International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) ISSN 2394-3777 (Print)
Vol. 5, Issue 01, January 2018 ISSN 2394-3785 (Online)

Intelligent Traffic Control System based on Artificial Intelligence

ALOK KUMAR[1]
Assistant Professor
Department of Computer Science and Engineering
Government College of Engineering, Dharmapuri
abesalok@gmail.com

K PRAKASH[2]
Assistant Professor
Department of Computer Science and Engineering
Government College of Engineering, Thanjavur
prakashgreen@gmail.com

ABSTRACT

Nowadays vehicles are increasing daily traffic. Since we are using fixed timing in the traffic control system, many people are wasting their time and fuel at the traffic signal, some road has many vehicles, and some remain ideal. So we have developed an intelligent traffic control system based on real-time traffic density on the road. We apply the background subtraction algorithm presented in openCV to count the number of vehicles in the lane by subtracting the background from the video frame. As a result, traffic signal time will be adjusted depending on the vehicle count. We also give first preference to emergency vehicles; when any emergency vehicle arrives, the signal turns green using an RFID reader and RFID tag.

Keywords: OpenCV, background subtraction, RFID, Erosion and Dilation

I. Introduction

In a developed city, an increase in daily traffic is standard, now a day it may cause traffic congestion and traffic jam. To avoid this sophisticated condition, traffic signals are introduced, but all signals have standard and predefine fixed signal timing for all roads, so people face many troubles in that case. For example, if an ambulance or fire vehicle arrives to signal in any critical situation, if there is heavy traffic, or if many vehicles are waiting for a green signal, human life will be at risk. Sometimes there will be a green signal for an ideal road. Simultaneously, the vehicle in the busy lane wants to wait for a green signal. Many innovative traffic systems designed to rectify this condition using some sensors. Our main aim is to adjust the signal timing depending on the density of the road and give first preference to the emergency vehicle when they arrive. By using raspberry pi, this system design will be a compact one. In this, a camera module is connected to the raspberry pi board though, and a live video stream of the road will be captured and sent to the raspberry pi; the video frame will be processed thereby frame by frame and find the density of the road, and also the number of vehicle count will be sent to the traffic signal system to increase or to decrease the time delay of the signal. Using this system makes vehicles no longer need to waste their time at traffic signals. The signal timing is adjusted depending upon the count of the vehicle; we include an RFID tag for the emergency vehicle; when they enter that particular region, the RFID placed near the signal will detect the tag, and it automatically changes the signal to green.

The paper is organized as follows: section II explains the system overview, explains the Design Components of the system, and Finally, Section III gives the conclusion and future scope of the project

II. System Overview

This section deals with the components we used and how they are connected between them. First, the camera module is connected to the raspberry pi board to get the live video stream, then the video is processed and gets the vehicle count and sent to the signal system to adjust the timing, and the RFID reader is connected to the GPIO pin in raspberry pi it will send the signal to switch on the green signal when it read the RFID tag.

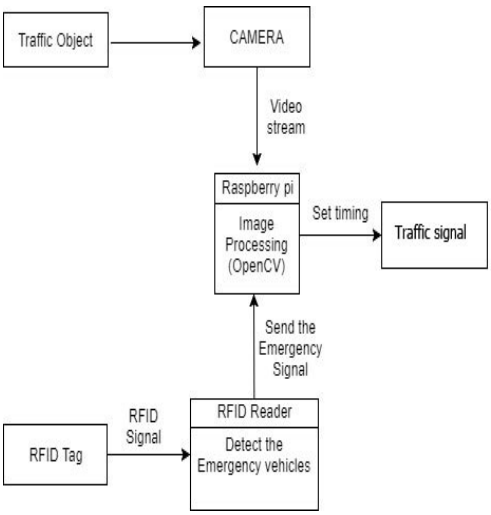

Figure 1: System Architecture

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET) ISSN 2394-3777 (Print)
Vol. 5, Issue 01, January 2018 ISSN 2394-3785 (Online)

Design Components

The proposed system is to deals with the existing system and has predefined signal timing, and some have used the sensor we proposed with the live time image processing to count the vehicle, and depending upon the count, the signal wants to be adjusted, either increase or decrease the timing and give first preference to an emergency vehicle.

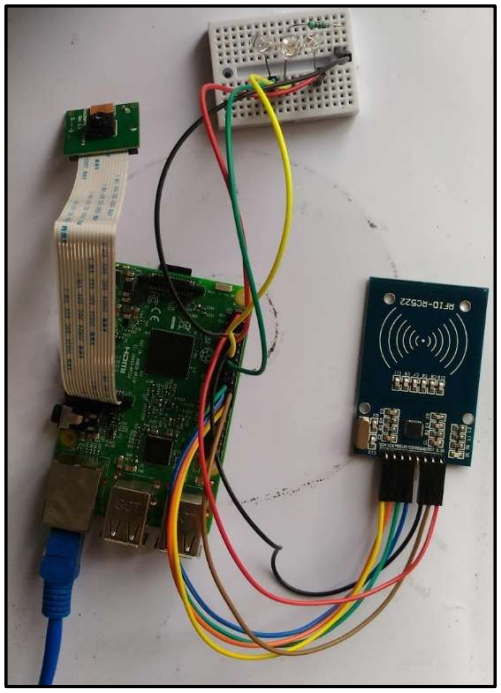

Figure 2: Hardware setup

The proposed system distinctly consists of four units:

1) Live video streaming.
2) Background Subtraction.
3) Erosion and Dilation.
4) RFID tag & reader

1) Live video streaming

We have used raspberry pi3 model B, a tiny computer with more specifications like quad-core 64-bit ARM cortex A53 clocked at 1.2 GHz. Compared to the pi 2, the RAM remains the same- 1 G.B. of LPDDR2-900 SDRAM, and the graphics capabilities provided by the video-core IV GPU are the same as ever. As the leaked FCC docs will tell you, the pi3 now includes onboard 802.11n Wi-Fi and Bluetooth 4.0. Wi-Fi, wireless keyboards, and wireless mice now work out of the box, and there are four output ports: one for display HDMA port, the second for Audio jack, the third for USB, and finally for 40 GPIO(general purpose for input and output) pins.

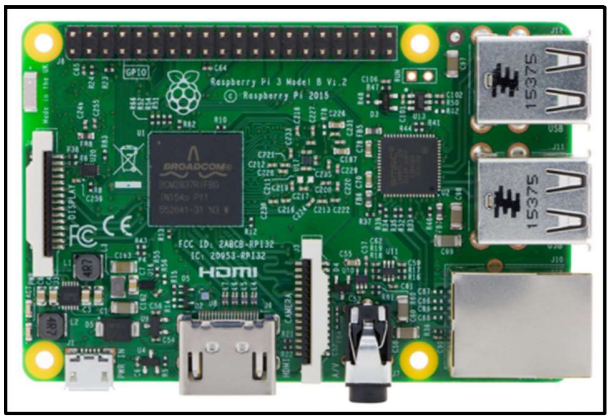

Figure 3: Raspberry Pi3 Model B

This board has an S.D. card slot for the bootable S.D. card loaded with Raspbian O.S.

Pi camera

The raspberry pi has a ribbon cable camera slot in the Pi camera installed and enables the camera module using sudo raspi-config.

Features

5MB sensor, wider image, capable of 2592x1944 stills, 1080p30 video, and 1080p video supported, CSI, Size: 25 x 20 x 9 mm. The camera comprises a small (25mm by 20mm by 9mm) circuit board connecting to the Raspberry Pi's Camera Serial Interface (CSI) bus connector via a flexible ribbon cable. The camera's image sensor has a fixed focus, a native resolution of five megapixels, and a lens Pi camera module can take high-definition video streams; using this camera module, we can take live streaming of the traffic object.

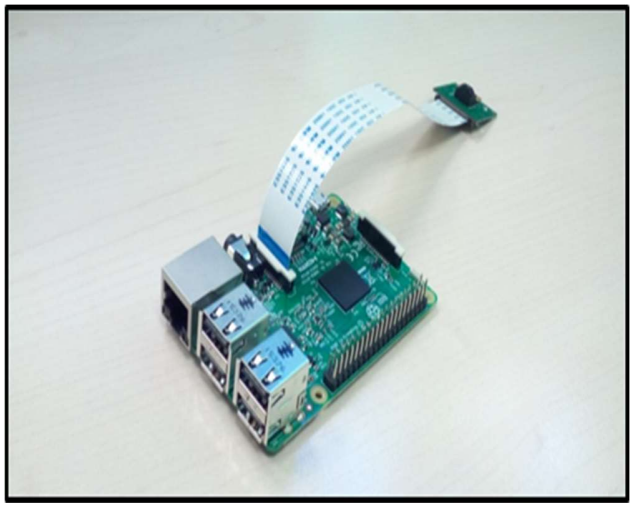

Figure 4: Pi camera

2) Background Subtraction

Background subtraction is an algorithm in openCV (open computer vision), mainly aimed at real-time computer vision and an open source containing many library files. In the early days of OpenCV, the goals of the project were described as:

- Advance vision research by providing open and optimized code for basic vision infrastructure. No more reinventing the wheel.
- Disseminate vision knowledge by providing a shared infrastructure that developers could build on, making code more readily readable and transferable.
- Advance vision-based commercial applications by making portable, performance-optimized code available for free – with a license that does not require code to be open or accessible.

[2] proposed a system about Efficient Sensor Network for Vehicle Security. Today vehicle theft rate is very high, greater challenges are coming from thieves thus tracking/ alarming systems are being deployed with an increasingly popularity .As per as security is concerned today most of the vehicles are running on the LPG so it is necessary to monitor any leakage or level of LPG in order to provide safety to passenger. Also in this fast running world everybody is in hurry so it is required to provide fully automated maintenance system to make the journey of the passenger safe, comfortable and economical. To make the system more intelligent and advanced it is required to introduce some important developments that can help to promote not only the luxurious but also safety drive to the owner. The system "Efficient Sensor Network for Vehicle Security", introduces a new trend in automobile industry.

Background subtraction (B.S.) is a common and widely used technique for generating a foreground mask (a binary image containing the pixels belonging to moving objects in the scene) using static cameras. [5] discussed about Intelligent Sensor Network for Vehicle Maintenance System. Modern automobiles are no longer mere mechanical devices; they are pervasively monitored through various sensor networks & using integrated circuits and microprocessor based design and control techniques while this transformation has driven major advancements in efficiency and safety. In the existing system the stress was given on the safety of the vehicle, modification in the physical structure of the vehicle but the proposed system introduces essential concept in the field of automobile industry. It is an interfacing of the advanced technologies like Embedded Systems and the Automobile world..

Background Modeling consists of two main steps

1. Background Initialization
2. Background Update

In this first step, the initial model of the background is computed, while in the second step, that model is updated to adapt to possible changes in the scene.

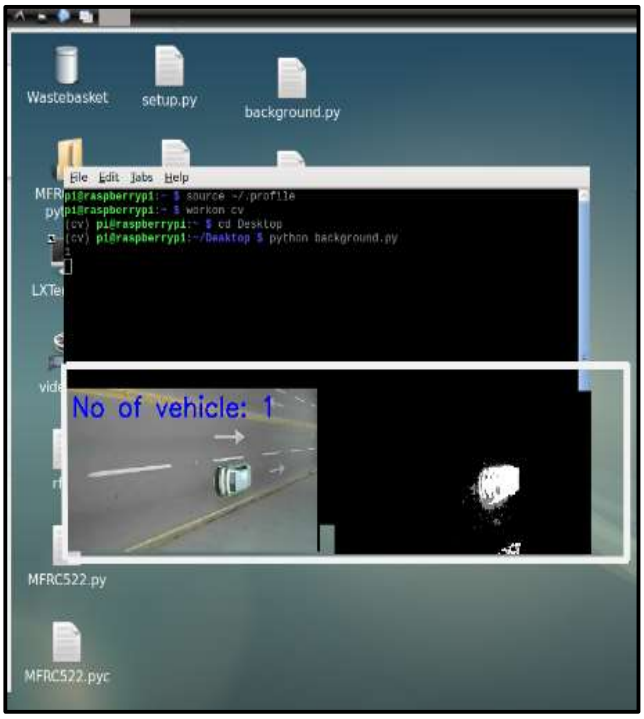

Figure 5: Background Subtraction and counting the number of vehicles

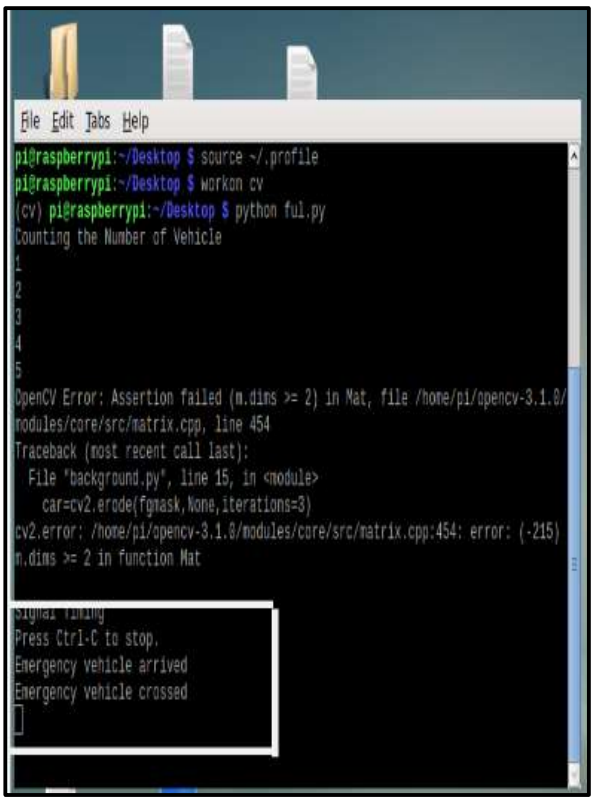

Figure 6: Detecting the emergency vehicle when it arrives

Figure 7: Depending upon the vehicle count Signal timing is adjusted

3) Erosion and Dilation

Erosion and Dilation are two standard operations that come under morphology operation; it applies a structuring element to an input image and generates an output image. These techniques will remove the noise. Isolation of individual elements and joining disparate elements in an image. In Dilation, the pixel element original image is one if at least one pixel under the kernel is one. Erosion operation is the sister of Dilation; erosion gets thinner the object in that image. In this operation, when the pixel element in the original image is '1' if at least one pixel under the kernel is '1'. It increases the white region in the image or the size of the foreground object. In cases like noise removal, erosion is followed by Dilation. Because erosion removes white noises, it also shrinks our objects. So we dilate it. Since the noise is gone, they will not come back, but our object area increases. The erosion operator takes two pieces of data as inputs. The first is the image which is to be eroded. The second is a (usually small) set of coordinate points known as a structuring element (also known as a kernel). It is this structuring element that determines the precise effect of the erosion on the input image. Using erosion and Dilation will remove the slight unwanted noise from the video stream other than a vehicle like a human. The objects that come in this operation will not take for the count.

4) RFID tag & reader:

It stands for Radio- frequency identification, which uses electromagnetic fields to identify and track tags attached to objects automatically. The tags contain electronically stored information. Two-way radio transmitter-receivers called interrogators or readers send a signal to the tag and read its response. Signaling between the reader and the tag is done in several different incompatible ways, depending on the frequency band used by the tag. In our work, we use RFID to give first preferences for emergency vehicles; when they arrive near the signal, they automatically turn on to the green signal until the vehicle crosses the lane. RFID tag will be kept in the vehicle; when the RFID reader reads it, the emergency alert will send to the traffic signal to change the signal light to green.

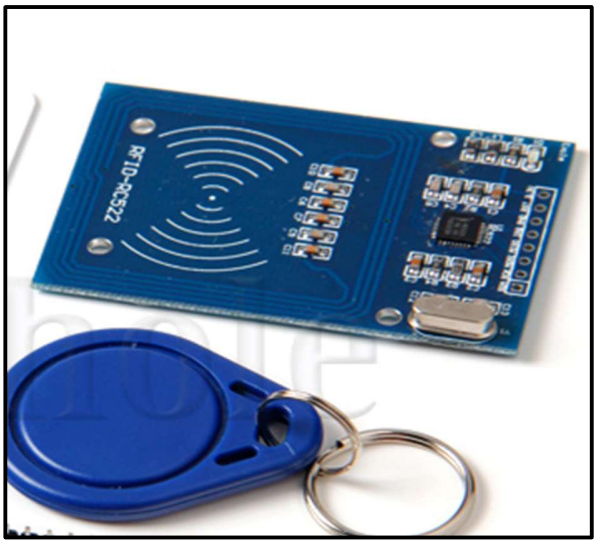

Figure 8: RFID tag & reader

III. Conclusion & Future Scope:

Traffic congestion is the most common issue faced on Indian roads. We developed an intelligent traffic control system to set the traffic signal timing depending on real-time traffic density of the road using image processing (openCV); signal time will be adjusted either increase or decrease depending upon the vehicle count the RFID is used to switch on the green signal when the emergency vehicle comes near to the traffic signal.

In future work, this live video stream will be updated to the cloud storage using a mobile application; one can get the traffic information. By knowing this status, we can avoid traffic and select the better route to reach our destination.

References:

[1] Sabya sanchi kanojia, "Real –time Traffic light control and Congestion avoidance system", International Journal of Engineering Research and Applications (IJERA), pp.925-929, Vol. 2, Issue 2,Mar-Apr 2015.

[2] Christo Ananth, I.Uma Sankari, A.Vidhya, M.Vickneshwari, P.Karthiga, “Efficient Sensor Network for Vehicle Security”, International Journal of Advanced Scientific and Technical Research (IJST), Volume 2, Issue 4, March-April 2014,pp – 871-877.

[3] Celil Ozkurt, et al. Automatic Traffic Density Estimation And Vehicle Classification For Traffic Surveillance Systems Using Neural Networks. Mathematical and Computational Applications, Vol. 14, No. 3, pp. 187- 196, 2012.

[4] Wisnu Jatmiko, et.al," Detection and Counting of Vehicles Based on Video Processing In Distributed Traffic System", International Conference on Advance Computer Science and Information System 2010.

[5]Christo Ananth, C.Sudalai@UtchiMahali, N.Ebenesar Jebadurai, S.Sankari@Saranya, T.Archana, “Intelligent sensor Network for Vehicle Maintenance system”, International Journal of Emerging Trends in Engineering and Development (IJETED), Vol.3, Issue 4, May 2014, pp-361-369.

[6] LIST G.F., CETIN M.: 'Modeling traffic signal control using Petri nets', IEEE Trans. Intelligent Transport. Syst., 2004, 5, pp. 177–187

[7] Elisabeth ILIE-ZUDOR "The RFID Technology and Its Current Applications", MITIP 2006, ISBN 963 86586 5 7, pp.29-36.

[8] Pratishtha Gupta, G.N Purohit, Sweta Pandey, "Traffic Load Computation for Real Time Traffic Signal Control", (IEEE), Vol. 2, Issue 4, April 2013.

[9] Vikramaditya Dangi, Amol Parab, Kshitij Pawar & S.S Rathod, "Image Processing Based Intelligent Traffic Controller", (IEEE), Vol.1, Issue 1, 2012.

[10] O. K. Tonguz, and M. Ferreira, "Performance Limits of In-Vehicle Traffic Lights During Rush Hour Traffic," (IEEE) , September 2014