Real Time Traffic Density Count using Image Processing

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ABSTRACT
Nowadays traffic jams and congestion is a common issue because of the day by day increment of numerous vehicles. A smart traffic control system can be one of the solutions to the above problem. This can be done by measuring the vehicular density on that road wherein real time image and video processing techniques will be used. The main aim is to coordinate the traffic by keeping a check of its density from all the sides and thereby controlling the traffic signal intelligently. This paper will present an algorithm so as to determine the amount of vehicles on that road. This density counting algorithm will work by the comparison between one frame of the live video (real time) and the reference image followed by looking for the vehicles in the desired region. The 0traffic signal will be controlled smartly by comparing the vehicle density and the direction of the traffic.

Keywords
Traffic Density count, Image Processing, Intelligent Controlling of Traffic, Camera, Raspberry Pi, Server.

1. INTRODUCTION
Following point 1.1 will give the introduction about the topic. Managing the traffic dynamically will reduce the traffic congestion. The videos are captured by stationary cameras. Then images from the live videos are retrieved one frame in a second. Image processing is performed over these retrieved frames. The output obtained from the image processing algorithm is the number of vehicles coming from a specific direction. Using this output we apply a real time traffic management algorithm which controls the traffic signal by synchronizing all the neighboring signals and manage the time duration of the signal accordingly.

1.1 Problem Statement
It is necessary to efficiently manage the traffic flow by completely utilizing the existing capacity of the road. Modern Cities are facing a lot of trouble due to the traffic congestion. Increasing population results in subsequent increase in the vehicles causing congestion. Traffic jams and congestion create several issues like wastage of time, excess fuel consumption. Apart from these, it directly affects routine life and sometimes may result in loss of life. E.g. In emergency cases, the ambulance boarding a critical patient cannot reach the destined hospital on time due to the congestion, where every second counts.

2. PROJECT SCOPE
2.1 Aim
To suggest a smart traffic controller system to decrease the number of traffic-jam, vacating the road which has more density of vehicles by synchronizing the traffic signals. Managing the traffic dynamically will reduce the traffic congestion

2.2 Objectives
The main goal is to reduce the potential jams, which are due to the traffic lights by vacating the road which has more number of vehicles, to a certain extent. Through which there will be less number of vehicles in waiting state and can reduce time consuming. And it will help clear the path for the emergency vehicles (fire brigade, ambulance, VIP person's vehicles, etc.,) if any.

3. LITERATURE SURVEY

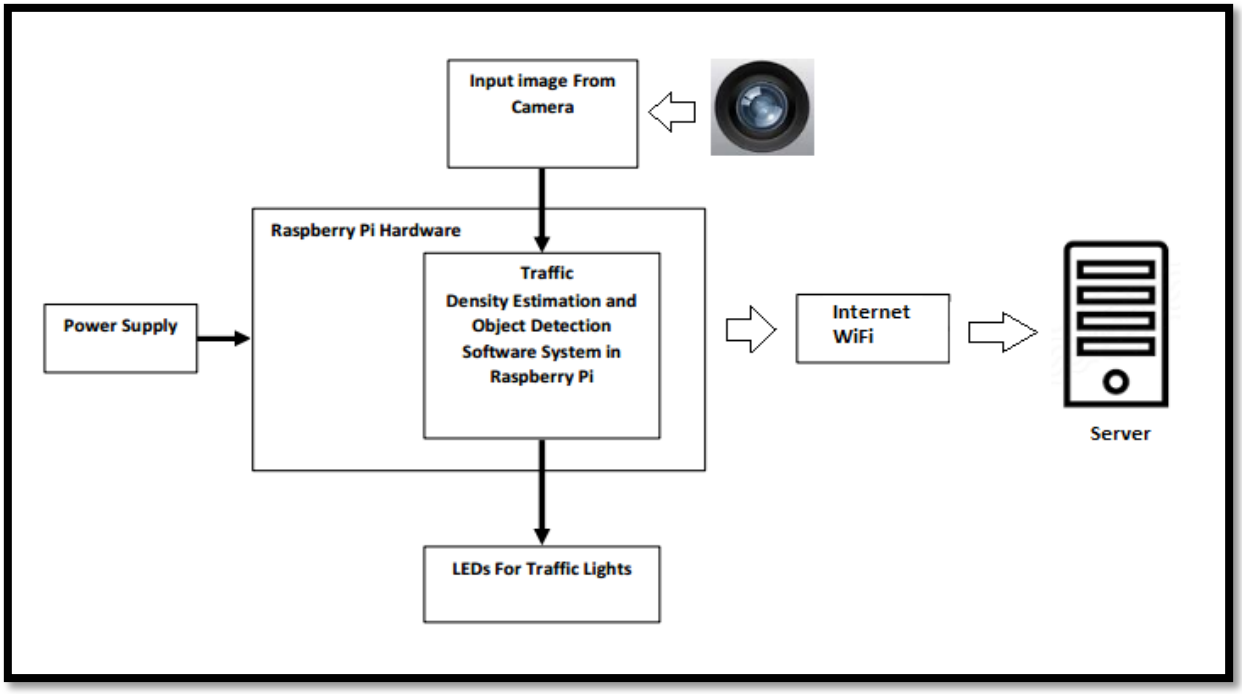
Table 1: Detail Literature Survey

NAME OF THE PAPER	DESCRIPTION
Robust and Adaptive Traffic Surveillance System for Urban Intersections on Embedded Platform	The paper presents a real time traffic monitoring system that makes use of image processing algorithm to detect and estimate the of count of vehicles using motion detection approach.
Real-Time Integrated CCTV Using Face and Pedestrian Detection Image Processing Algorithm For Automatic Traffic Light Transitions	Integration of face detection and pedestrian. When pedestrians are detected, it adds extra seconds to the red light and the signal changes back to normal after sometime.
Review of the Closed Circuit Television (CCTV) Techniques for Vehicular Traffic Management	CCTV's can lessen the traffic problems.By treating video images having parameters of traffic, desired information is noted, such as traffic composition , speed , shapes and types of vehicles, breaking of traffic rules or accidents.
An Algorithm for Full Coverage and Real Time Traffic Density Calculation on Roads	An algorithm is proposed that will increase the coverage area to the entire road. It will also assess the incoming and outgoing traffic.
Recognition of Car Makes and Models From a Single Traffic-Camera Image	This paper reecognises car models from a single image captured by a camera. Due to various configurations of traffic cameras, a traffic image may be captured in different viewpoints and lighting conditions, and the image quality varies in resolution and color depth.
Speed Detection Camera System using Image Processing Techniques on Video Streams	A Speed Detection Camera System (SDCS) is applicable as a radar alternative. SDCS uses several image processing techniques on video stream in online -captured from single camera. It uses a hybrid algorithm based on combining an adaptive background subtraction technique with a three-frame differencing algorithm.
Adaptive Traffic Control System Using Raspberry Pi	Implement an artificial density traffic control system using image processing and Raspberry Pi.

4. SYSTEM DESIGN

4.1 System Architecture

System Architecture is shown below in Figure 1



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4.2 Main modules

4.2.1 Camera

The camera will be located near the traffic lights. It will capture videos of the traffic coming from a particular

direction. It will be located on an angle so that it can capture maximum number of vehicles. The camera will send the captured video to the Raspberry Pi board.

4.2.2 Raspberry Pi Board

Raspberry Pi is a credit card sized computer. It will hold the camera driver. The videos which are captured by the camera will be processed here. Images will be extracted one frame per second from the live video. An image processing algorithm will be enforced on the extracted frames. The number of objects seen in the image will be counted and it will be taken as input. A dynamic traffic management algorithm will be performed which will synchronize the traffic signals. The Raspberry Pi board will update this information on the server.

4.2.3 Server

The server acts as a central storage area for all the data. It collects the data generated. It will synchronize all the neighboring signals which will be helpful for later analysis

5. ANALYSIS MODELS

5.1 Data Flow diagram

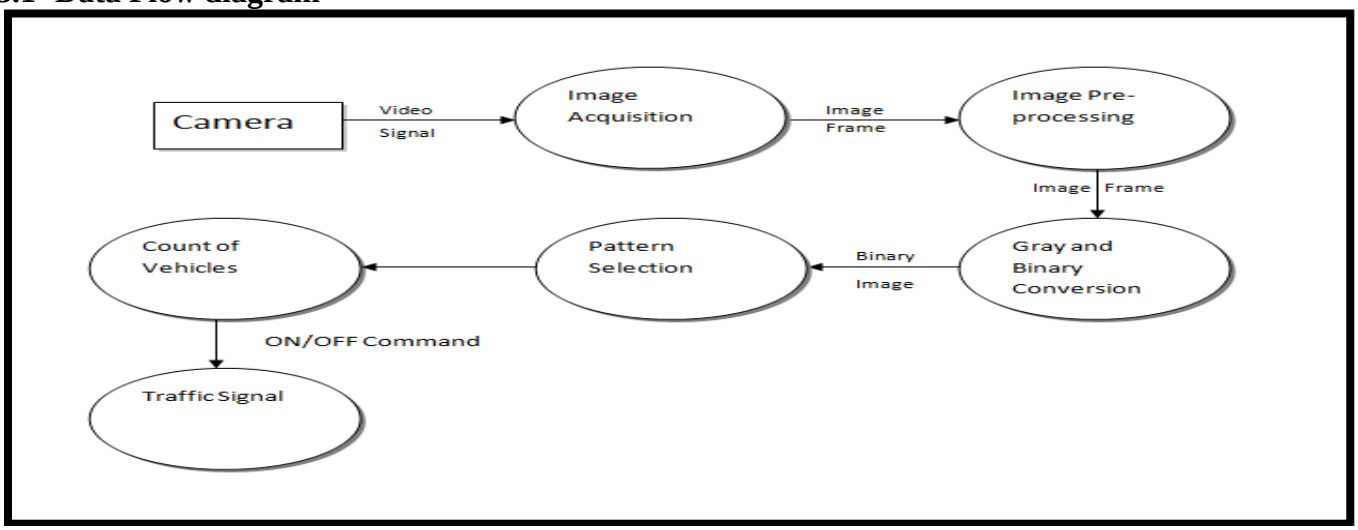

Fig 2: Data Flow Diagram.

5.2 Sequence Diagram

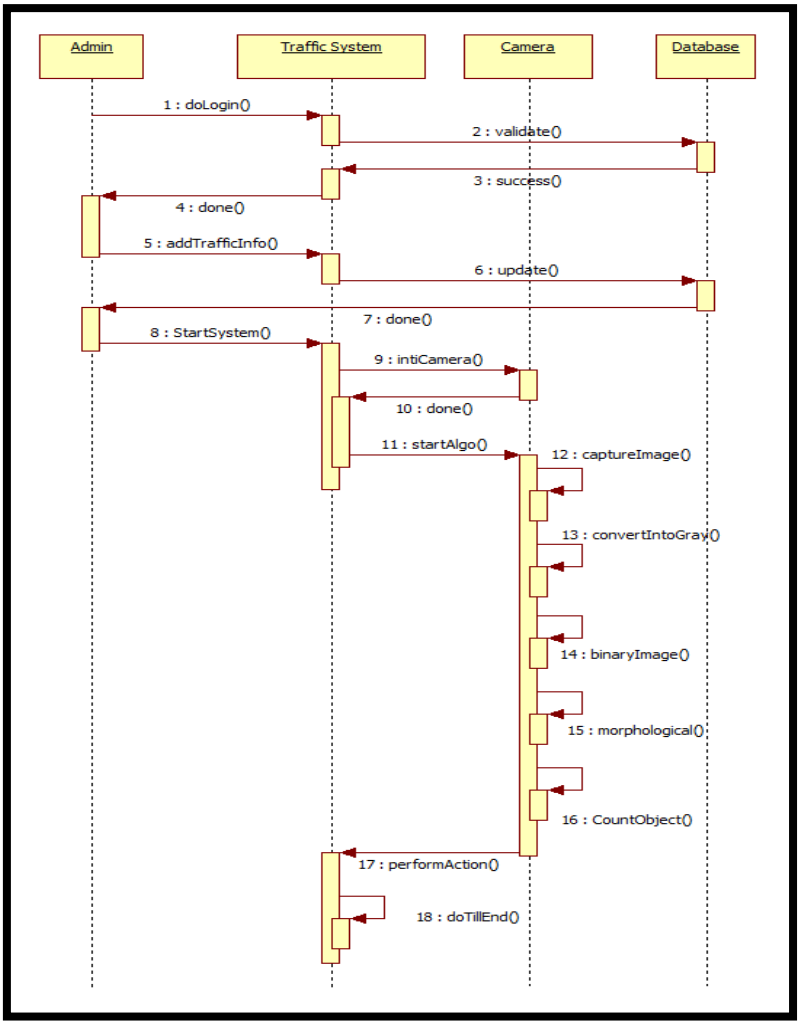

Fig 3: Sequence Diagram.

5.3 Use Case Diagram

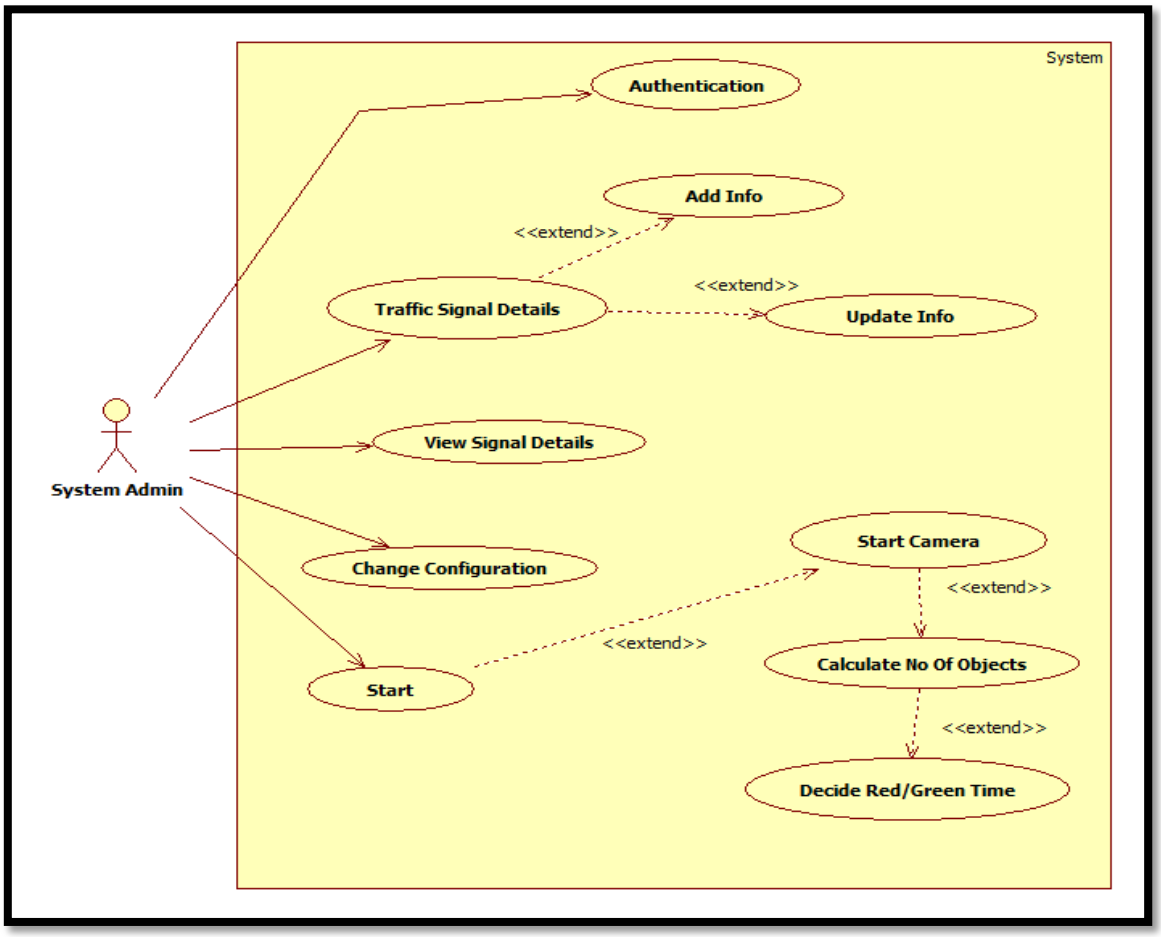

Fig 4: Use Case Diagram

5.4 E-R Diagram

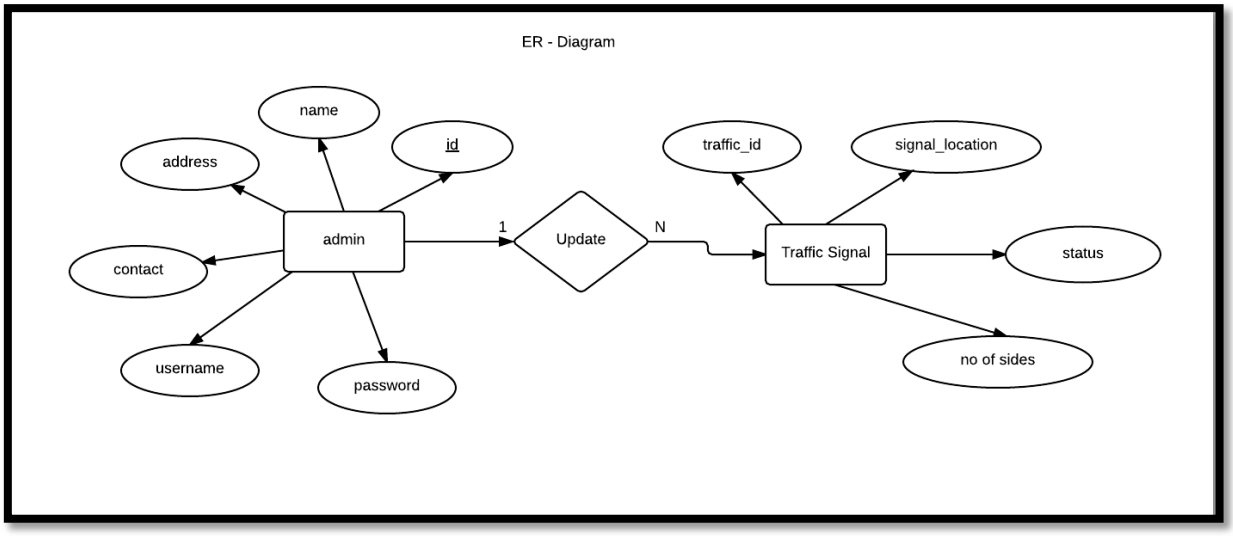

Fig 5: E-R Diagram

6. MATHEMATICAL MODEL

- 1. Set Theory Analysis
  - 1. Let S be the New Traffic Light

System using Image Processing.

- Set S is divided into 6 modules
- S= S1, S2, S3, S4, S5, S6
- S1= GUI Handler (GH)
- S2= Image Pre-processor (IP)
- S3= Gray Scale Convertor (GSC)
- S4= Image Binarization (IB)
- S6= Traffic Light System (TLS)

- 2. Identify the inputs.
    - Inputs = X1, X2, X3
    - X1= Input Images
    - X2= Object Count
    - X3= Image Pre-processing
- 3. Identify the output as O.
    - Outputs= Y1, Y2, Y3
    - Y1= Object Count
    - Y2= Traffic density
    - Y3= Traffic light On/Off

7. CONCLUSION

The terrific growth in the number of vehicles has led to traffic jams. The method used above of detecting the density of vehicles and processing the duration of the traffic signal, can be used for controlling the traffic, avoiding traffic congestion, accidents, etc.

Using this method at each crossway could help in a continuous journey of the people. Also, the signals will be monitored and the status of the traffic signal will be updated at the server. This will help in future reference.

Now as we are only monitoring the number of vehicles present at the signal, we can also use this method to monitor the number plate (registration no.) of the vehicle to detect the vehicles which disobey the traffic laws. We can also monitor the traffic at night since no patrol team would be required and the vehicles can run smoothly.

8. REFERENCES

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