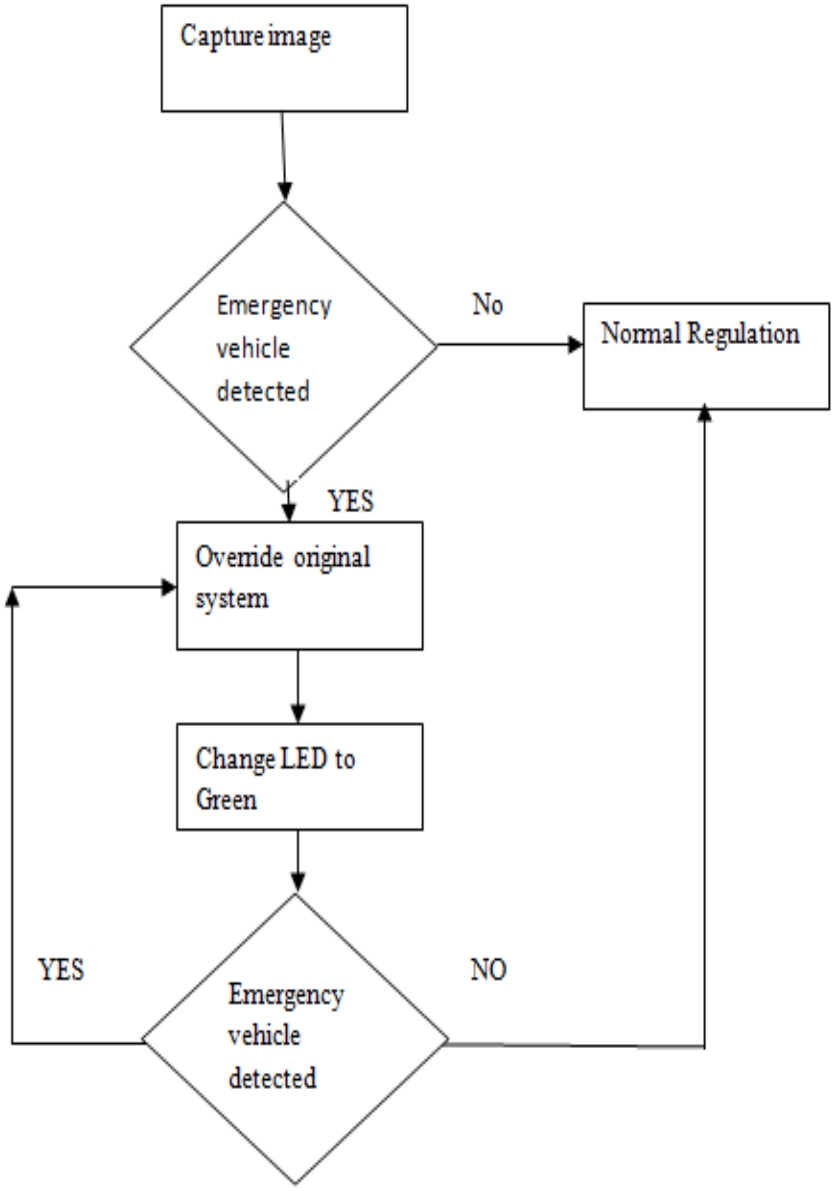

Fig3. Emergency vehicle Detection System flowgraph

III. RESULT & DISCUSSION

A. capture input image

Image is captured using web cam mounted on the top of the pole

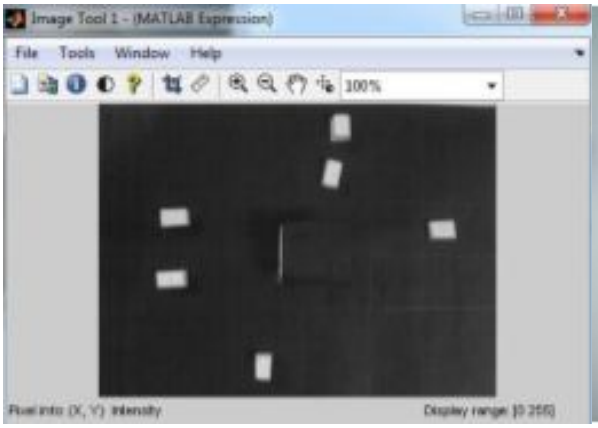

Fig 4.Captured input image 1

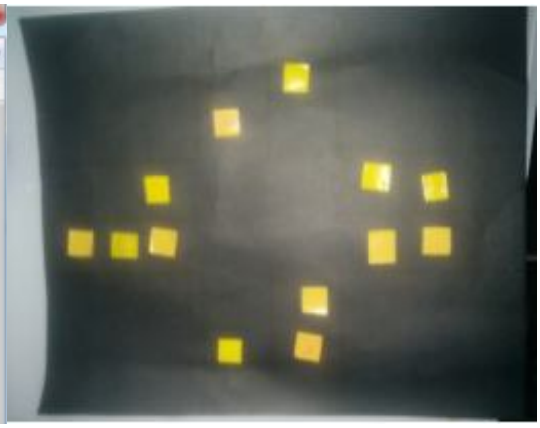

Fig 5. Captured input image 2

B. Captured image is converted into grey scale image

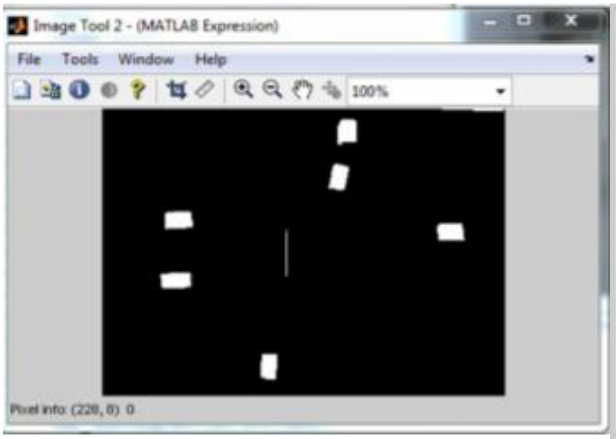

Fig6. Grey scale image 1

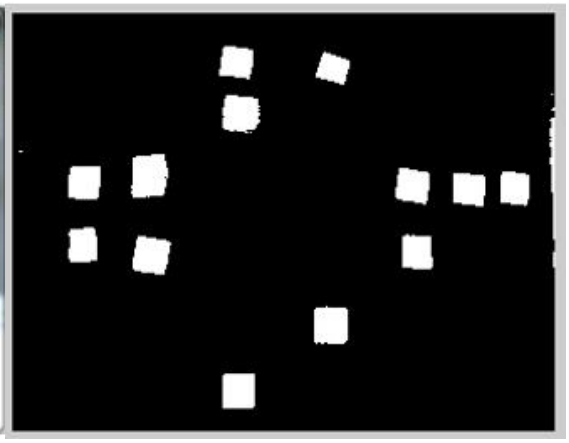

Fig 7. Grey scale image 2

*C.*grey scale image is converted into binary image and then ANDed with Reference image

*D.*Edge detection done by using blob detection method and no of vehicles are counted at each lane and respective output is displayed n command window as below.

Fig8.Output from command window
For image 1

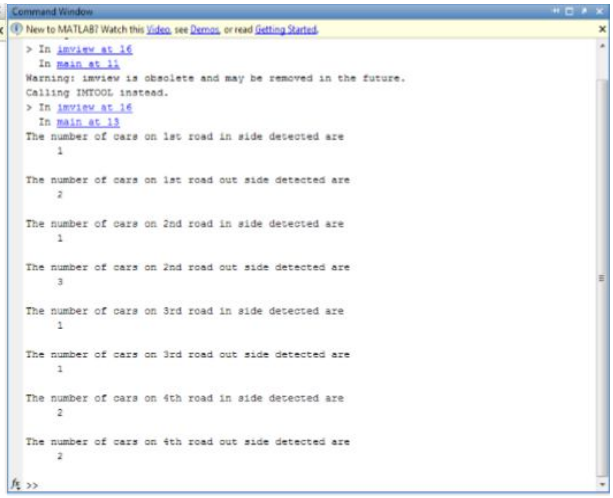

Fig8. Output from command window
for image 2

E. signals light are controlled based on no of vehicles at each lane.

IV. CONCLUSION

In this project, a method for estimating the traffic using Image Processing is presented. This is done by using the camera images captured from the highway and videos taken are converted to the image sequences. Each image is processed separately and the number of cars has been counted. If the number of cars exceeds a specific threshold, warning of heavy traffic will be shown automatically. We have successfully implemented an algorithm for a real-time image processing based traffic controller using edge detection technique. The advantages of this new method include such benefits as use of image processing over sensors ,low cost, easy setup and relatively good accuracy and speed. Because this method has been implemented using Image Processing and MATLAB software, production costs are low while achieving high speed and accuracy.

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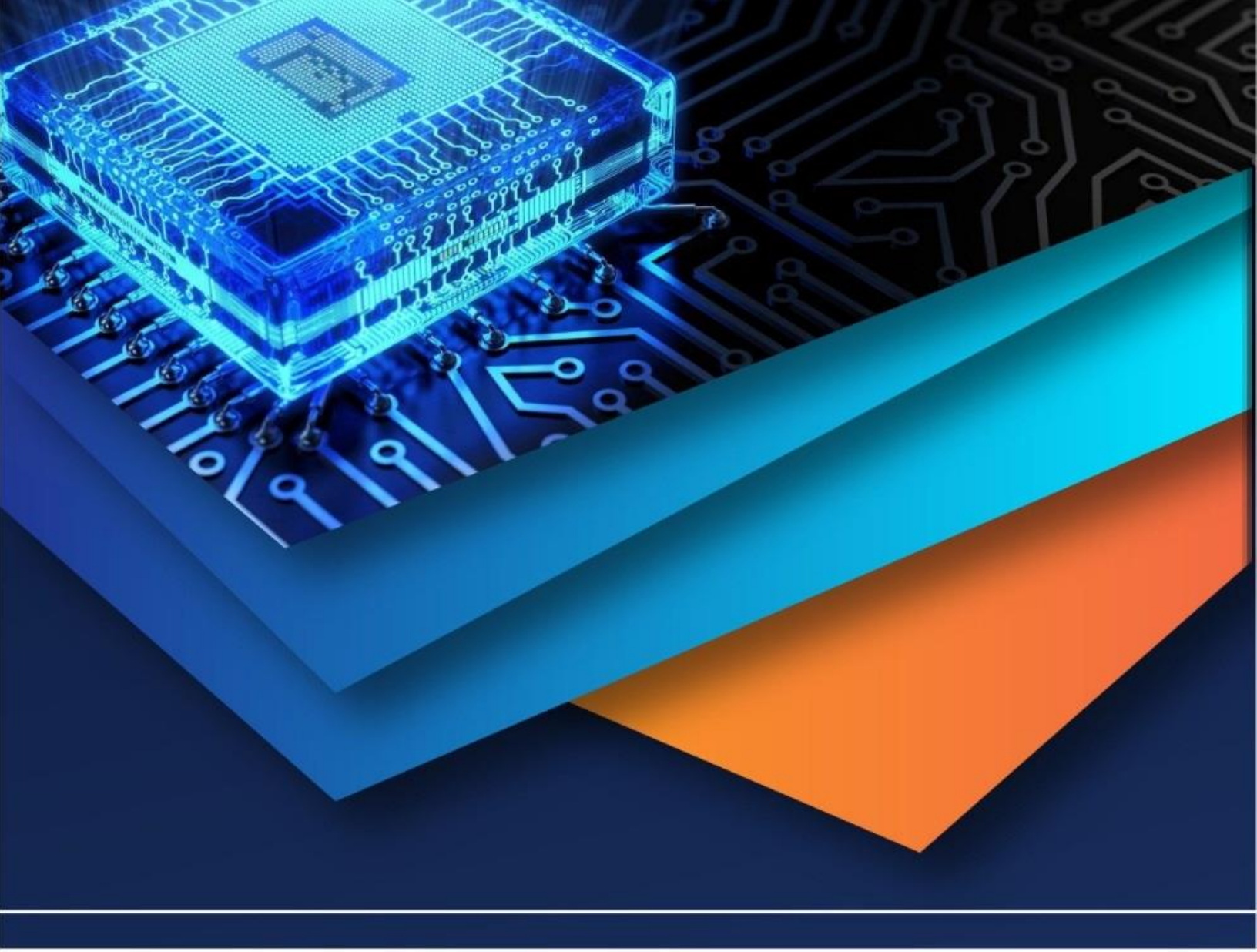

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