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I ABSTRACT

In 2014, 54% of the total global population was urban residents. The prediction was a growth of nearly 2% each year until 2020 leading to more pressure on the transportation system of cities. Cities should be making their streets run smarter instead of just making them bigger or building more roads.

This leads to the proposed system which will use a Raspberry pi and Camera for tracking the number of vehicles leading to time-based monitoring of the system.

Stable urbanization trends lead to the concentration of e population in large cities, as well as the expansion of the car fleet, while there is a colossal lag in the development of transport infrastructure.

This article is dedicated to exploring traffic management and the ways in which it can be performed. Various approaches to defining a transport system were explored, and the elements of a transport system were presented.

Existing practices of traffic management system implementation in cities around the world were reviewed.

We formulated the main purposes of using traffic management and elements of traffic management systems.

Based on that, a traffic management system architecture model was created.

II LIST OF FIGURES:

III List Of Graphs:

IV   List Of Abbreviation:

1.YOLO (You Only Look Once)

2. CNN (Convolution Neural Networks)

3. R-CNN (The Region-based Convolutional Network)

4. SSMD (Single Shot MultiBox Detector)

5. SSD (Single Shot Detector).

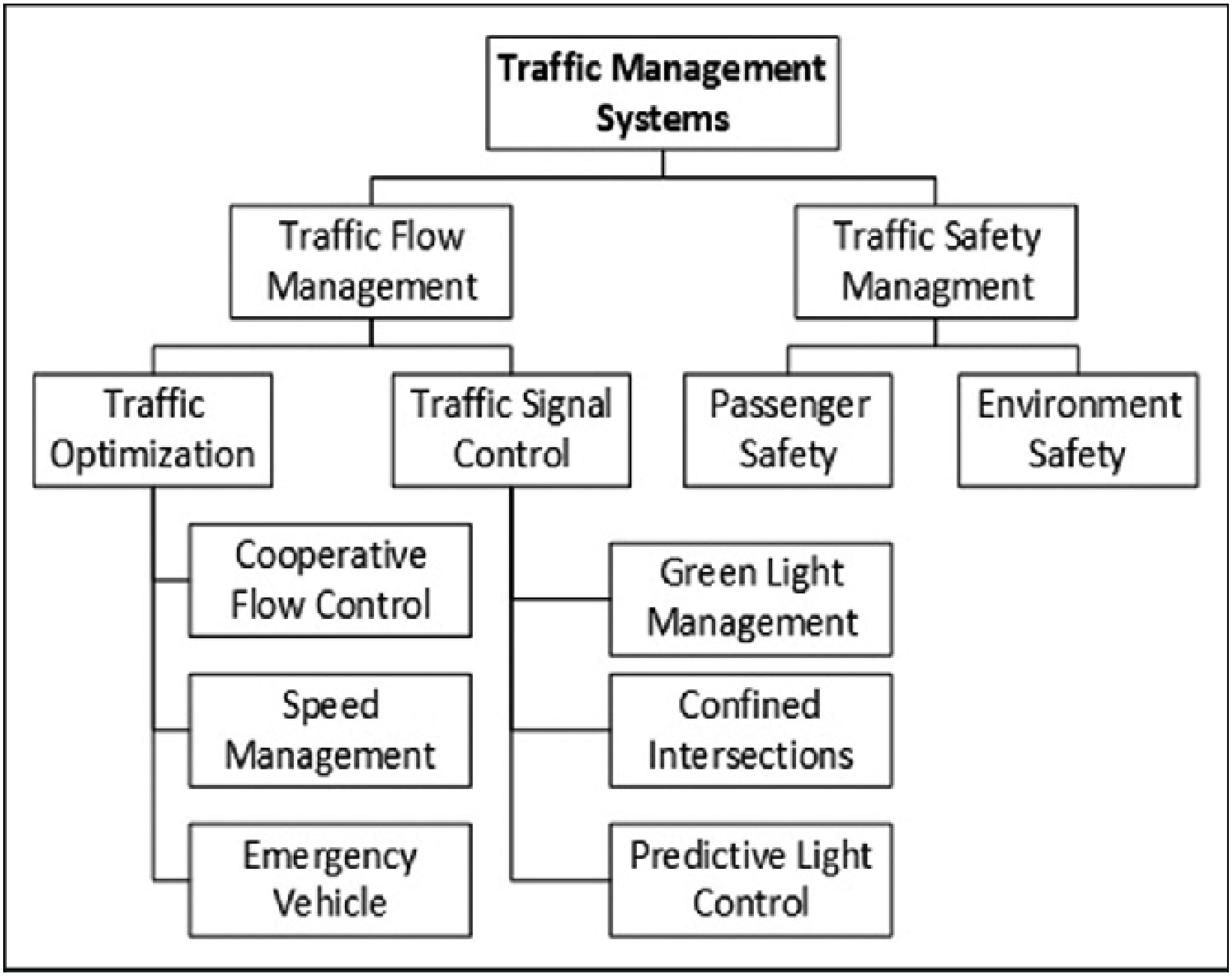


Fig: design of Traffic management system

1.Introduction:

A smart traffic management system utilizing camera data, communication and automated algorithms is to be developed to keep traffic flowing more smoothly. The aim is to optimally control the duration of green or red light for a specific traffic light at an intersection.

The traffic signals should not flash the same stretch of green or red all the time, but should depend on the number of vehicles present. When traffic is heavy in one direction,the green lights should stay on longer; less traffic should mean the red lights should be on for a longer time interval.

This solution is expected to eliminate inefficiencies at intersections and minimize the cost of commuting and pollution.Traffic management is the organisation, arrangement, guidance and control of both stationary and moving traffic, including pedestrians, bicyclists and all types of vehicles.

Its aim is to provide for the safe, orderly and efficient movement of persons and goods, and to protect and, where possible, enhance the quality of the local environment on and adjacent to traffic facilities. This book is an introduction to traffic management, written in laypersons' language, and assuming no background knowledge of the subject.

Various basic traffic characteristics relating to road users, vehicles and roads, and traffic regulation and control, are discussed, including some traffic volume and traffic flow considerations relevant to traffic management.

2.System Requirements:

2.1 Hardware:

Connected CCTV cameras.

Connected traffic light systems.

Smart toll gates / electronic road pricing gantry systems.

Edge devices — chips on edge nodes for faster data processing.
IoT road sensors including:

RFID (radio frequency identification) or AIDC (automatic identification and data collection) tags.

Temperature sensors.

Air quality sensors.

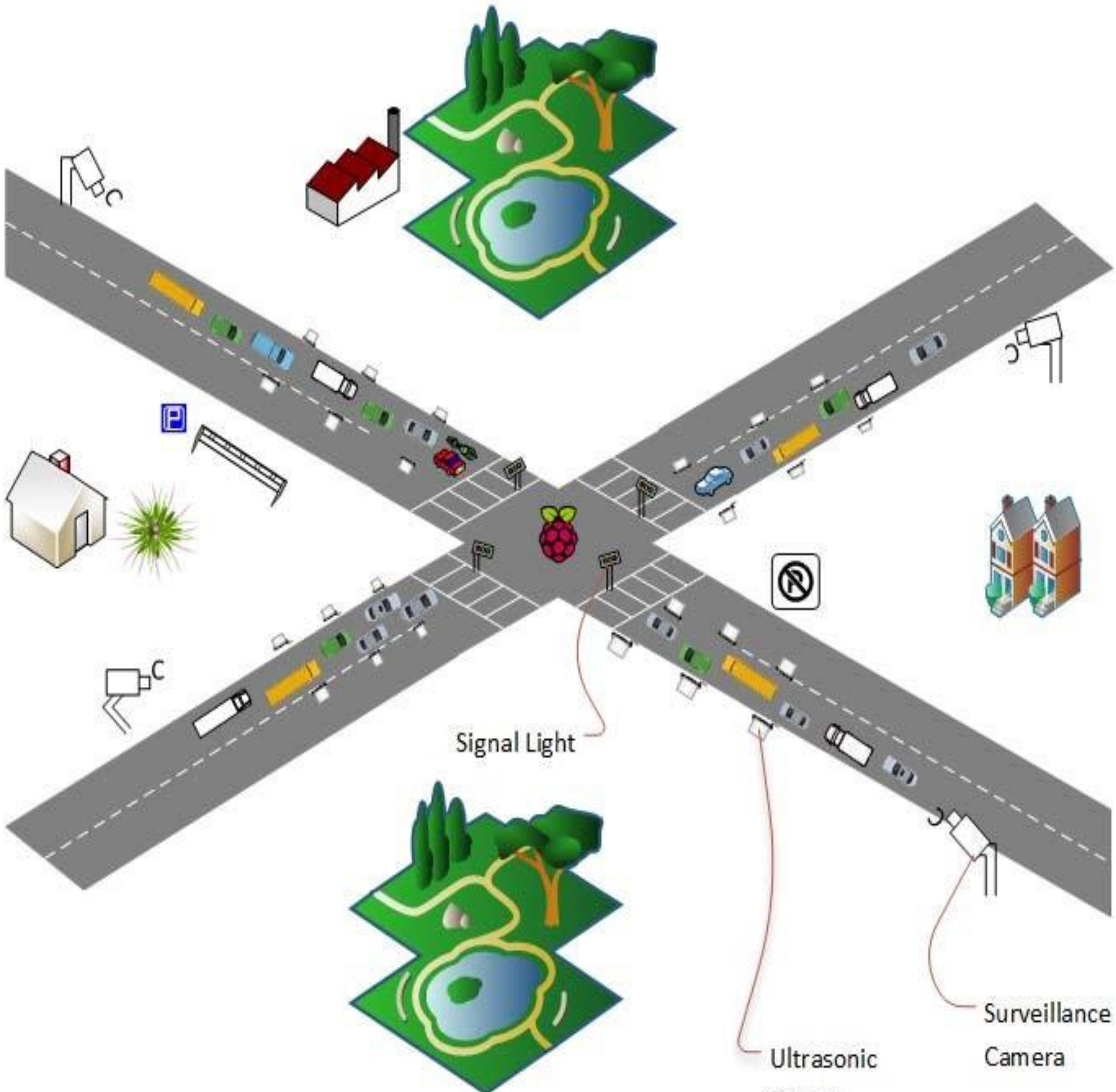
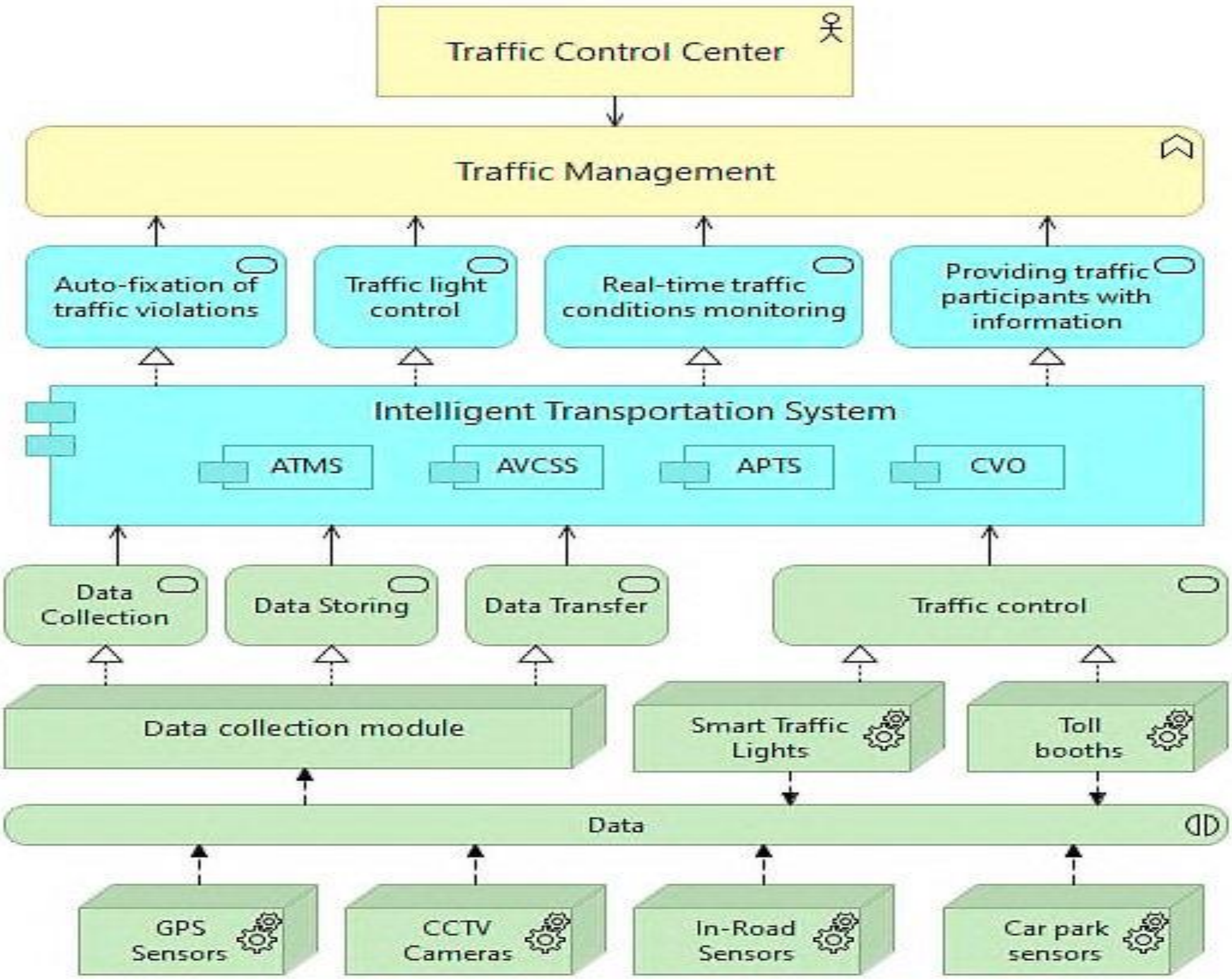


Fig: : Traffic management system using IOT



Fig; [Developing a Traffic Management System Architecture Model]

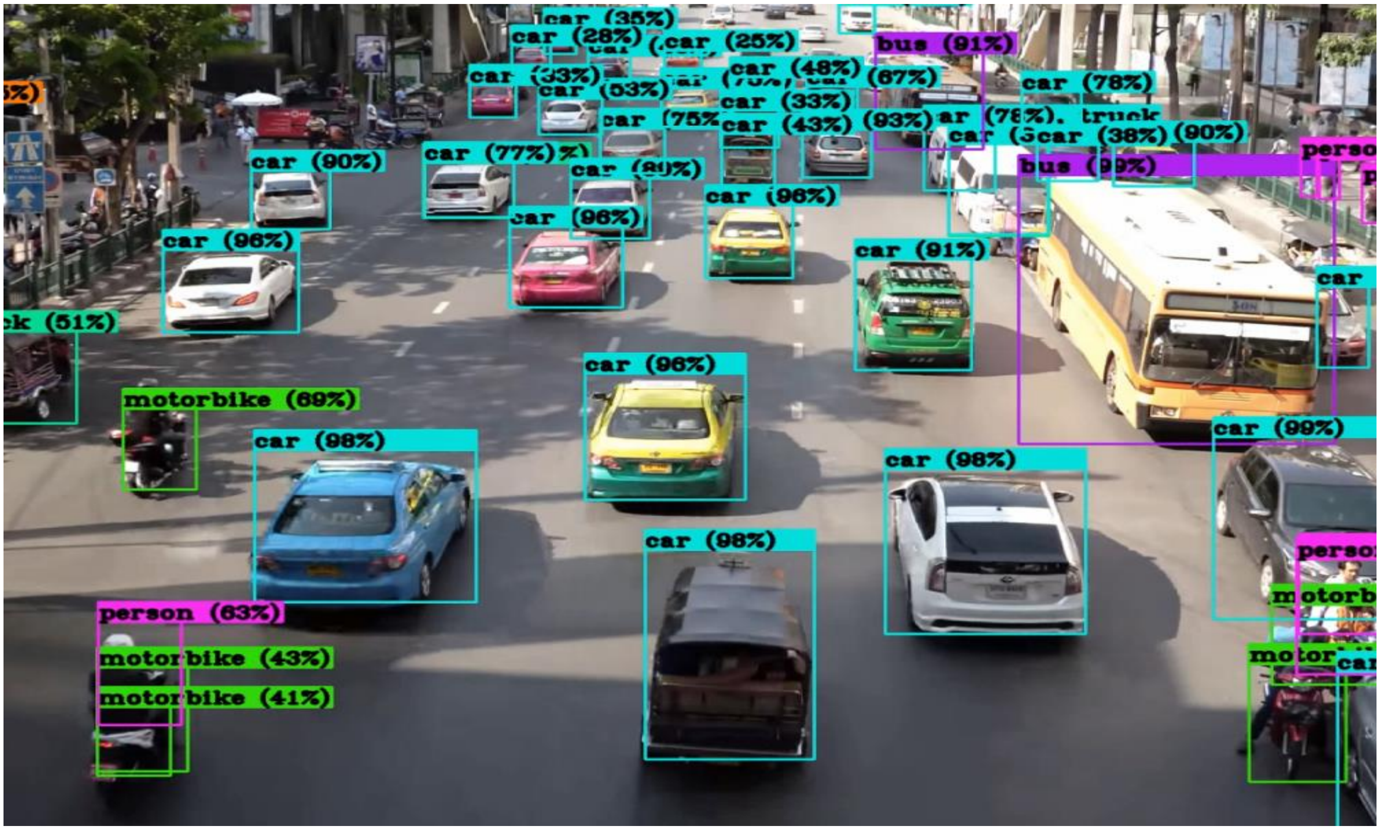


Fig : Analysis of YOLO Model

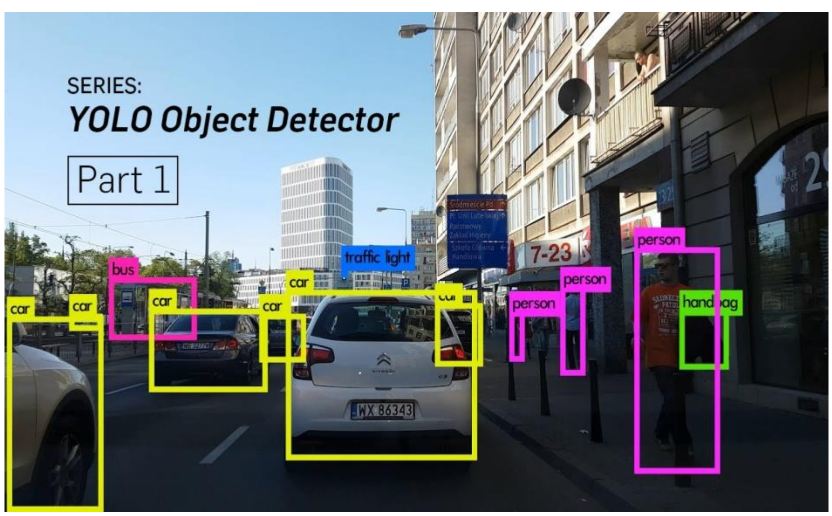


Fig:YOLO Object detection

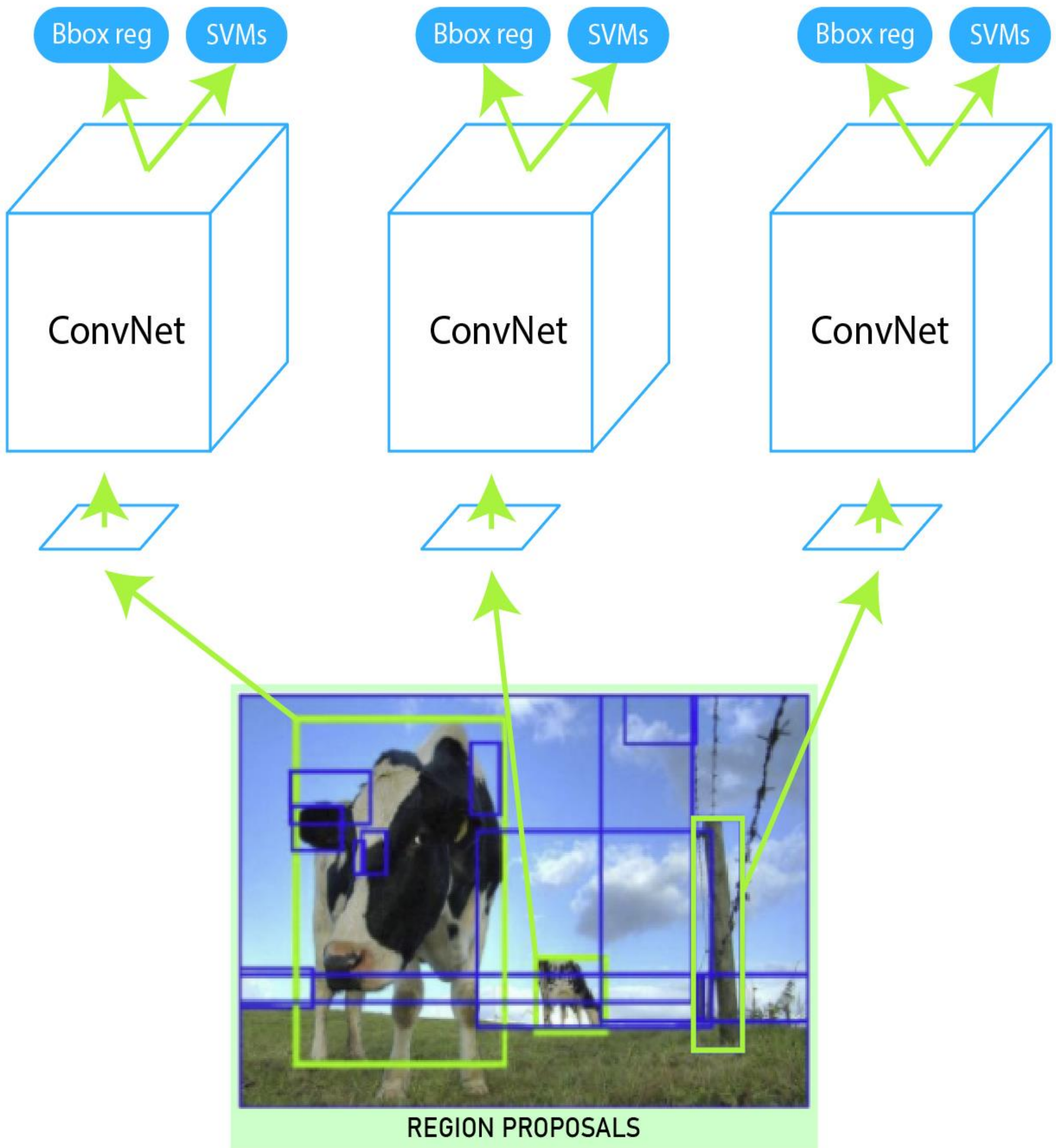


Fig. Regional based CNN

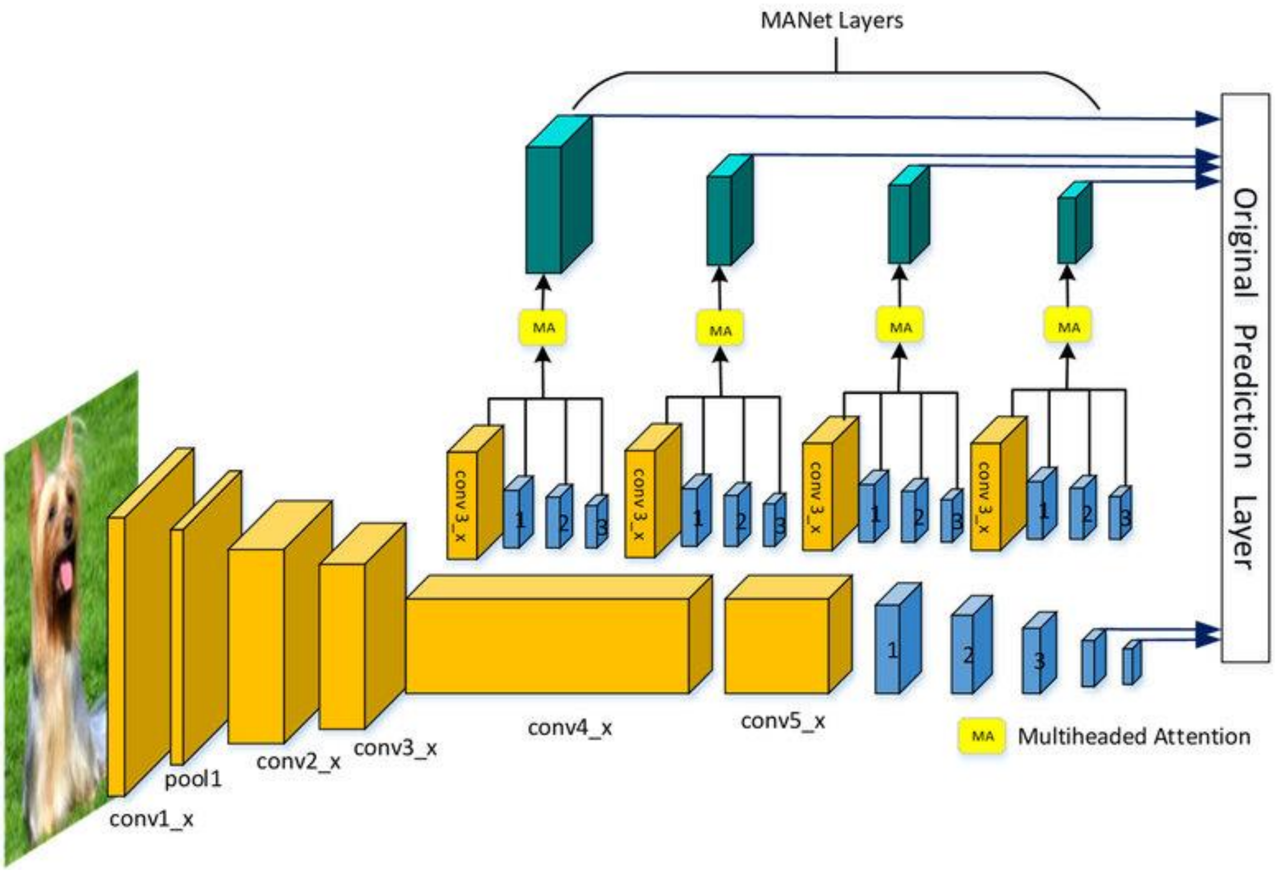


Fig. Single shot MultiBox detector

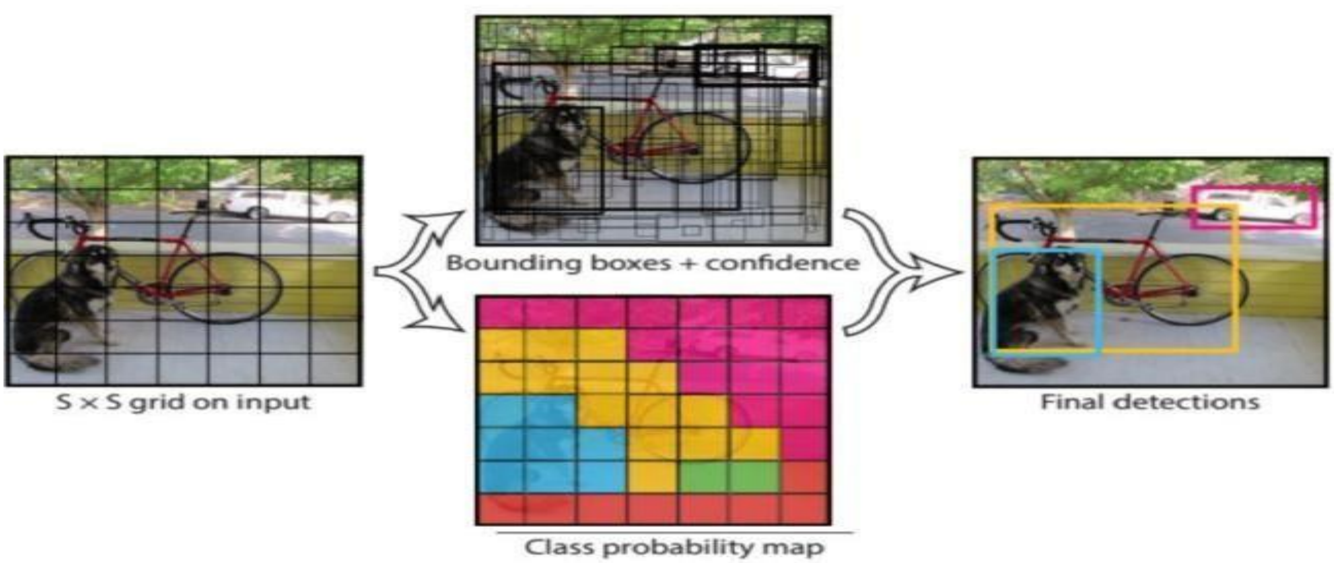
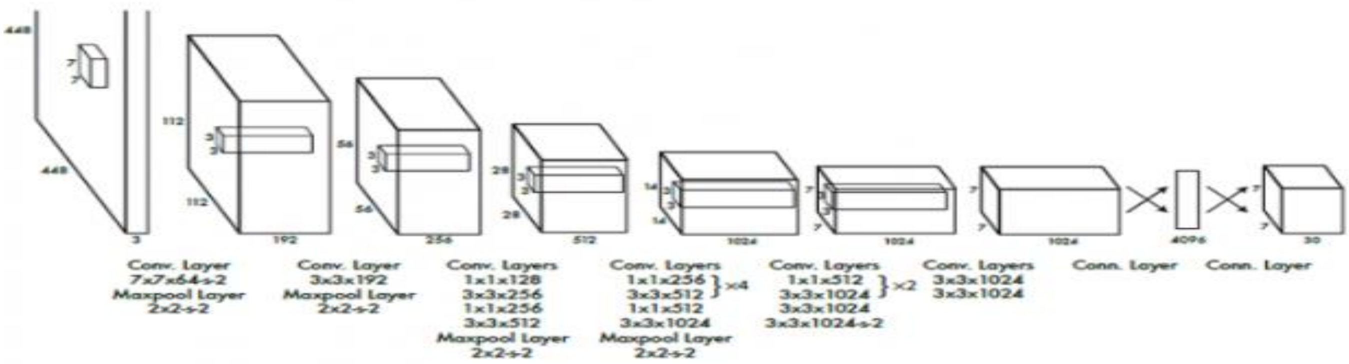


Fig: YOLO object detector



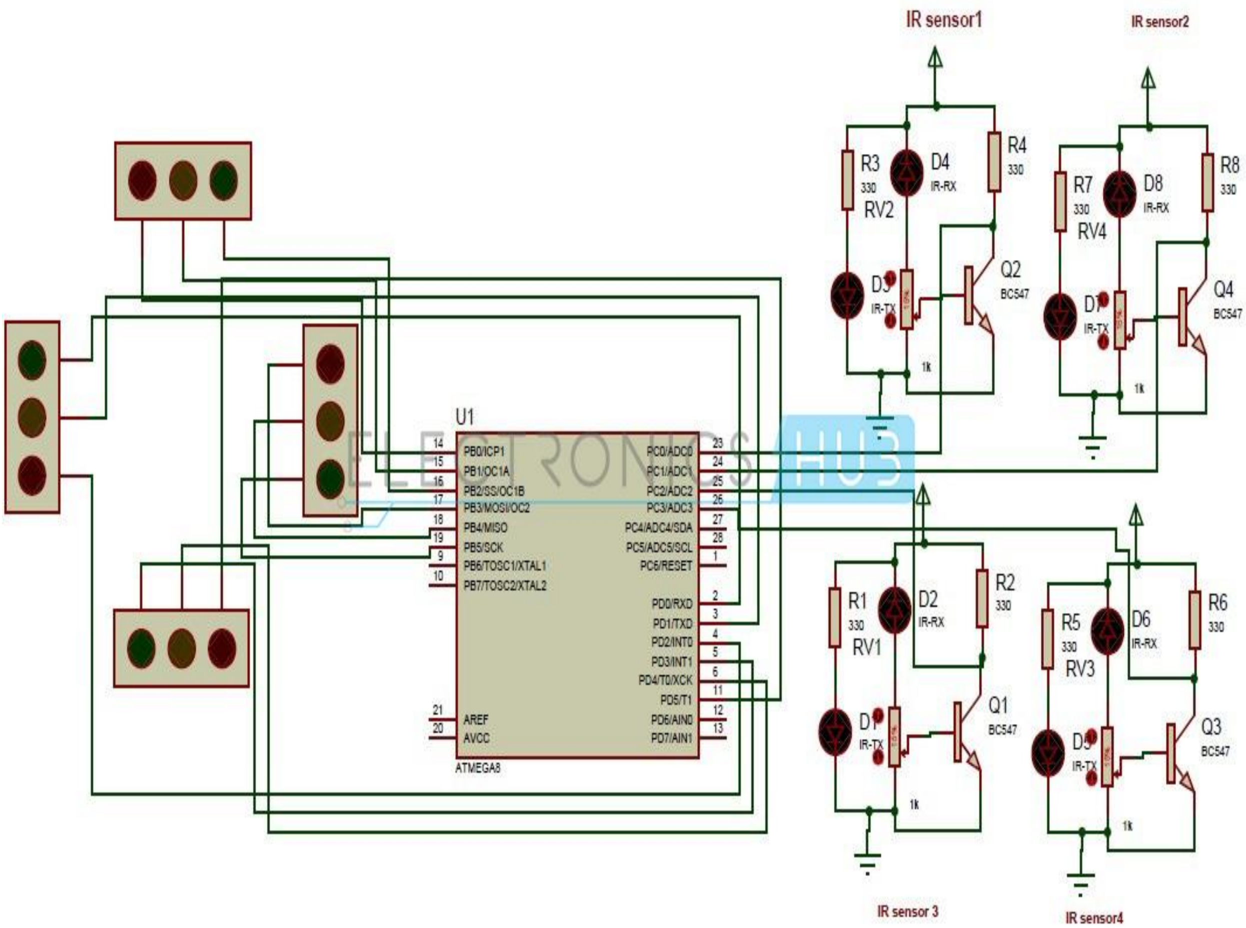


Fig: circuit diagram for traffic management system

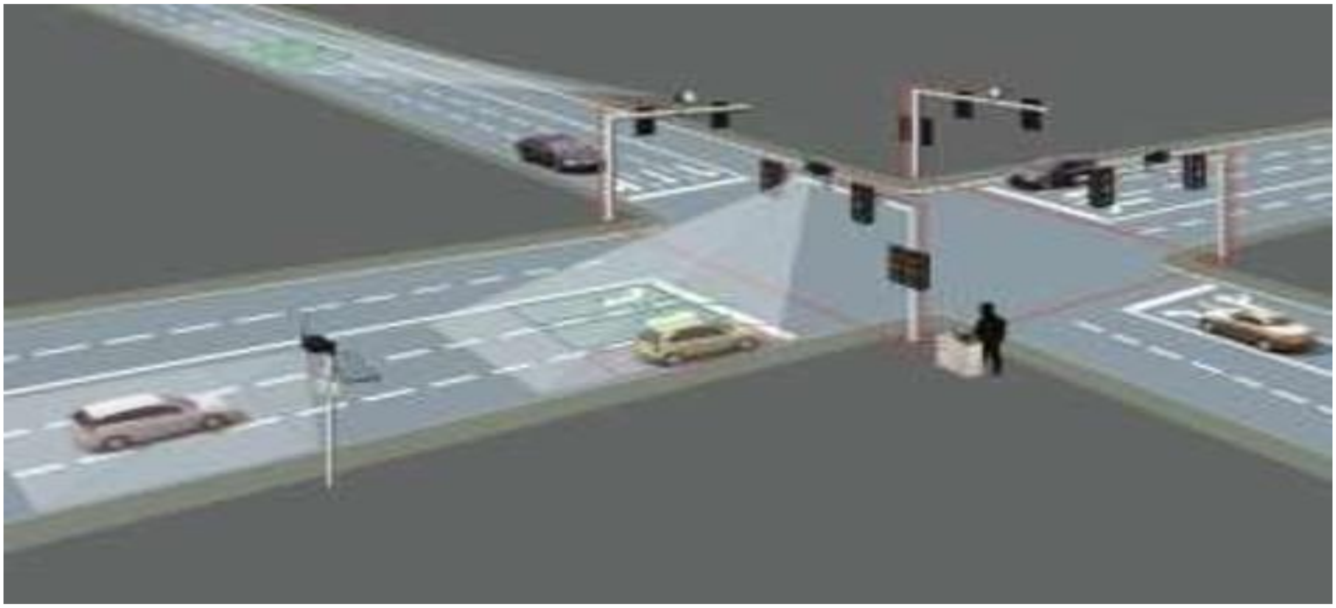


Fig: working process

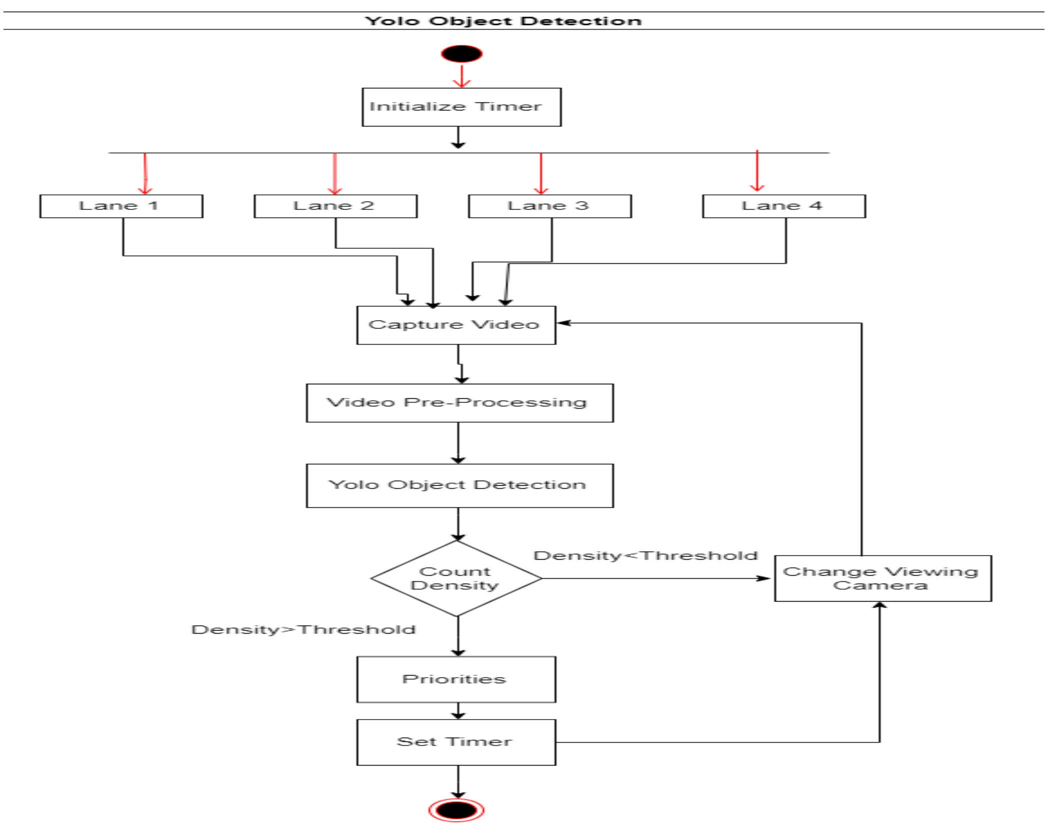


Fig: YOLO object detection

SampleOutput:

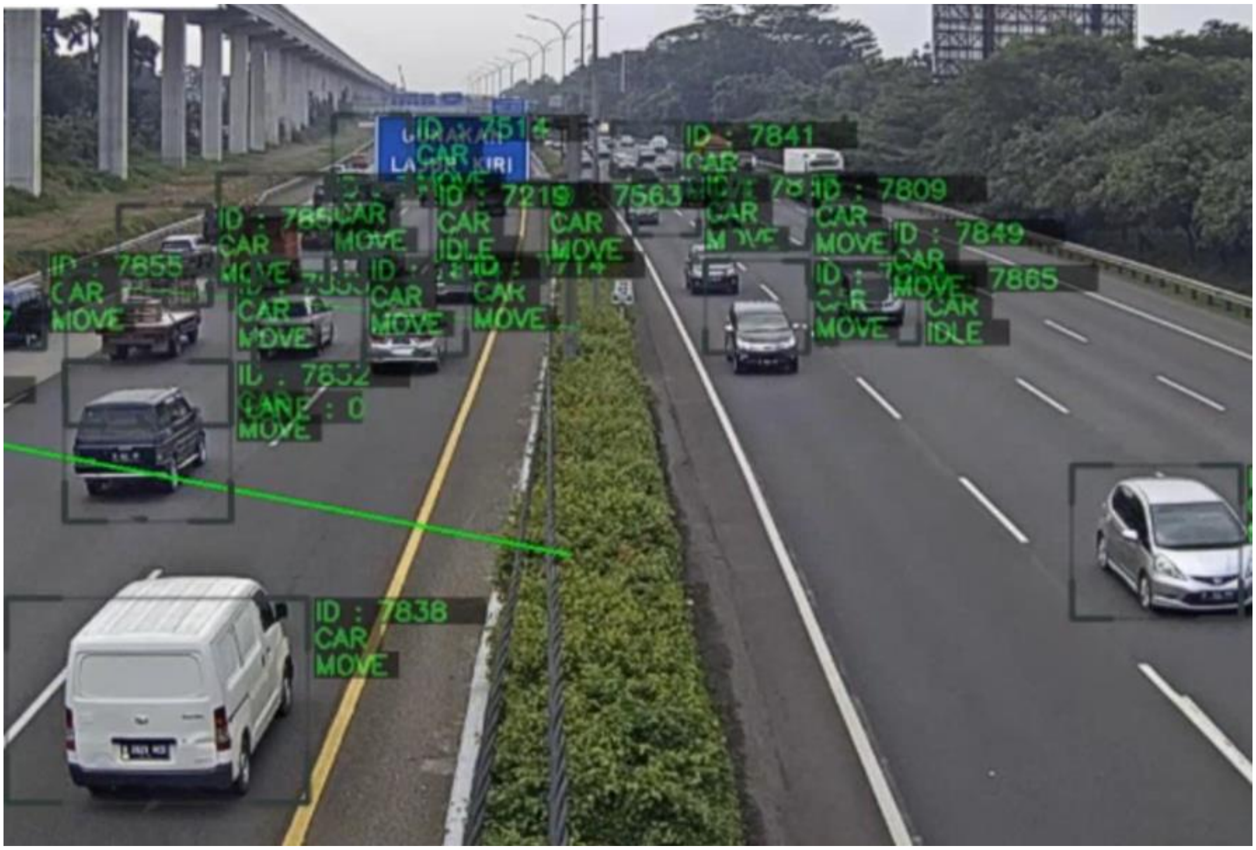
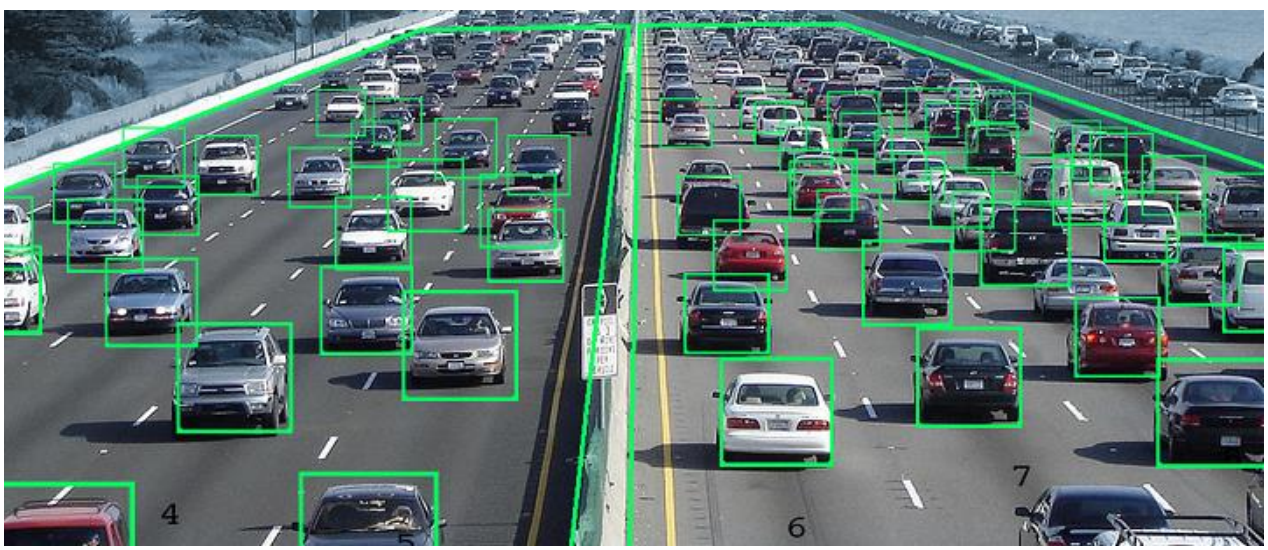


Fig: Object Detection for Traffic Management System



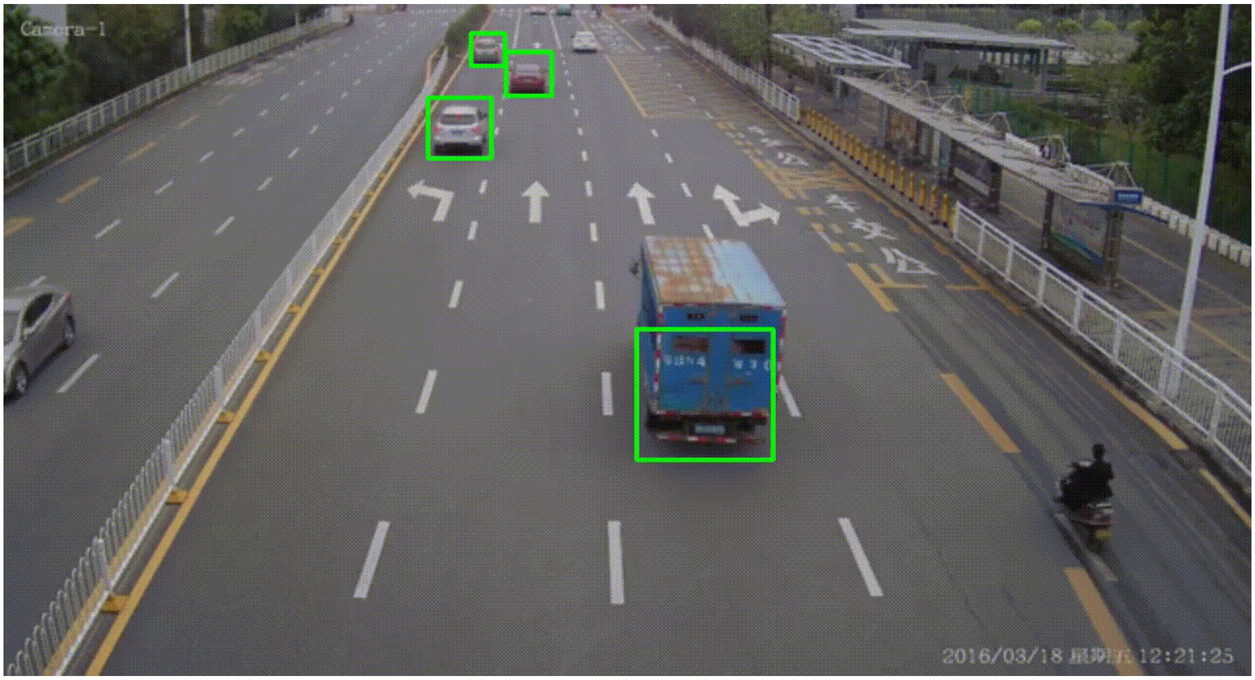


Fig: Object Detection for Traffic Management System

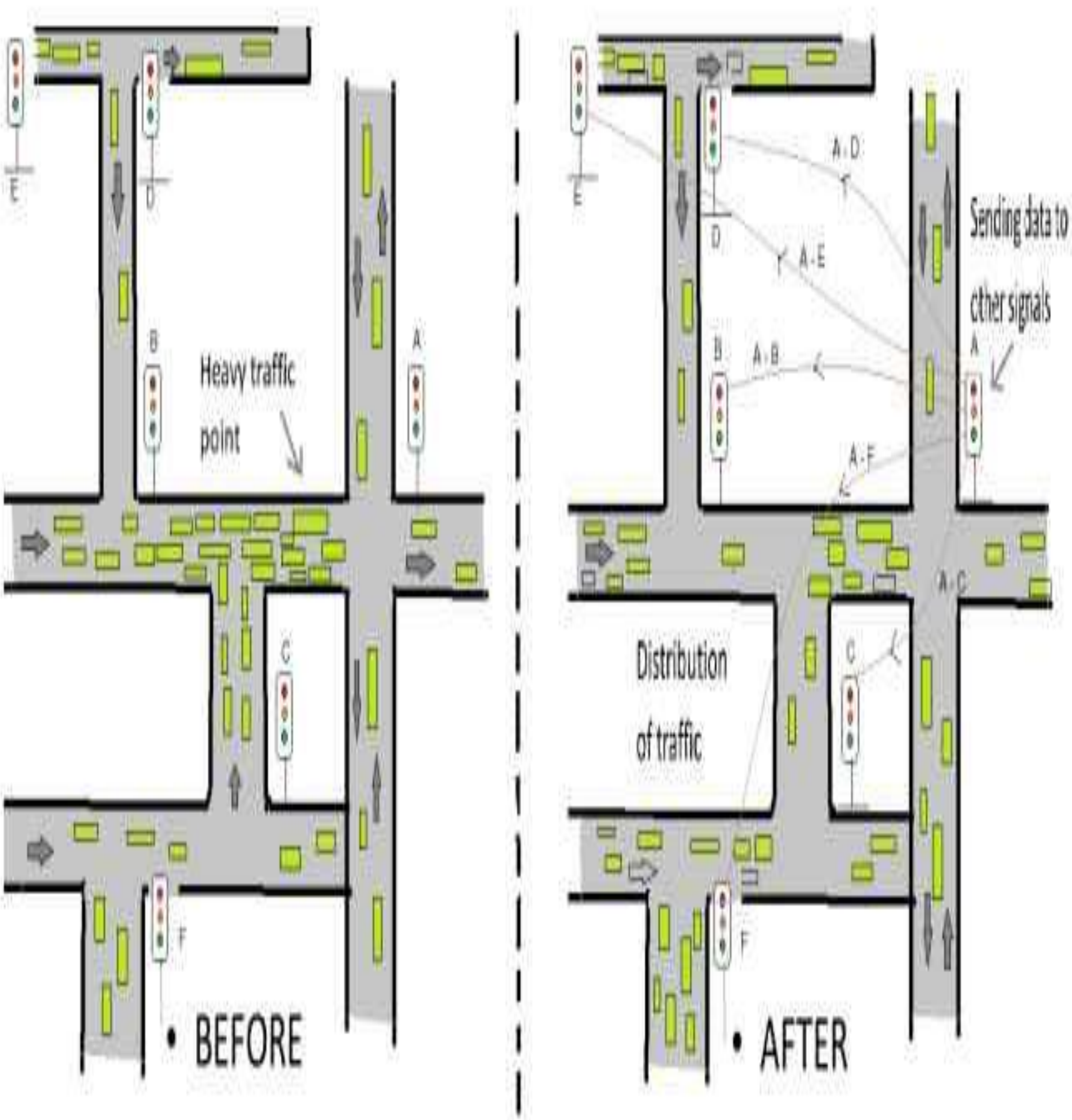


Fig: graph of traffic management

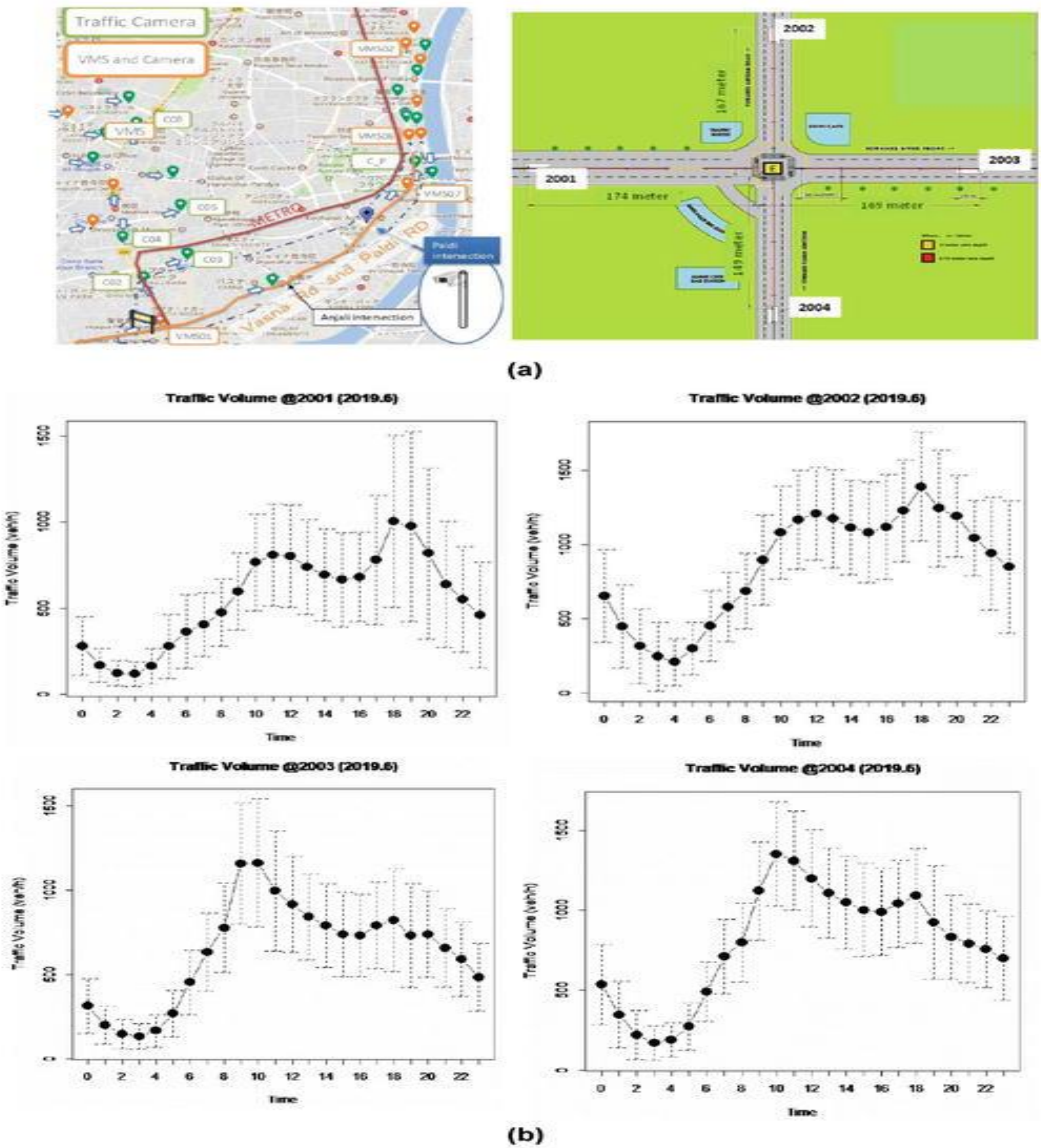


Fig:T raffic volume detector

2.2 Software:

Big data and predictive analytics

Cloud computing and edge processing capabilities:

Traffic data platform/.

Cloud-based traffic control systems.

Geographic information systems (GIS).

All supporting transportation app

AI/ML:

Computer Reinforcement learning.

Optical character recognition (OCR)Location-based services.

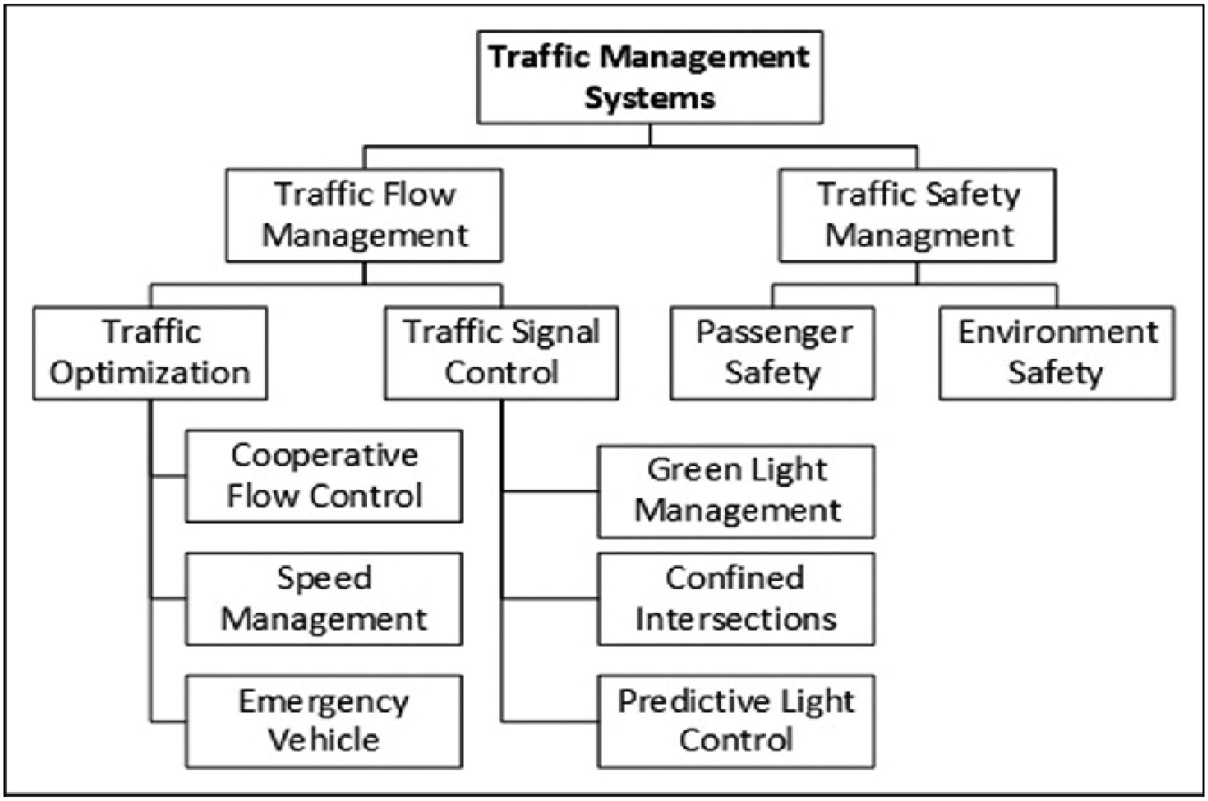
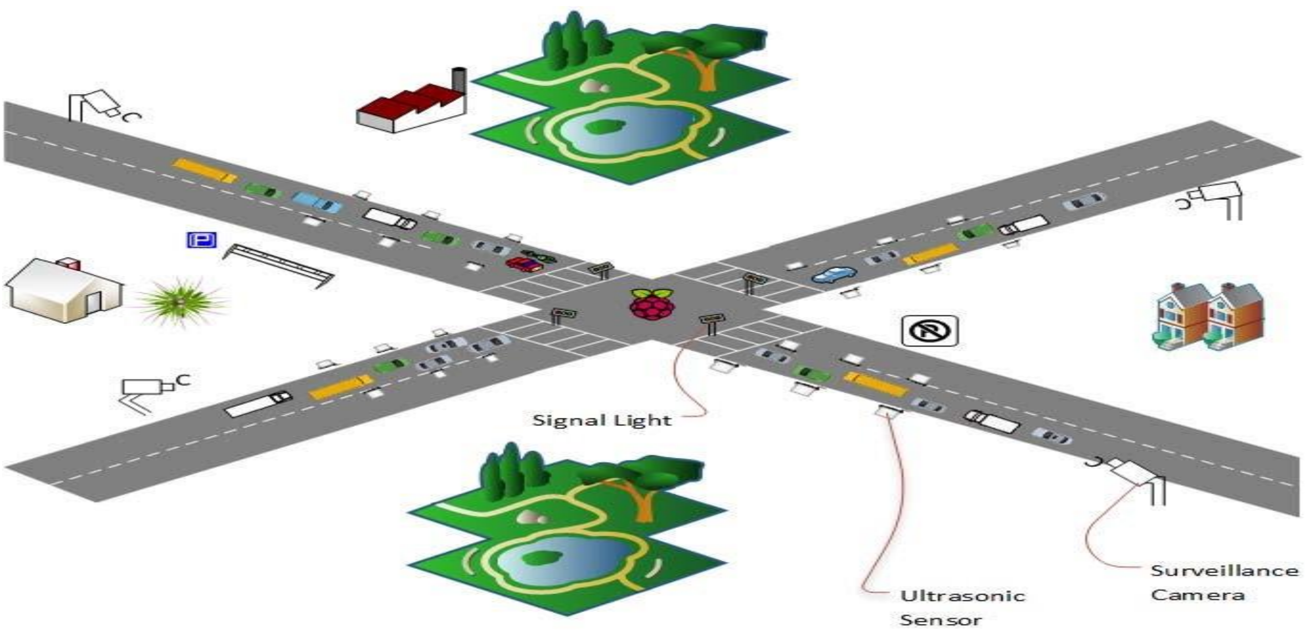


Fig: Desing of Traffic Management System



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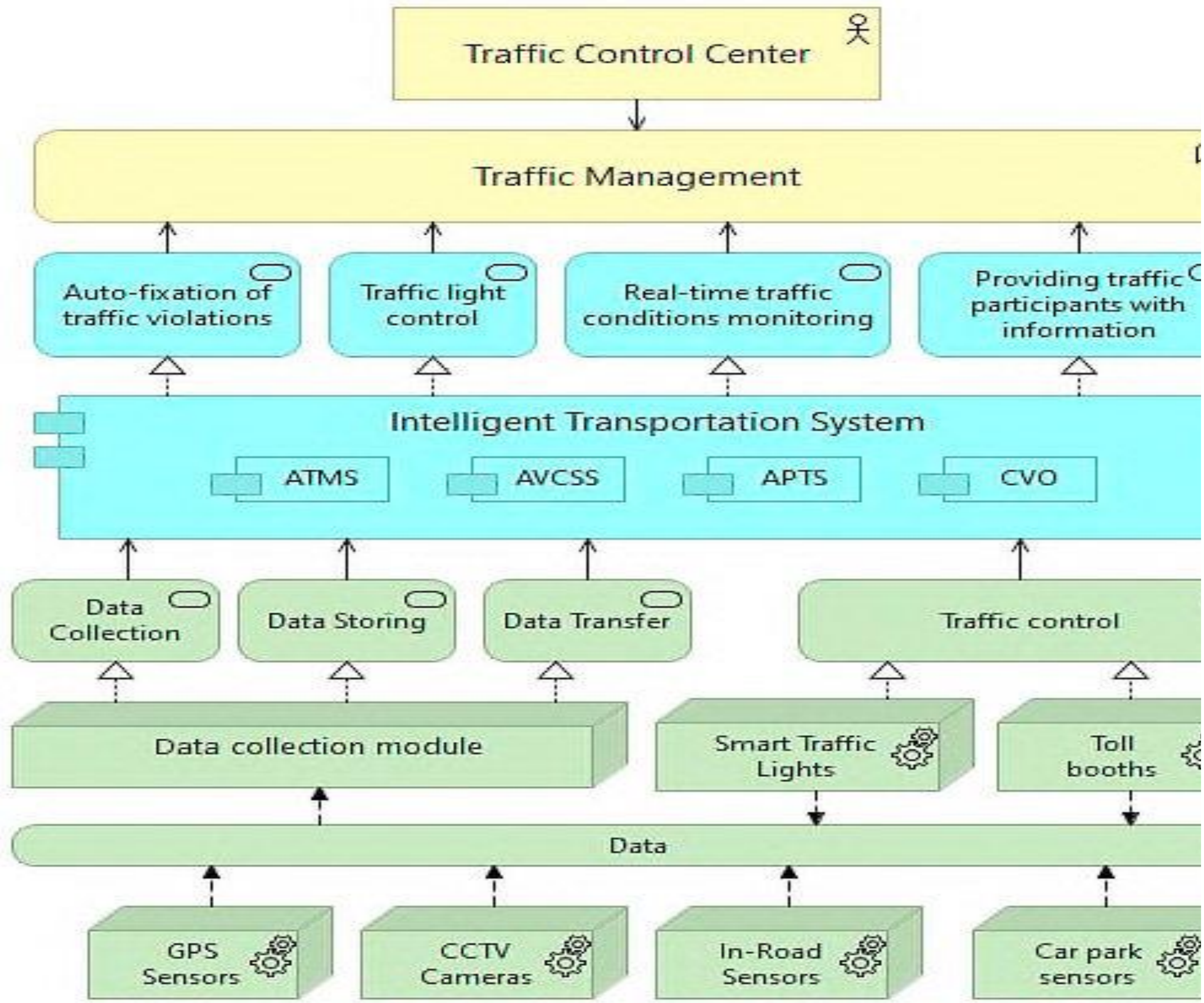
- Fig: Traffic management system using IOT



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  - **Fig; [Developing a Traffic Management System Architecture Model]**
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The improvement of town traffic condition is largely dependent on the modern ways of traffic management and control. Advanced traffic signal controllers and control system contribute to the improvement .

3.System Design:

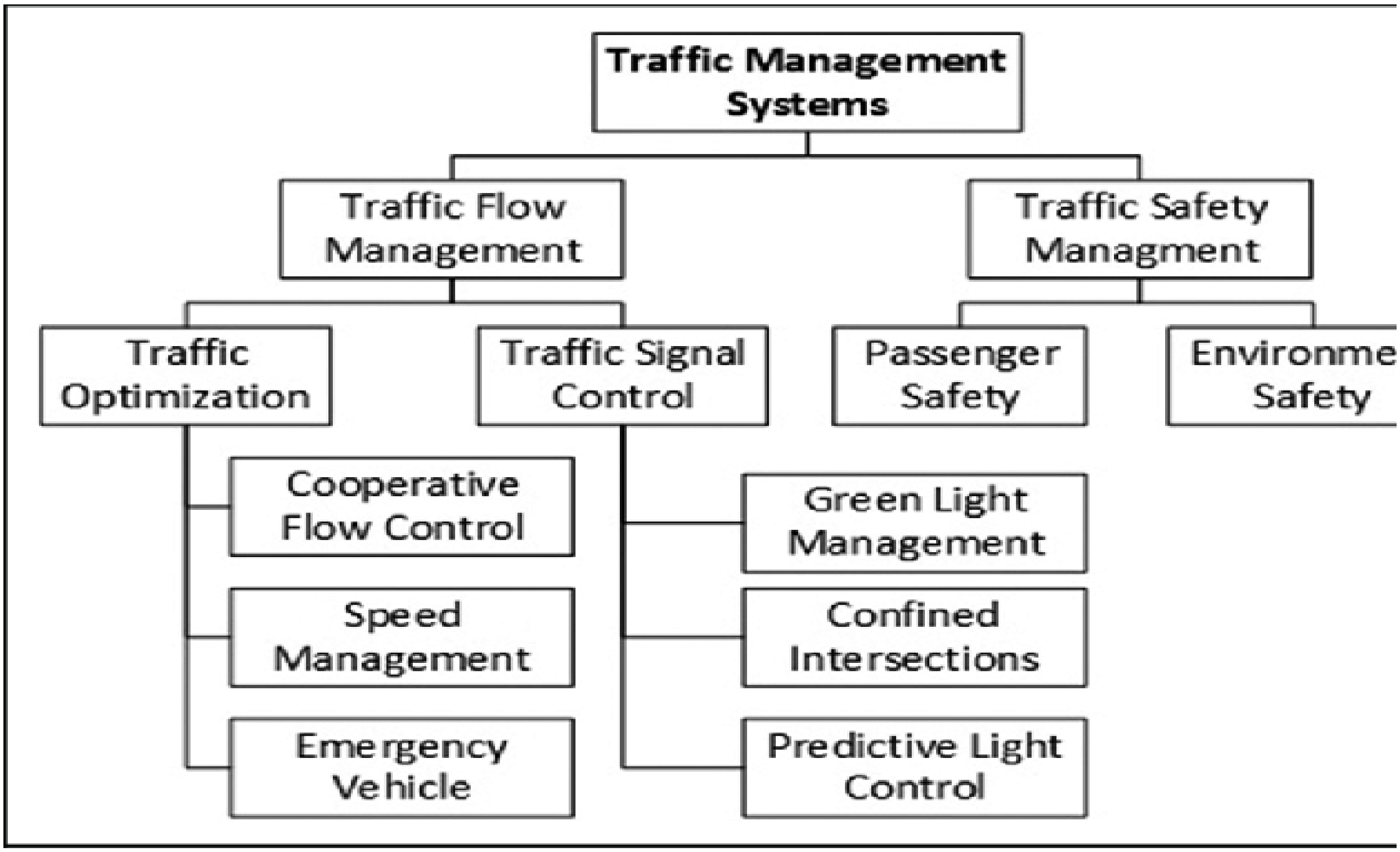


Fig: design of traffic management system

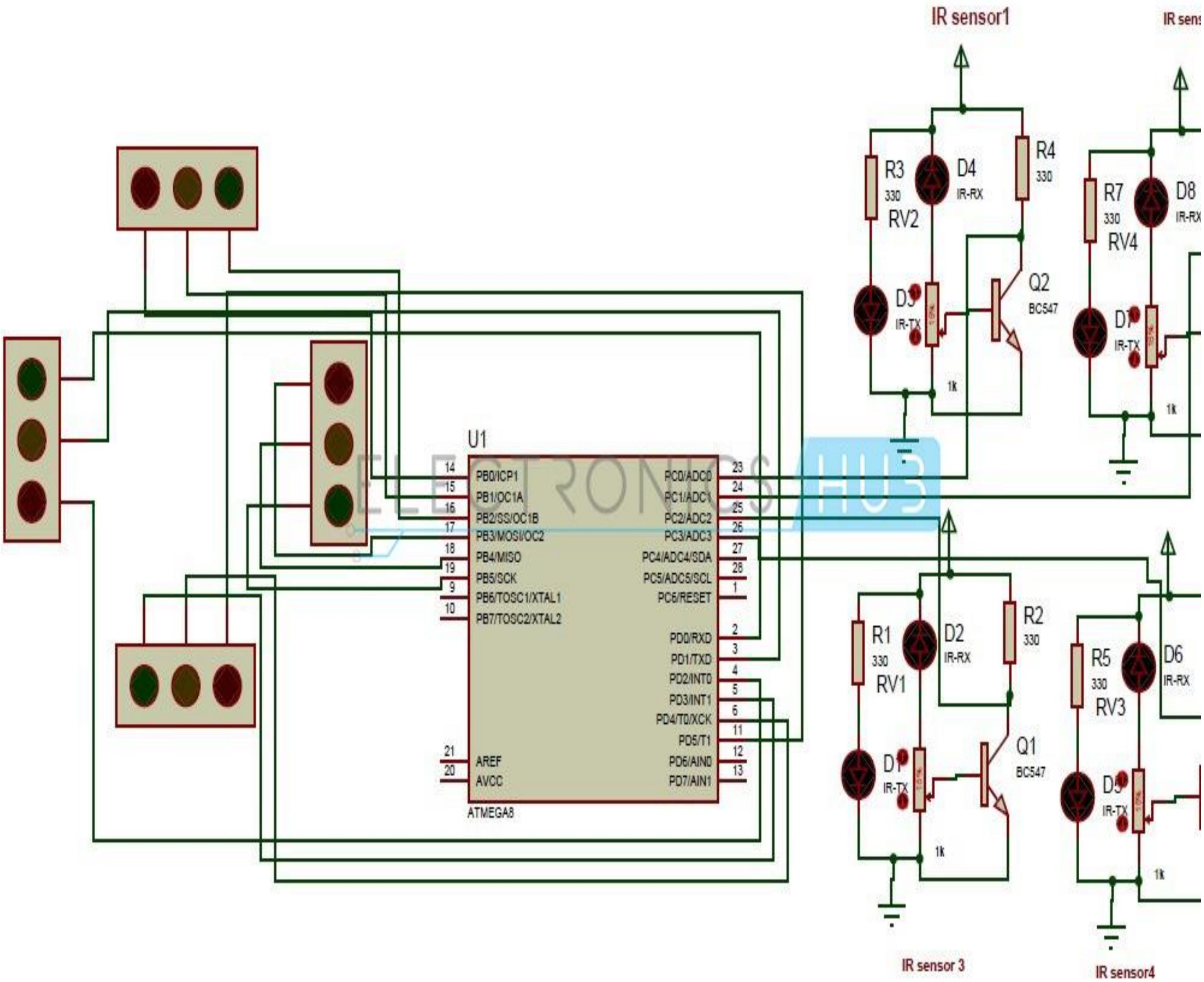
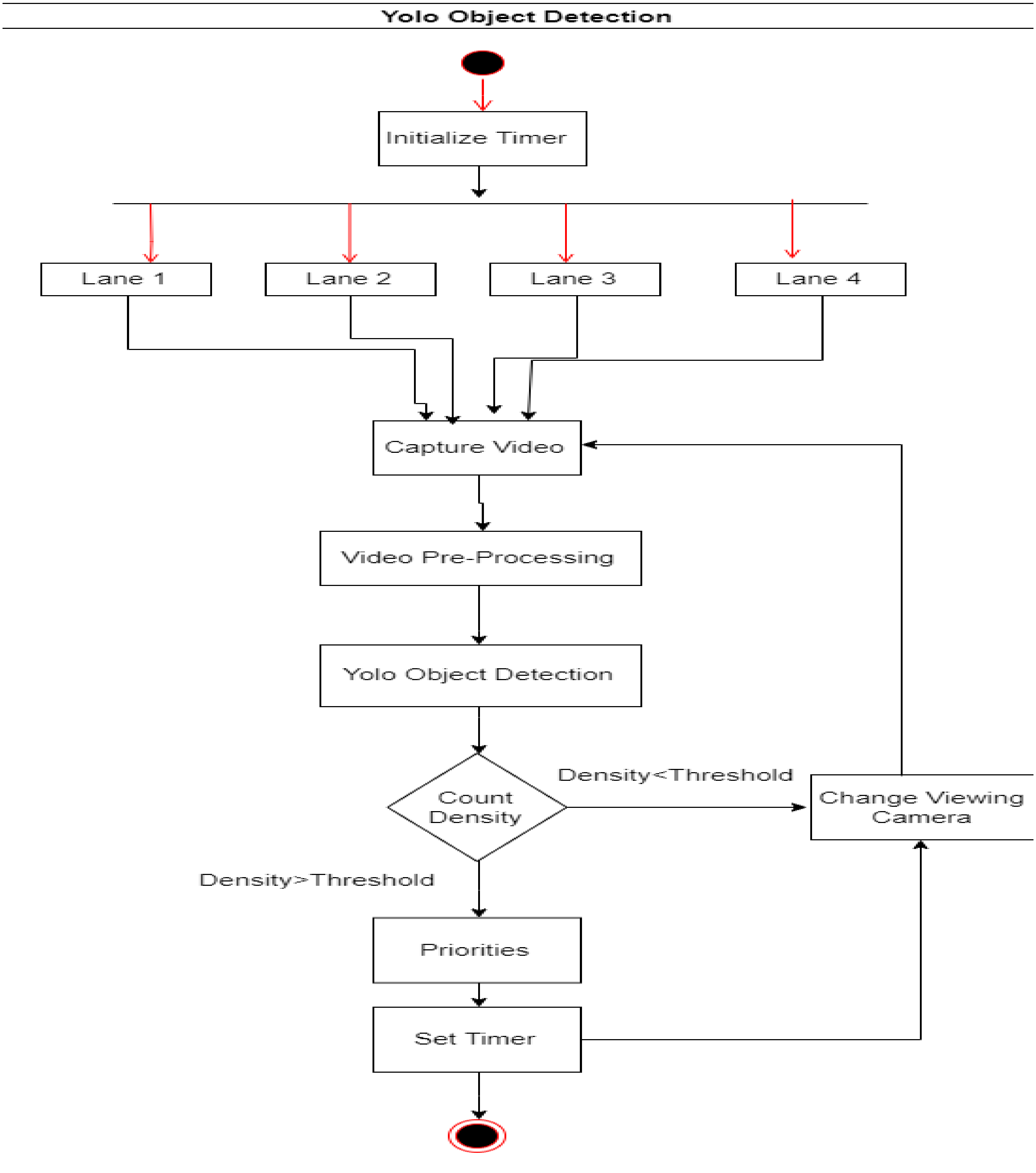


Fig: circuit diagram for traffic management system


Yolo Object Detection
Initialize Timer
Lane 1
Lane 2
Lane 3
Lane 4
Capture Video
Video Pre-Processing
Yolo Object Detection
Count Density
Density<Threshold
Change Viewing Camera
Density>Threshold
Priorities
Set Timer

4.System Analysis:

YOLO ALGORTHM

YOLO (You Only Look Once) real-time object detection algorithm, which is one of the most effective object detection algorithms that also encompasses many of the most innovative ideas coming out of the computer vision research community.

Object detection is a critical capability of autonomous vehicle technology. It is an area of computer vision that's exploding and working so much better than just a few years ago.

At the end of this article, we will see a couple of recent updates to YOLO by the original researchers of this important technique. YOLO is a clever convolutional neural network (CNN) for doing object detection in real-time.

The algorithm applies a single neural network to the full image, and then divides the image into regions and predicts bounding boxes and probabilities for each region.

These bounding boxes are weighted by the predicted probabilities. Fig shows that the analysis of YOLO model.

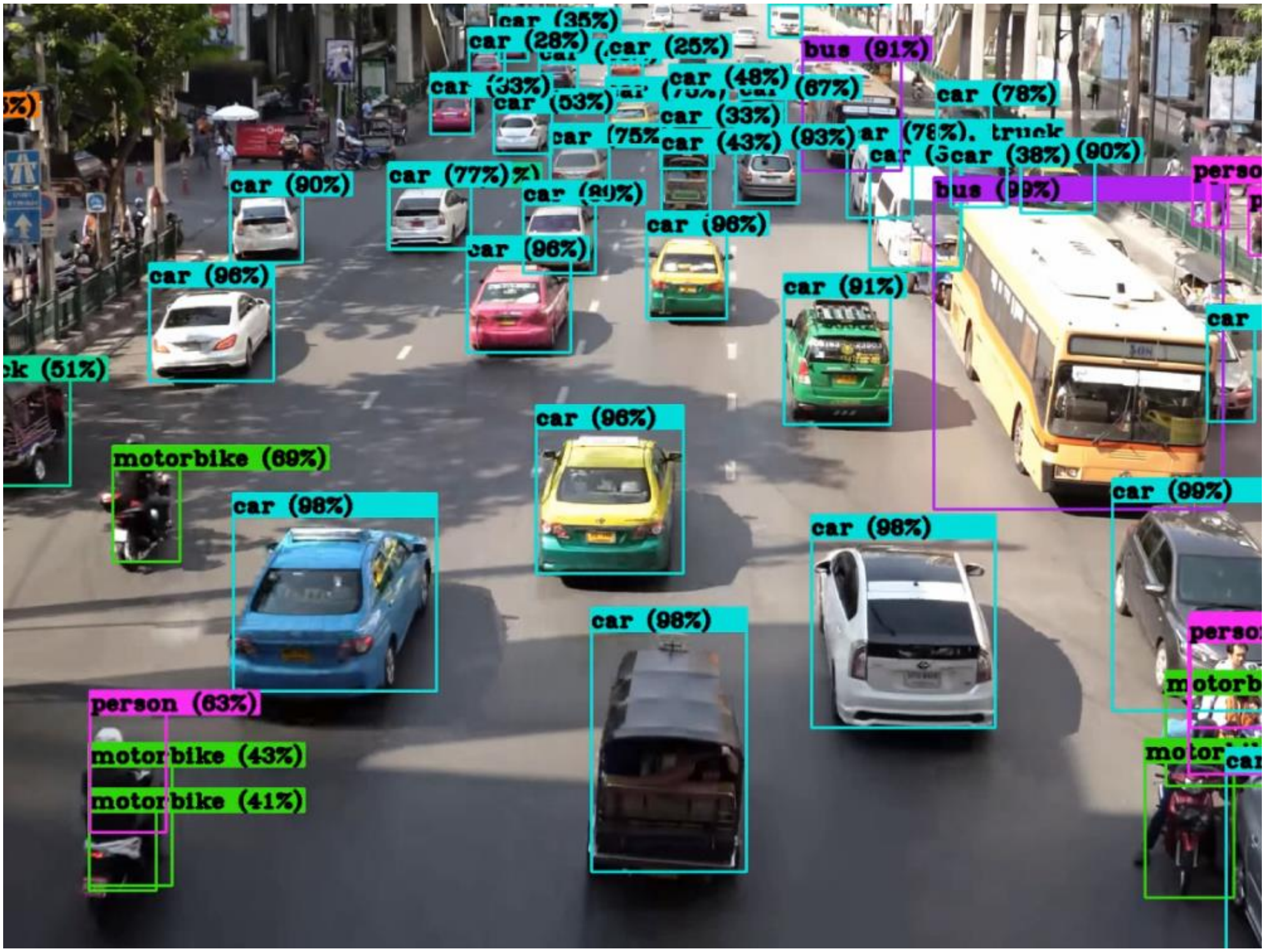


Fig. Analysis of YOLO Model

YOLO achieves high accuracy while also being able to run in real-time. The algorithm “only looks once” at the image in the sense that it requires only one forward propagation pass through the neural network to make predictions.

After non-max suppression, it then outputs recognized objects together with the bounding boxes. With YOLO, a single CNN simultaneously predicts multiple bounding boxes and class probabilities for those boxes.

YOLO trains on full images and directly optimizes detection performance. Fig shows the object detection.

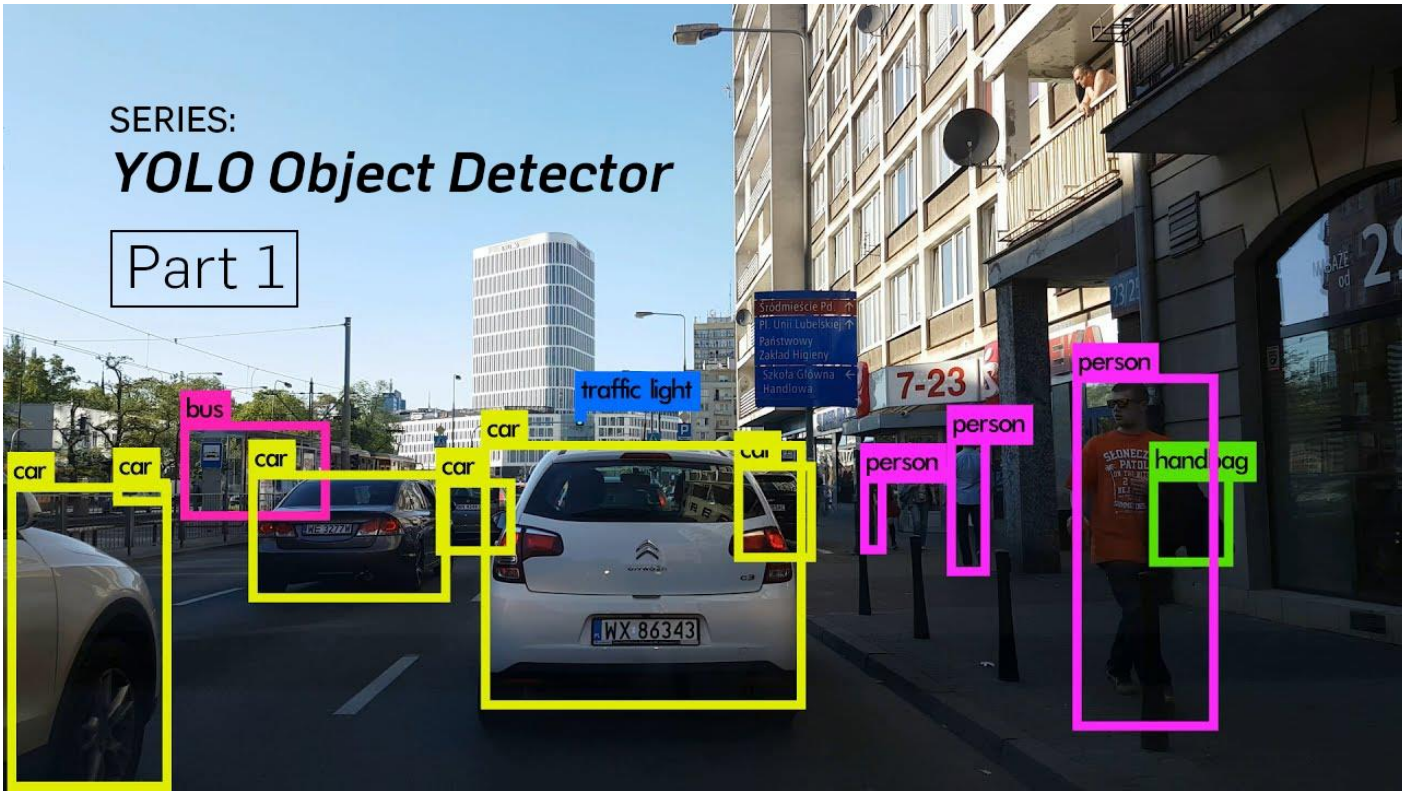


Fig.Object detection

Object detection

A. Convolution Neural Networks (CNN): CNN is widely used neural network architecture for computer vision related tasks. Advantage of CNN is that it automatically performs feature extraction on images i.e. important features are detected by the network itself. CNN is made up of three important components called Convolutional Layer, Pooling layer, fully connected Layer. Considering a gray scale image of size 32*32 would have 1024 nodes in multi- layer approach. This process of flattening pixels loses

spatial positions of the image.

B. Region-based Convolutional Neural Networks

(R-CNN): The Region-based Convolutional Network method (RCNN) is a combination of region proposals with Convolution Neural Networks (CNNs). R-CNN helps in localising objects with a deep network and training a high-capacity model with only a small quantity of annotated detection data. It achieves excellent object detection accuracy by using a deep Convert to classify object proposals. R-CNN has the capability to scale to thousands of object classes without resorting to approximate techniques, including hashing. The fig shows that Regional based convolutional neural network.

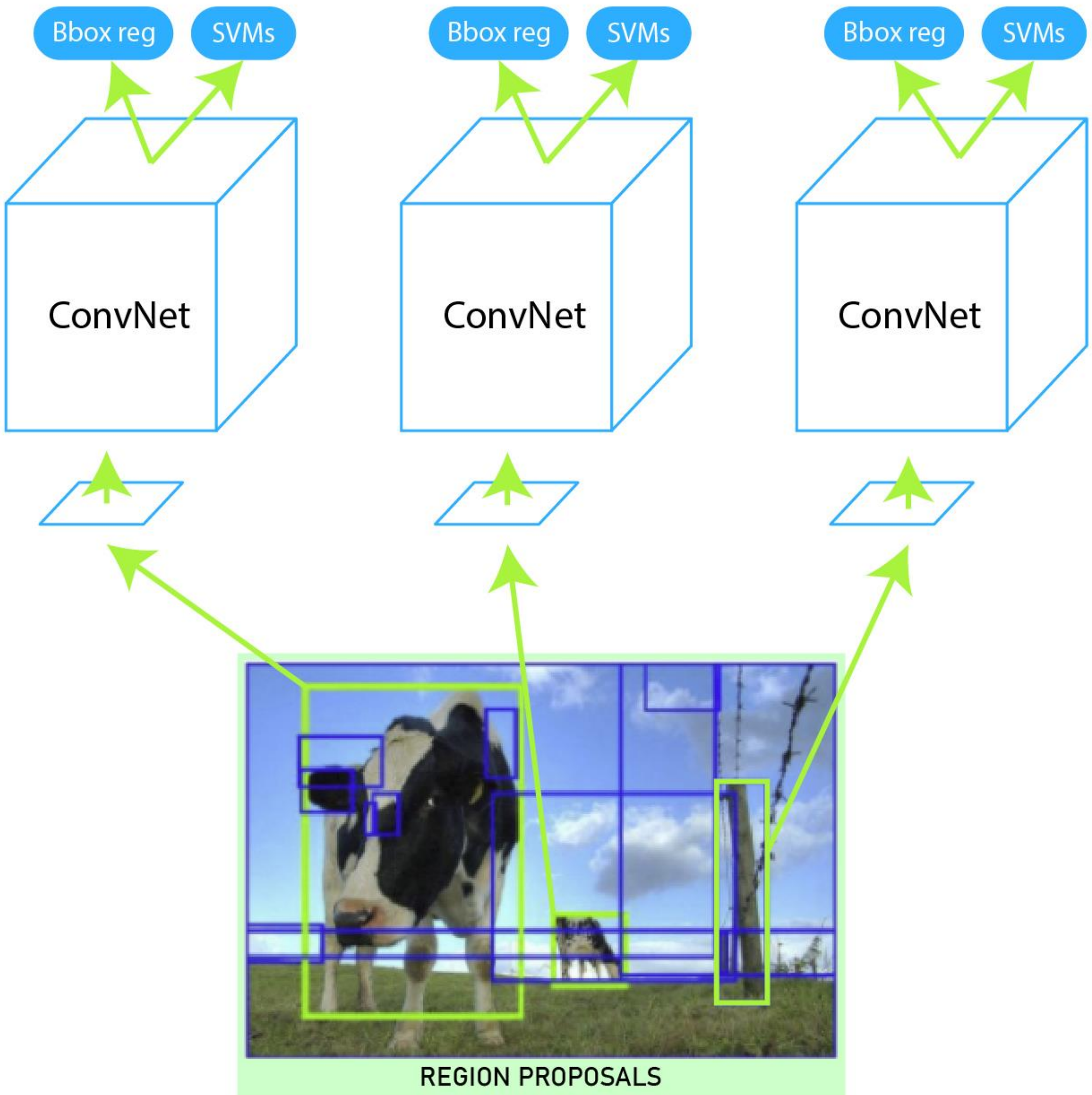


Fig. Regional based CNN

C. Single Shot MultiBox Detector (SSD): Single Shot Detector (SSD) is a method for detecting

objects in images using a single deep neural network. The Single Shot Detector network combines predictions from multiple feature maps with different resolutions to naturally handle objects of various sizes. Fig shows Single Shot MultiBox Detector.

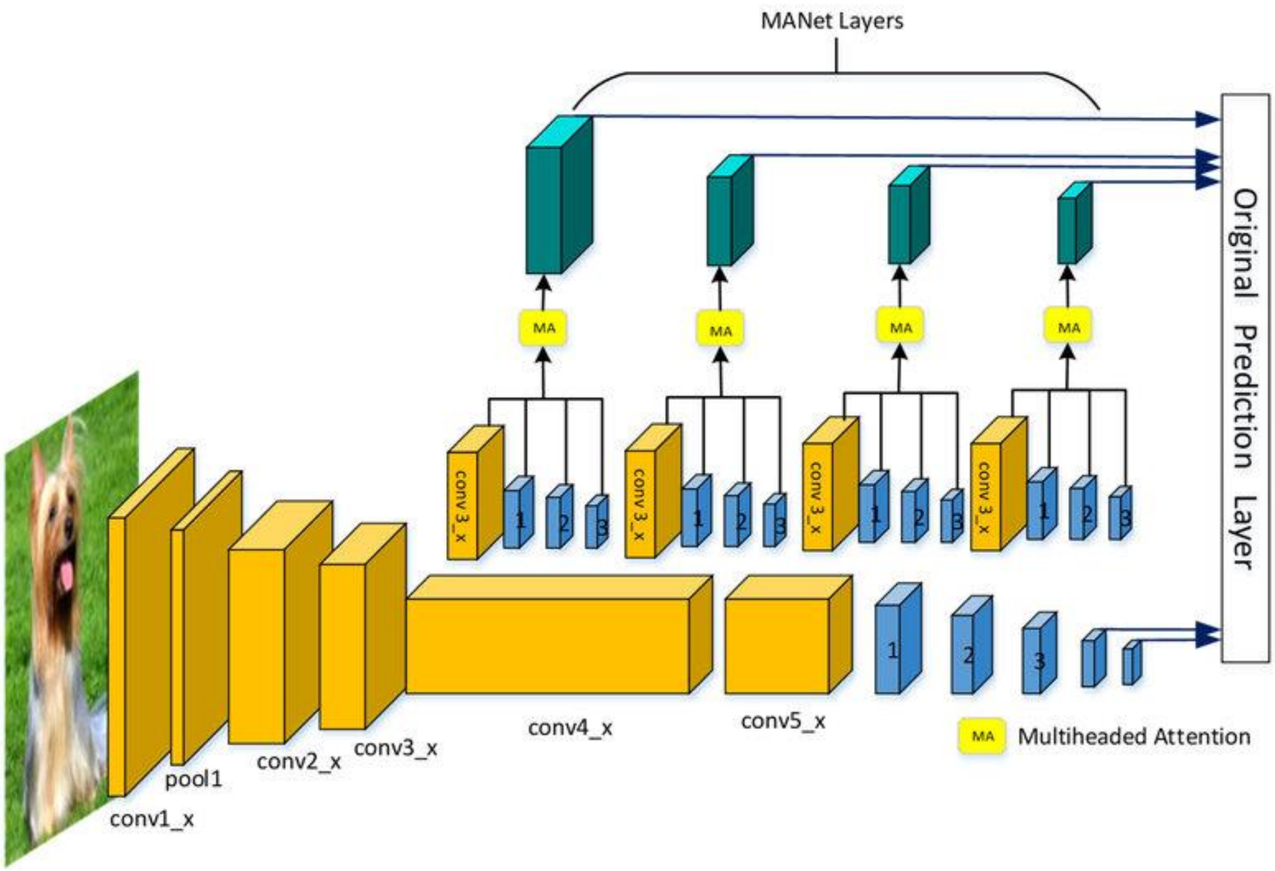


Fig. Single shot MultiBox detector

5. Project Description:

Traffic congestion is becoming a serious problem with a large number of cars on the roads. Vehicles queue length waiting to be processed at the intersection is rising sharply with the increase of the traffic flow, and the traditional traffic lights cannot efficiently schedule it.

ows at the signalized road intersection. This is done by a state-of-the-art, real-time object detection based on a deep Convolutional Neural Networks called You Only Look Once (YOLO). Then traffic signal phases are optimized according to collected data, mainly queue density and waiting time per vehicle, to enable as much as more vehicles to pass safely with minimum waiting time. YOLO can be implemented on embedded controllers using Transfer Learning technique.

YOLO uses a totally different approach. YOLO is a clever convolutional neural network (CNN) for doing object detection in real-time. The algorithm applies a single neural network to the full image, and then divides the image into regions and predicts bounding boxes and technique.

6.Project Implementation:

1.To build a self adaptive traffic control system based on yolo.

2.Disproportionate and diverse traffic in different lanes leads to inefficient utilization of same time slot for each of them characterized by slower speeds, longer trip times, and increased vehicular queuing .

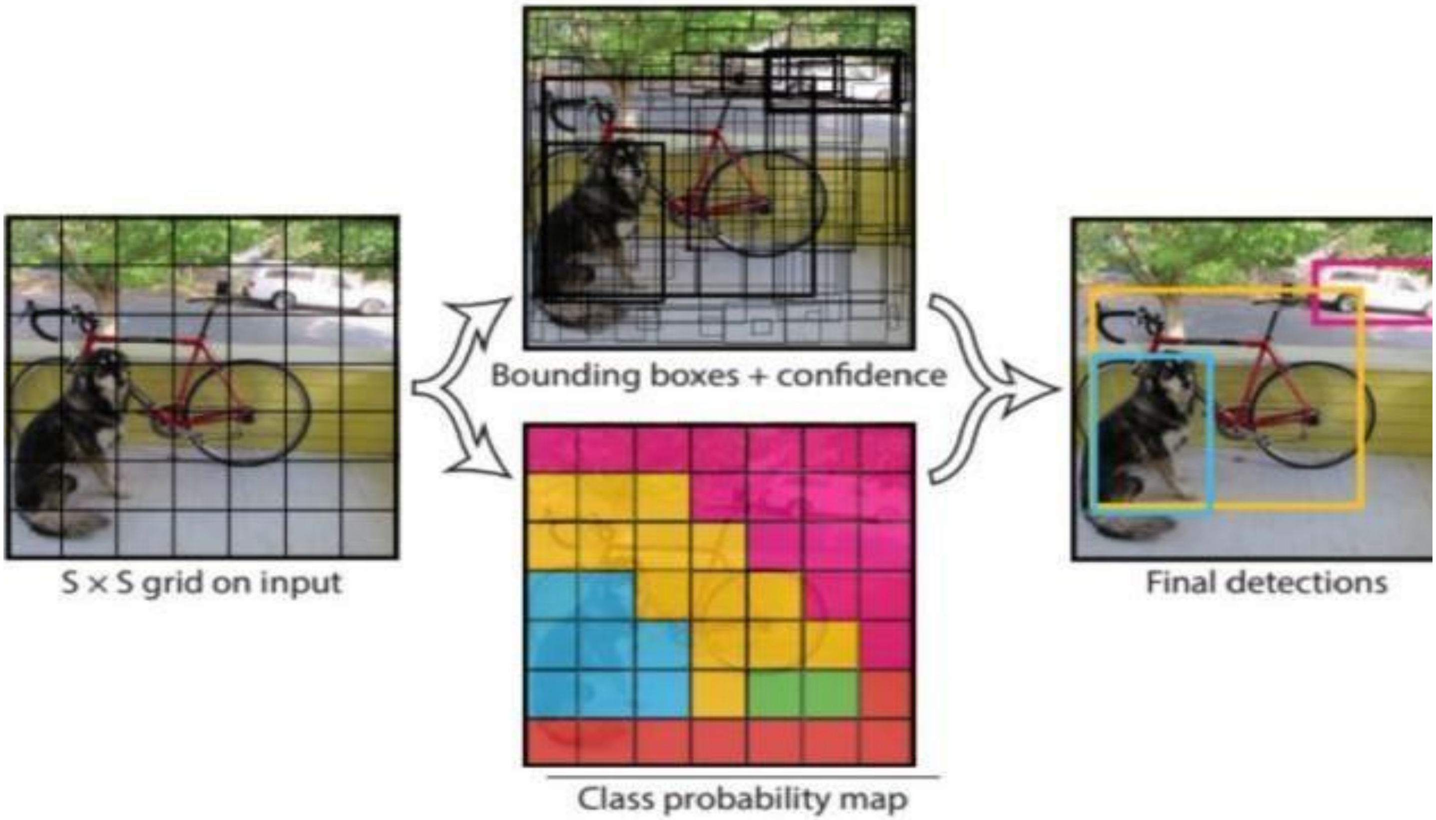
3.To create a system which enable the traffic management system to take time allocation decisions for a particular lane according to the traffic density on other different lanes .

4. Technology :

4.1 YOLO

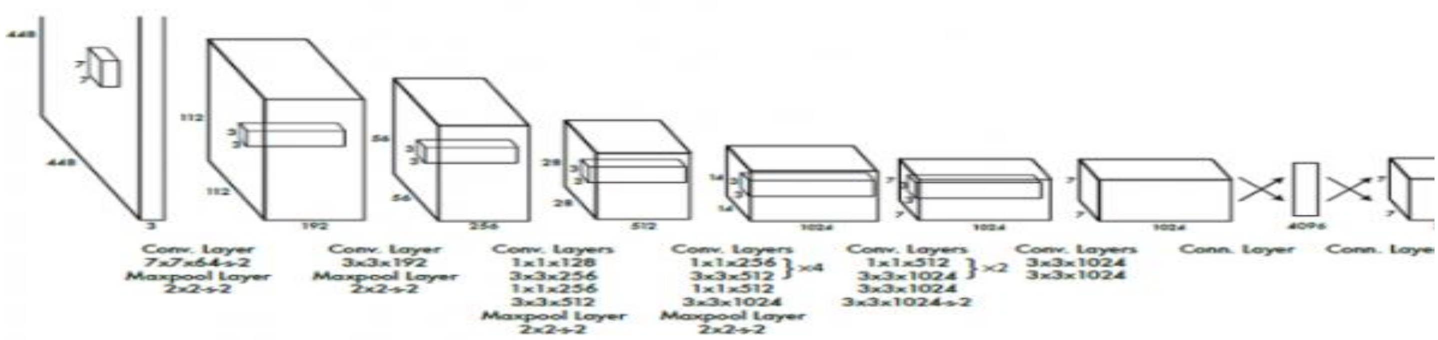
You only look once (YOLO) is a state-of-the-art, real-time object detection systemYOLO, a new approach to object detection. Prior work on object detection repurposes classifiers to perform detection. Instead, we frame object detection as a regression problem to spatially separated bounding boxes and associated class probabilities.

A single neural network predicts bounding boxes and class probabilities directly from full images in one evaluation. Since the whole detection pipeline is a single network, it can be optimized end-to-end directly on detection performance.elp of cameras, image processing modules.



The object detection task consists in determining the location on the image where certain objects are present, as well as classifying those objects. Previous methods for this, like R-CNN and its variations, used a pipeline to perform this task in multiple steps.

This can be slow to run and also hard to optimize, because each individual component must be trained separately. YOLO, does it all with a single neural network.



YoloV3 Car Counter

This is a demo project that uses YoloV3 neural network to count vehicles on a given video. The detection happens every x frames where x can be specified. Other times the dlib library is used for tracking previously detected vehicles.

Furthermore, you can edit confidence detection level, number of frames to count vehicle as detected before removing it from trackable list .

The maximum distance from centroid (see CentroidTracker class), number of frames to skip detection (and only use tracking) and the whether to use the original video size as annotations output or the YoloV3 416x416 size.

YoloV3 model is pretrained and downloaded (Internet connection is required for the download process).

Circuit Diagram:

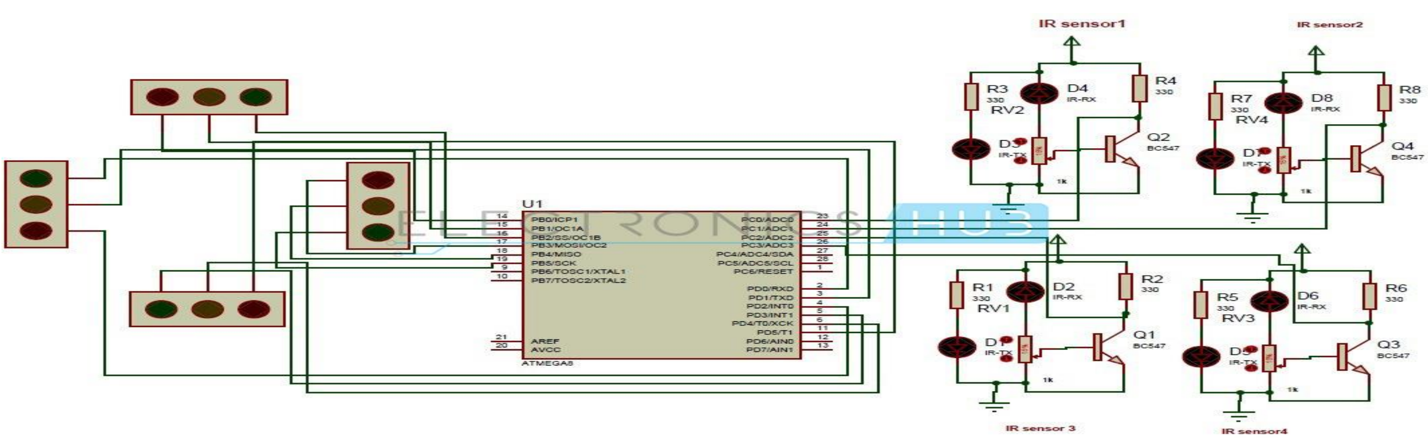
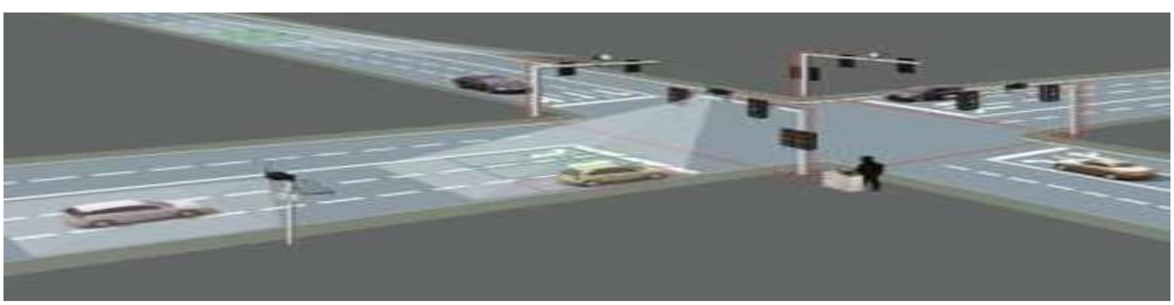


Fig: circuit diagram for traffic management system

6.1 Source Code:

```
f = open("out.txt", "r")

no_of_vehicles=[]

no_of_vehicles.append(int(f.readline()))

no_of_vehicles.append(int(f.readline()))

no_of_vehicles.append(int(f.readline()))

no_of_vehicles.append(int(f.readline()))

baseTimer = 120 # baseTimer = int(input("Enter the base timer value"))

timeLimits = [5, 30] # timeLimits = list(map(int,input("Enter the time limits ").split()))

print("Input no of vehicles : ", *no_of_vehicles)



t = [(i / sum(no_of_vehicles)) * baseTimer if timeLimits[0] < (i / sum(no_of_vehicles)) * baseTimer < timeLimits[1] else min(timeLimits, key=lambda x: abs(x - (i / sum(no_of_vehicles)) * baseTimer)) for i in no_of_vehicles]

print(t, sum(t))
```

Working:



The solution can be explained in four simple steps:

1.Get a real time image of each lane.

2.Scan and determine traffic density.

3.Input this data to the Time Allocation module.

4.The output will be the time slots for each lane, accordingly.

The goal of this work is to improve intelligent transport systems by developing a Self-adaptive algorithm to control road traffic based on deep Learning.

This new system facilitates the movement of cars in intersections, resulting in reducing congestion, less CO2 emissions, etc.

The richness that video data provides highlights the importance of advancing the state-of-the-art in object detection, classi□cation and tracking for real-time applications.

YOLO provides extremely fast inference speed with slight compromise in accuracy, especially at lower resolutions and with smaller objects.

While real-time inference is possible, applications that utilize edge devices still require improvements in either the architecture's design or edge device's hardware.

Final This is done by a state-of-the-art, real-time object detection based on a deep Convolutional Neural Networks called You Only Look Once (YOLO).

Then traffic signal phases are optimized according to collected data, mainly queue density and waiting time per vehicle, to enable as much as more vehicles to pass safely with minimum waiting time.

YOLO can be implemented on embedded controllers using Transfer Learning technique.

lly, we have proposed a new algorithm taking this real-time data from YOLO.

Sequence of operations performed:

1.Camera sends images after regular short intervals to our system.

2.The system determines further the number of cars in the lane and hence computes its relative density with respect to other lanes.

3.Time allotment module takes input (as traffic density) from this system and determines an optimized and efficient time slot.

4.This value is then triggered by the microprocessor to the respective Traffic Lights.

6.2 Sample Output:

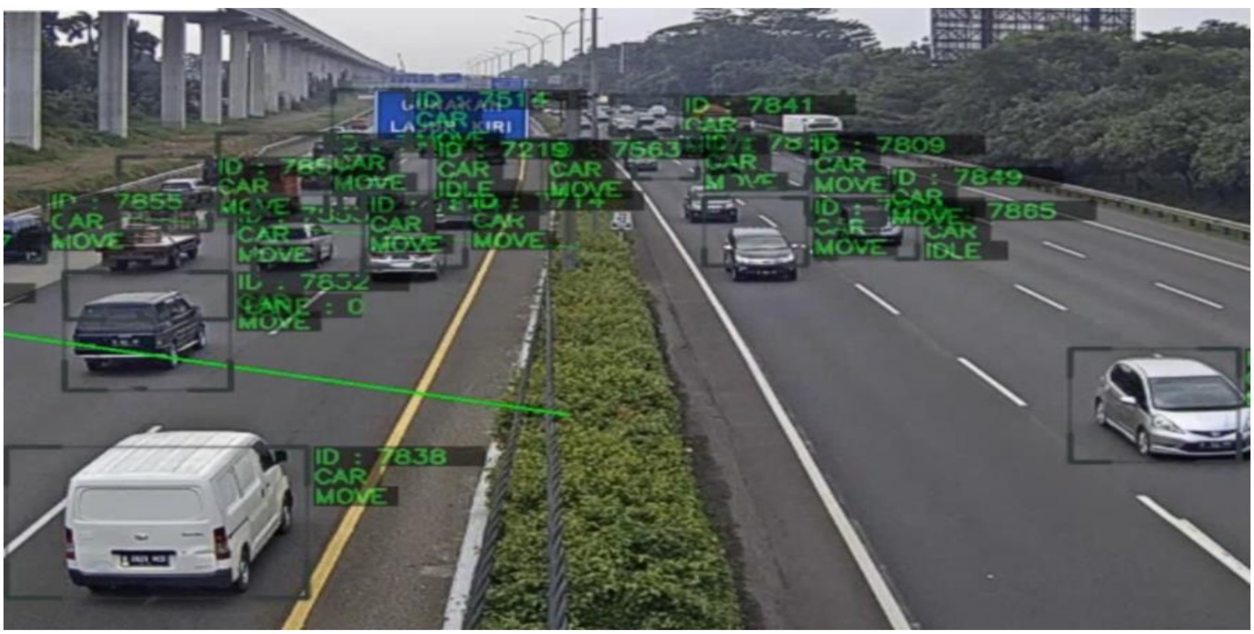


Fig: Object Detection for Traffic Management System

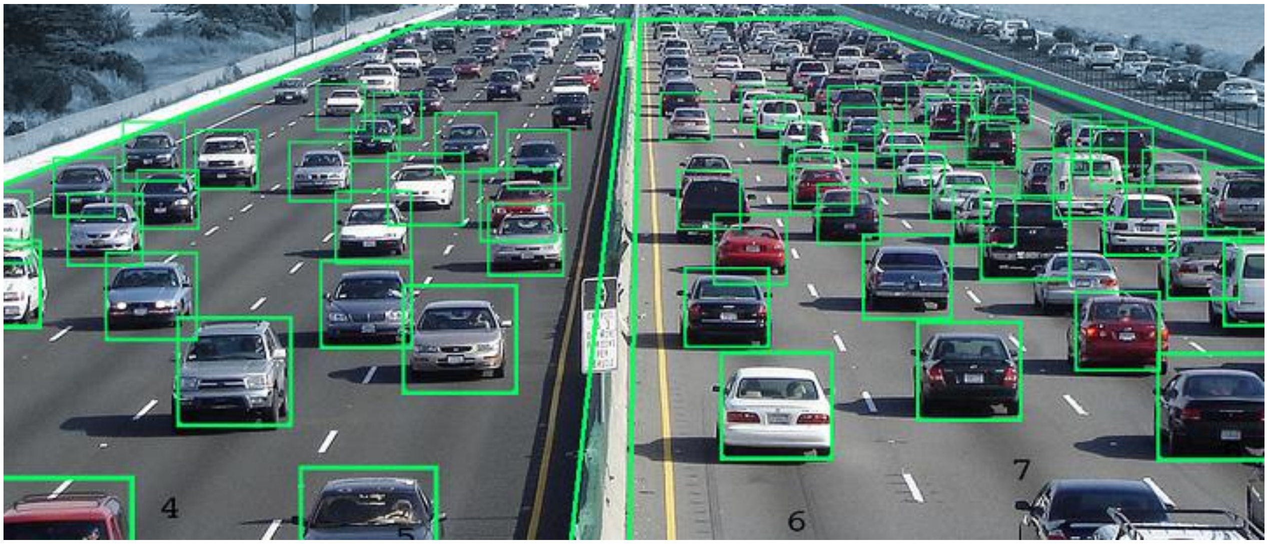


Fig: sample output

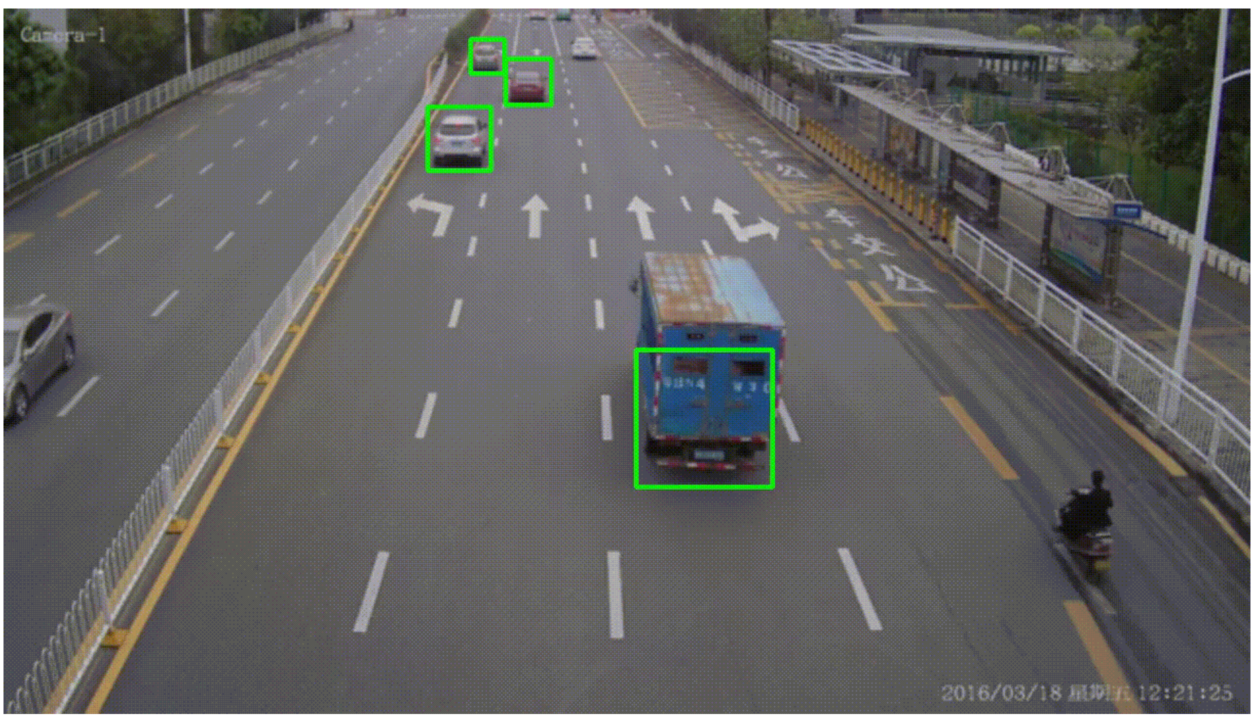


Fig: Object Detection for Traffic Management System

7.Conclusion:

In software implementations, should choose clear and understandable the solutions.

Design a traffic light using the state machine is very difficult compare to design using the logic gates.

Verilog HDL (Hardware Description Language) text editor was chosen to write a program code for simulation only to get a timing diagram. This is because it easy to write and understand compare to other language.

Future Enhancement:

We know that there are critical problems that call for traffic management solutions. Despite the fact that the Netherlands boasts the highest motorway density in the European Union, we still spend about 65 million hours per year in congestion. The economic cost of this congestion is estimated at an amount between 2.5 and 3.4 billion euros each year. Because our road network along key routes is already heavily loaded, each percent increase in traffic flow compounds the problem. Promising Solutions Solutions to improve mobility, accessibility and reliability are therefore necessary and very much desired. Traffic management is obviously not the only approach toward solving congestion and mobility problems (see also the page 9), but it is certainly one of the most important, cost-effective and promising tools in our toolbox. What do we mean by traffic management? Definitions vary slightly, but simply put, we try to influence supply and demand with traffic management, such that the traffic demand and the supply (capacity) of the network better match, along both the dimensions of time and space.

The problems that occur on the road primarily concern specific bottlenecks (points in space) and specific moments in time (peak periods, incidents and special events). The aim is to spread both the traffic demand and the supply of infrastructure (capacity) in order to adapt dynamically and thus make better use of the existing road network. The field of traffic management includes both traffic control and traveler information.

8.Reference:

1. "Traffic Engineering Handbook" by Institute of Transportation Engineers (ITE): This comprehensive handbook covers a wide range of topics in traffic engineering, including traffic flow theory, traffic control devices, traffic signal operations, transportation planning, and safety analysis. It serves as a valuable reference for both practitioners and students.
2. "Transportation Engineering: An Introduction" by C. Jotin Khisty and B. Kent Lall: This book offers a thorough introduction to transportation engineering, covering topics such as transportation planning, traffic flow theory, geometric design of highways, traffic control systems, and transportation economics. It provides a good balance between theory and practice.
3. "Highway Capacity Manual" by Transportation Research Board (TRB): Published by the TRB, this manual is considered a standard reference for highway capacity analysis and level-of-service assessment. It presents methodologies for analyzing and predicting traffic flow, capacity, and congestion on highways. It is particularly useful for understanding traffic operations and planning.
4. "Traffic Engineering: Theory and Practice" by Louis J. Pignataro: This book provides a

comprehensive overview of traffic engineering principles and practices. It covers a wide range of topics, including traffic studies, traffic control devices, traffic signal timing, transportation planning, and traffic safety. It is suitable for both students and professionals.

5. "Introduction to Transportation Engineering" by James H. Banks: This introductory textbook covers various aspects of transportation engineering, including traffic engineering, transportation planning, geometric design of roadways, and transportation systems management. It offers a good blend of theory, application, and case studies.