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Intelligent Traffic Control& Surveillance System Based on Machine Learning

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Abstract: ***Traffic Rules are very important for our road safety. According to World Health Organization road traffic injuries causes an estimate of 1.25 million deaths worldwide ie one person is killed in every 25 seconds. There are numerous factors responsible of these accidents but majority of them are because of lack of traffic awareness and strict system to supervise the implementation of traffic rules. So our proposed system is a small initiative towards the road Safety that is "An Intelligent Traffic Control & Surveillance System ".The proposed system will be Regulating the traffic in particular area, moreover it will be smart enough to recognize the vehicles with emergency passages like ambulance , Fire Fighter trucks, VIP Passages etc ,with all this features it will be having additional feature of Stolen vehicle Detection all this will be possible with the implementation of RFID Technology and implementation of Machine Learning controlling the Surveillance Camera.***
Keywords: Radio Frequency, emergency, Traffic, Surveillance

I. INTRODUCTION

Since our Nursery age we have been tought various traffic rules about the Traffic Lights ,We should walk on footpath and always on the left hand side,not run on road, use Zebra crossing etc .but all these are the individual concern one should always follow as best as he could, but still the casualties in Road accidents happens to be at the peak, It is not surprising that each year all across the globe Road Accidents appears as a leading cause of deaths. According to World Health Organization road traffic injuries causes an estimate of 1.25 million deaths worldwide ie one person is killed in every 25 seconds. So why is this ratio so high? Why people are getting killed in such simple looking Disasters(Road) . There are numerous factors responsible of these accidents but majorty of them are because of lack of traffic awareness and strict system to supervise the implementation of traffic rules. So our proposed system is a small initiative towards the road Safety that is "An Intelligent Traffic Control and Surveillance System"

Our proposed system is "An Intelligent Traffic Control and Surveillance System" The proposed system will be Regulating the traffic in particular area, moreover it will be smart enough to recognize the vehicles with emergency passages like ambulance , Fire Fighter trucks, VIP Passages etc ,with all this features it will be having additional feature of Stolen vehicle Detection all this will be possible with the implementation of RFID Technology and implementation of Machine Learning controlling the Surveillance Camera. The entire propose system can be divided into Four sub-systems 1. Automatic Signal Control System. 2. Emergency Vehicle Clearance System 3. Stolen Vehicle Detection System

II. LITRATURE SURVEY

Traffic congestion continues to be a major problem in cities of developing Countries like India. Growth in urban population and the middle-class segment contribute significantly to the rising number of vehicles in the cities.Such problem eventually leads to the traffic congestion. Combustion leads to fuel wastage and increases the efforts , sufferings and travel time. Which is one of the major issue in metropolitan area. This can be controlled and regulated by the use of RFID tag and RFID readers. In one of the reference paper, for the pourpose of emergency vehicle clearance , the principal of "Green Wave System" was discussed. In the Green wave process, the emergency vehicle was identified prehand and the movement of that vehicle was predefined from source to destination, and all the intermediate traffic lights of that root was turned to green, in order to give passage to the emergency vehicle ,hence giving a green wave to the desired vehicle. Advantage of the system is is that GPS inside the vehicle does not require additional power. The biggest disadvantage of green waves is that, when the wave is disturbed, the disturbance can cause traffic problems that can be exacerbated by the synchronization is that GPS inside the vehicle does not require additional power. The real burden of green waves is that, when the wave is aggravated, the unsettling influence can cause traffic issues that can be exacerbated by the synchronization. However earlier there were no such system for detection of stolen vehicles ,and the detection process was a pathetic and time-taking process, many a times there happens to be the cases where the stolen vehicles are modified and soled so if

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we implement the RFID technology then no matter how many times model is modified but the RFID VIN(Vehicle Identification Number) of the Vehicle will not be changed,this will be a major breakdown for such types of crime.

RFID technology implementation roots out the problems arising with Standard Traffic Control System, most of which arises in image processing and beam interruption techniques,RFID technology deals with a multivehicle ,multilane , multi-road, multi-signal and multiple junctions.

It also provides an effective time management Schema providing a dynamic time schedule to provide a real time traffic control, for the easy passages of vehicle. Traffic has been a critical issue in a de countries like India and China , where population is increasing at a higher rate.

For example in the metro city of Delhi ,the capital city of India. The survey reports tells that a sizable number of population uses public transport to two wheelers, two wheelers now contributes 66.6% of all the vehicles in the city, which saw a growth of 8.2% in the following year of 2016-2017. The number of cars 31.5 lakhs recorded increase at the rate of 5.6%.The average peak speed of 20 km /hr and even less were recorded at the peak hours of morning and evening leading to a lot of wastage of fuel and increase in travel time leading to inconvenience to the people

So all these statistics naturally demands for An Intelligent System, with effective and efficient management capability.

III. PROPOSED SYSTEM

A. Existing Systems

Earlier Systems were not such diverse in its working.They were simply based upon the Surveillance Camera which was controlled manually, involving a manual analysis of data by the traffic management team for determining the traffic light duration at each junction, thereby calling the traffic police control room for taking the necessary actions.

Disadvantage of Earlier System:-

1) It was based upon the manual approach
2) Earlier Systems were slow and not so effective.
3) There were no effective communication
4) Emergency vehicles were not getting clearences
5) There were no effective way of tracing the stolen Vehicles.

The following above issue resolves with the proposed model.

B. Proposed System

The proposed model consists of three sub-systems

Each of them is ment for performing a particular task, these three sub-systems are :

1) *Signal Control System:* Each vehicle will be having a RFID tag, when the vehicle would come to the range of RFID reader ,it sends signal to RFID reader ,The RFID reader which would be embedded with the traffic signal, would read the amount of vehicle passing through the given signal in a given period of time and thus the congestion volume, as per the congestion volume the traffic lights would be regulated. The basic working mainly depends upon RFID(Radio Frequency Identification).
2) *Emergency Vehicle Clearance:* Each emergency vehicle would be containing a ZigBee Transmitter module, and ZigBee receiver will be embedded with the traffic lights, buzzer will be switched on opon reception of signal from vehicle via ZigBee transmitter to ZigBee receiver and adain the system would take traffic signal under control and will turn the signal green , so that it could provide a free flow to such vehicles, as soon as the vehicle leaves the junction the next signal on the way is given notification about the approaching vehicle upon reception of Zigbee signal the whole process repeats again . thus providing the Green Wave to the emergency vehicles.
3) *Stolen Vehicle Detection*: This is a new feature that enhances the scope of traffic control, whenever a vehicle is lost ,stolen, or is to trace a doubtful vehicle . whenever such vehicle passes through the junction or signal RRID tag of respective vehicle is read by the RFID reader ,next the microcontroller of the system compares the RFID based VIN(Vehicle Identification Number),with the VIN of lost vehicle or stolen vehicle, if the match is found it sends the notification to the local nearby Police Station and Traffic control room,traffic light is turned to Red to give the time for the necessary action to be taken . List of components used in the experiment are CC2500RF module, Microchip PIC16F877A, RFID Reader–125KHz–TTL and SIM300 GSM module.

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C. Advantages of Proposed System

The proposed system is a new approach of controlling traffic and an approach to improvise people safety abd security against thefts the following are the advantages:-

1) Since it is fast in comparison to the todays approach it has got a great future ahead,
2) It is smart system with less power consumption.
3) Has got a strong communication networks since it uses wireless technology.
4) It ia a system with abroad feature of stolen vehicle identification
5) It will be effective and fast in controlling and managing the traffic,
6) It will also ensure the smooth flow of emergency vehicles
7) It's a three in one system.

D. Limitations of Proposed System

Followings are the limitations of our proposed model:

1) The proposed model is not embedded with GPS modules and transmitters.
2) The penalties and taxation features are not included in the system since it needs government approval.
3) Exact place where the tag can be placed is not sure.
4) The use of jammers can disrupt the entire working, the system is not jammer resistant

These were the few important limitations of the proposed system.

IV. MODULES OF THE SYSTEM

The various modules that will be contributing to the formation of this Intelligent Traffic Control system includes the following:-

A. Automatic Signal Control System

For this mode in our experiment passive RFID tag and RFID reader with 125 kHz frequencv was used . when vehicle comes in the range ,the receiver will transmit the unique RFID to the reader. The microcontroller which is connected to the RFID reader will count the RFID tags read in every 2 minute durations. For testing purpose, if the count gets more than 10, the green light duration will be set to 30 seconds, if count comes is between 5 and 9, the green light duration will be set set to 20 seconds. If the count gets less than 5, the green light duration will be set to 10 seconds. The red light duration proposed be for 10 seconds and orange light duration for 2 seconds.

B. Stolen Vehicle Detection System

For the efficient working of this module, RFID Reader first scans the RFID tags of vehicle, then a comparison task is performed between the unique RFID tag read by the RFID reader to the stolen RFIDs stored in the system. If a match is found to be there , then the traffic signal is immediately turned to red for a duration of 30 seconds, Also an SMS is sent describing the RFID number through the help of SIM300 GSM module. The LCD display will indicate the presence of stolen vehicle.

C. Emergency Vehicle Clearance System

This module constitutes of, 2 parts, first part the ZigBee transmitter is placed within the emergency vehicle. When the switch happens to be pressed, it transmits the signal. These signal contains unique id and security code. The transmitter constitutes of PIC16F877A microcontroller and ZigBee module. The microcontroller sends the commands and data to the ZigBee through serial communication. Second part which is the receiver, that is placed at traffic pole. It also contains PIC16F877A microcontroller and ZigBee module.

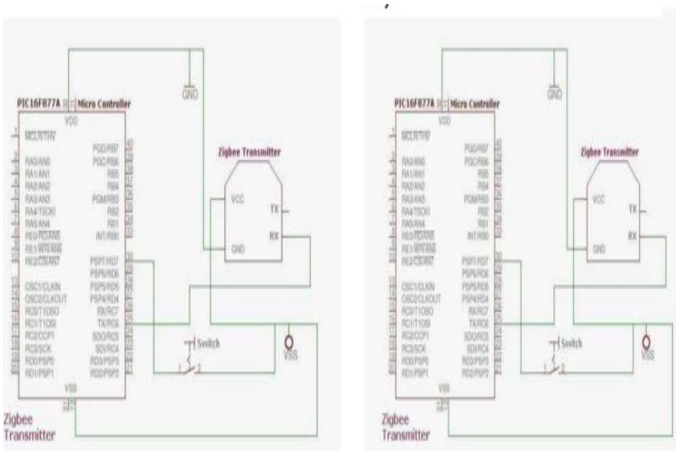
The receiver makes comparison of the security code received with the security code that is present in its database. If there is a match, then it will turn the green light on. For testing purpose, a short range RFID reader in our prototype which is being used . First, the receiver is turned on.

The red and green signal will be on for 10 seconds duration and orange light will be on for 2 seconds duration consecutively one after another.

Secondly, if we bring the RFID of stolen vehicle into the range of RFID reader. then the signal is made to turn to red for duration of 30 seconds approx and a SMS is received. Thirdly, through this approach we bring 12 RFIDs into the range of RFID reader, and then the green light duration will change to 30 seconds.Fourthly, we bring a crisis vehicle conveying ZigBee transmitter into the scope of ZigBee recipient, and after that the traffic light will change to green till the beneficiary gets the ZigBee flag.

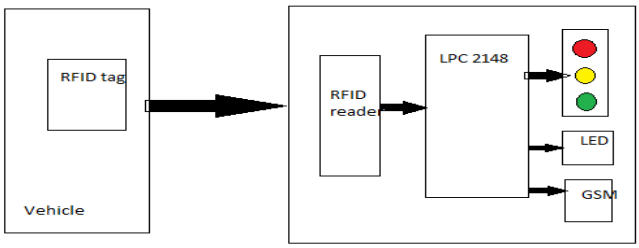
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Circuit diagram sensors connection with Arduino



2 3

Implementation for ambulance. (1) Block diagram for emergency
vehicle clearance. (2) PIN Diagram for ZigBee transmitter. (3) PIN Diagram for ZigBee receiver.



4. Block Diagram for Autromatic signal control system

V. HARDWARE USED

A. ZigBee Module CC2500

The CC2500 is a RF module and contains transreceiver, which provides an easy way to use RF communication at a frequency of 2.4 GHz. Every CC2500 is made equipped with the microcontroller (PIC 16F877A), which has a Unique Identification Number (UIN). This UIN is based on the registration number possessed by the vehicle. The most important features is serial communication without making use of any extra hardware and extra coding. Hence, it is a transreceiver which do not provides communication in both directions, but only one direction.

The microcontroller and CC2500 everytime communicate with the microcontroller via serial communication. Rx pin of CC2500 is connected to Tx (RC6) of microcontroller and Tx pin of CXC2500 is connected to Rx pin of microcontroller (RC7). Other two pins are used to energize transreceiver. It is implemented to transmit and receive the data at at a rate of 9600 baud . shows the image of transreceiver. Here, we make use of CC2500 ZigBee module as it has transmission range of 20 meters.

B. Microcontroller (PIC16F877A)

Peripheral Interface Control (PIC) 16F series has a lot of advantages when compared with the other series. It makes execution each instruction in time which is less than 200 nanoseconds. It has 40 pins and 8K program memory with 368 byte data memory.So it becomes easy to store and send UINs. At the junction, it becomes easy to store large number of emergency vehicles. Before switching to green, it should satisfy all the conditions. Simple interrupt option provides the advantage such as jump from one loop to another loop. It becomes easy to switch to any time. It has less power consuption and operates by vehicle battery itself without any extra hardware.

C. GSM Module SIM 300

Here, a GSM modem is associated with the microcontroller.

This enables the PC to utilize the GSM modem to convey over the portable system. These GSM modems are most much of the time used to give portable Internet availability, a considerable lot of them can likewise be utilized for sending and accepting SMS and MMS messages. GSM modem must help a "stretched out AT direction set" for sending/accepting SMS messages. GSM modems are

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a financially savvy answer for getting SMS messages, on the grounds that the sender is paying for the message conveyance. SIM 300 is intended for worldwide market and it is a tri-band GSM motor. It takes a shot at frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 highlights GPRS multi-opening class 10/class 8 (discretionary) and bolsters the GPRS coding plans. This GSM modem is an exceptionally adaptable fitting and play quad band GSM modem, interface to RS232, it underpins highlights like voice, information, SMS, GPRS and coordinated TCP/IP stack. It is controlled by means of AT directions (GSM 07.07,07.05 and upgraded AT directions). It utilizes AC – DC control connector with following appraisals DC Voltage: 12V/1A.D. RFID Reader–125 kHz–TTL

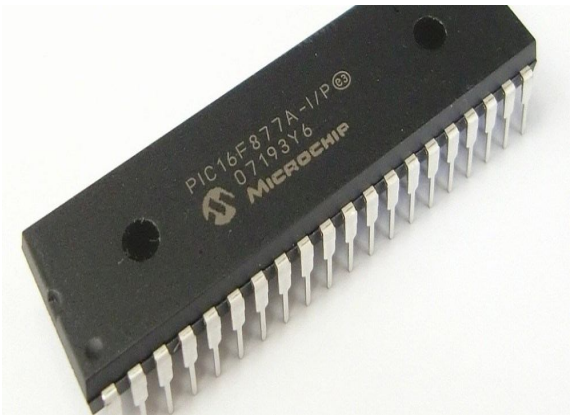
D. Radio Frequency Identification

(RFID) Recognizable proof (RFID) is an IT framework thattransmits signals without the nearness of physical devices in remote correspondence. It is classified under programmed recognizable proof innovation, which is entrenched convention. The working of a RFID framework is straightforward. The framework uses labels that are joined to different parts to be followed. The labels store information and data concerning the subtleties of the result of things to be followed. The peruser peruses the radio recurrence and recognizes the labels. The reception apparatus gives the way to the coordinated circuit to transmit its data to the peruser. There are two sorts of RFID classes, dynamic and detached labels. The labels that don't use control are alluded to as uninvolved and they are driven by anantenna that empowers the tag to get electromagnetic waves from a peruser. Despite what might be expected, dynamic labels depend on power and they have inbuilt power sources that empower it to send and get signals from RFID persuer. RFID run depends on transmit control, get affectability and effectiveness, receiving wire, recurrence, label introductions, environment. Ordinarily, the RFID go is from a couple of centimeters to more than hundred meters. RFID peruser utilizes recurrence 125 KHz with a scope of 10 cm.

VI. DIAGRAM OF HARDWARE SYSTEMS

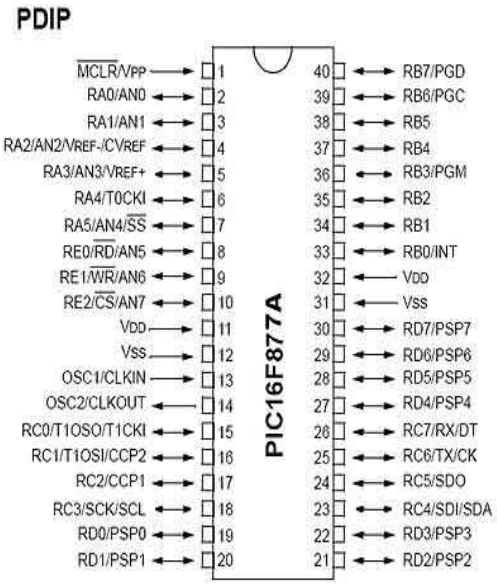


A. ZigBee Module CC2500



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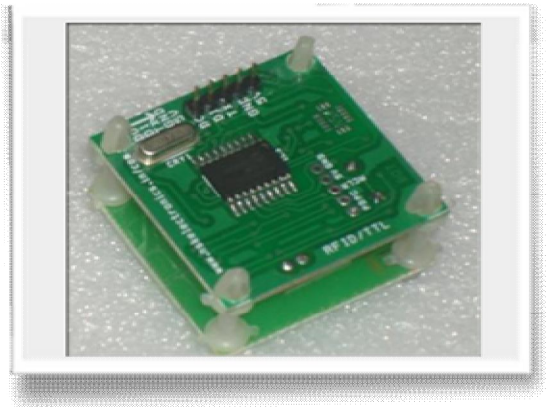
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B. Microcontroller (PIC16F877A)

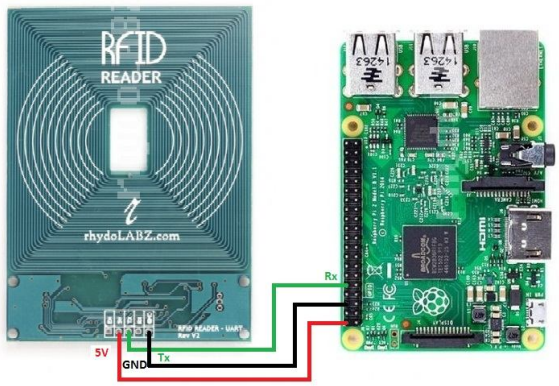


GSM Module SIM 300



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RFID Reader–125 kHz–TTL

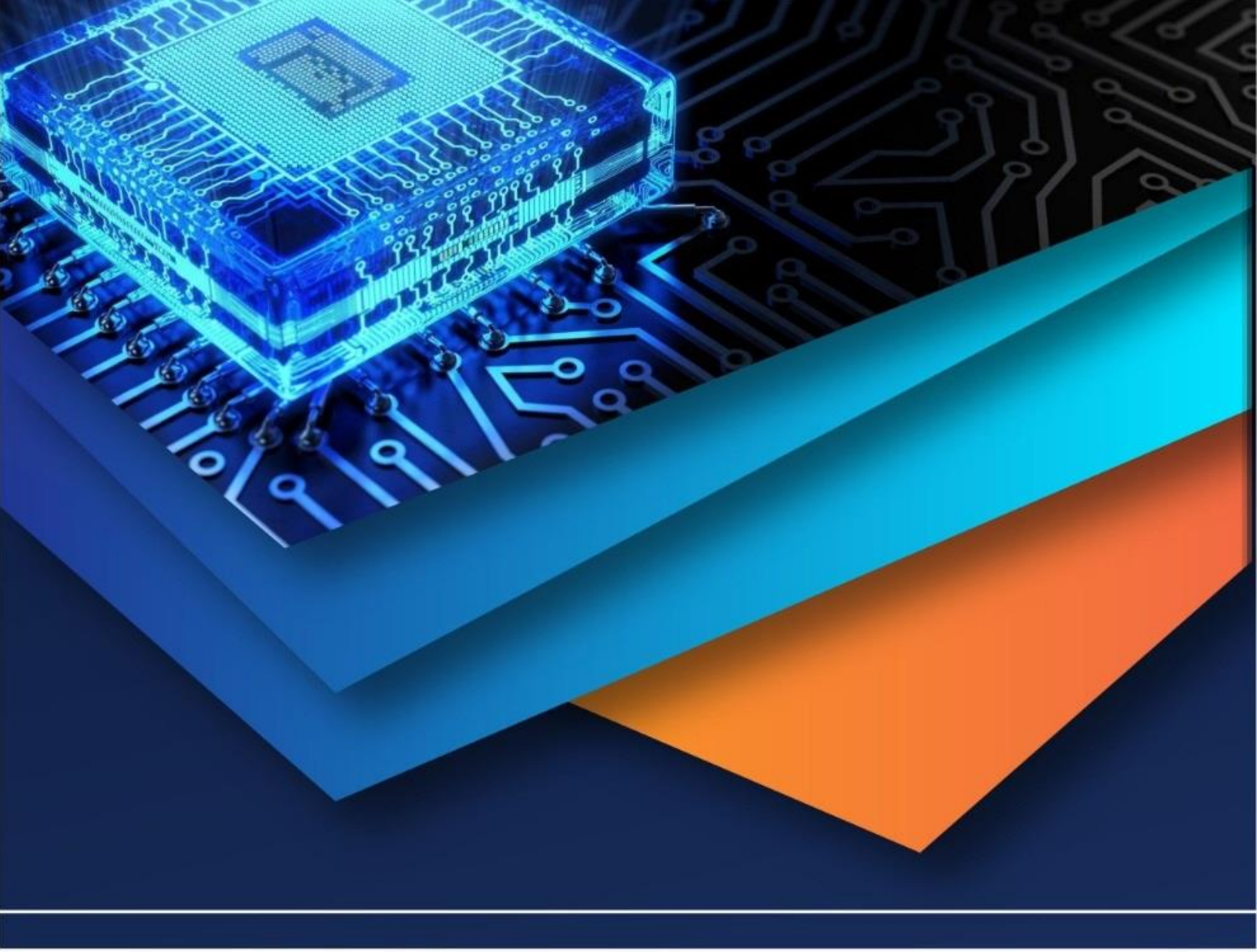
VII. CONCLUSION

With an Intelligent and highly automated traffic signal control based upon the traffic density present in the route, the manual effort of the traffic policeman is saved. As the entire system is automated, it requires very less human intervention. With the addition of stolen vehicle detection, the signal automatically turns red, so that the police officer can take appropriate action in the available slot of time without affection other vehicles, if he/she is present at the junction. Likewise SMS will be sent with the goal that they can get ready to get the stolen vehicle at the following conceivable intersections. Crisis vehicles like emergency vehicle, fire engines, need to achieve their goals at the most punctual. On the off chance that they invest a ton of energy in congested driving conditions, valuable existences of numerous individuals might be in danger.With crisis vehicle freedom, the traffic flag swings to green as long as the crisis vehicle is holding up in the rush hour gridlock intersection. The flag flashes to red, after the crisis vehicle goes through. Further upgrades should be possible to the model by testing it with longer range RFID perusers. Likewise GPS can be set into the stolen vehicle identification module, with the goal that the precise area of stolen vehicle is known. As of now, we have executed framework by thinking about one street of the traffic intersection. It tends to be improved by stretching out to every one of the streets in a multi-street intersection.

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