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Traffic Density Analysis Using Raspberry Pi and OpenCV

[1]Kotoju Rajitha, [2]Komatireddy Abhishek Reddy

[1]Asst Professor, [2]UG Scholar

[1]Departement of Computer Science and Engineering,

[1]Mahatma Gandhi Institute of Technology, Hyderabad, India

Abstract

This project is designed to develop a density based dynamic traffic signal system. The signal timing changes automatically on sensing the traffic density at the junction. Traffic congestion is a severe problem in many major cities across the world and it has become a nightmare for the commuters in these cities. Conventional traffic light system is based on fixed time concept allotted to each side of the junction which cannot be varied as per varying traffic density. Junction timings allotted are fixed. Sometimes higher traffic density at one side of the junction demands longer green time as compared to standard allotted time. The image captured in the traffic signal will be processed and converted into gray scale image then its threshold is calculated based on which the contour has been drawn in order to calculate the number of vehicles present in the image. After calculating the number of vehicles, we will come to know in which side the density is high based on which signals will be allotted for a particular side. Raspberry pi will be used as a microcontroller which provides the signal timing based on trafficdensity.

KEYWORDS:RASPBERRYPI,TRAFFIC DENSITY, CAMERA

1.INTRODUCTION:

1.2.PROBLEMDEFINITION

Traffic congestion is a relentless problem in many cities around the world. Congestion means a lost worker productivity, trade opportunities, delivery delays. Traffic lights which are of current technology use manual operating system for the time allocation and also require high maintenance during the operation. This makes more and more time lapsing and increase in the vehicular traffic. The proposed system results in making the traffic less and allow the vehicles based upon the density on the road. The aim of this project is to reduce the traffic in areas where there is a heavy density of vehicles by implementing Raspberry pi operation along with image processing.

1.3EXISTINGSYSTEM

In existing system, the traffic control is not according to the density, and does not reduce the effect of traffic in urban areas. The traffic signals allotted are fixed for some specific time and after a specified time the signal will be changed to another signal. This causes a delay of traffic on other sides of the road for a longer time and in some places, traffic lights also do not work properly which causes a traffic congestion. The traffic lights used in India are basically pre-timed wherein the time of each lane to have a green signal is fixed. In a four lane traffic signal one lane is given a green signal at atime.
Thus, the traffic light allows the vehicles of all lanes to pass in a sequence. So, the traffic can advance in either straight direction or turn by 90 degrees as shown in Fig.1. So even if the trafficdensity in a particular lane is the least, it has to wait unnecessarily for a long time and when it gets the green signal it unnecessarily makes other lanes wait for even longer durations.

1.3.PROPOSEDSYSTEM

In the proposed system by using the image processing along with the raspberry pi, the vehicle count is measured and accordingly the traffic will be reduced. According to the traffic densities on all roads, this system will smartly allocate the time period of green light for each road. We choose image processing for calculation of traffic density as cameras are very much cheaper than other devices such as sensors. In the proposed model, we will be using a Raspberry Pi that will be connected to 4

1.4 FLOW CHART

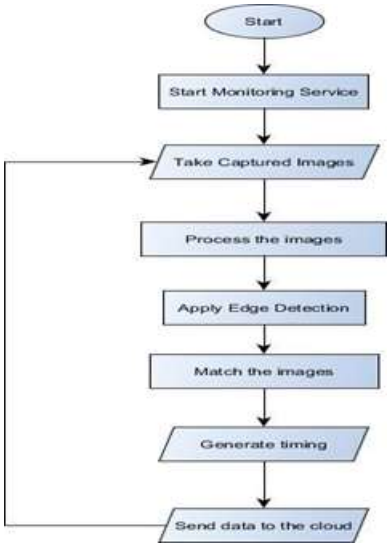

Fig 1.4 flow chart

sets of LEDs that represent the traffic lights. Using the image processing, we can monitor the traffic density of each side and signal can be changed accordingly based on the density of traffic. In this system we are going to implement crowd based traffic light signal,lane will be get open on the basis of crowd at the desired lane. It is identified by the capturing the vehicle crowd images in the lane and identifying the number of vehicles in that desired lane.Proposed solution-Flowchart is shown below

2. LITERATURE SURVEY:

Junchen Jinand Xiaoliang Maetal. (2017)[1] ,it proposes a group-based signal control approach capable of making decisions based on its understanding of traffic conditions at the intersection level. The control problem is formulated using a framework of stochastic optimal control for multi-agent system in which each signal group is model ledasan intelligent agent. The proposed system is designated to be compatible with the prevailing signal system. The parameters were off-line optimized using a genetic algorithm.Simulation results shown that the proposed adaptive group-based control system out performs the optimized control system mainly because of that'sreal-time adaptive learning capacity in response to the changes in traffic demand.

PavanKumar,Dr.M.Kamalakumaraetal.(2016)[2],studied adaptive traffic control systems with VANET, focused on reliable traffic prediction approaches and various types of adaptive traffic control algorithms also proposed a mobile crowd sensing technology to support dynamic route choices for drivers to avoid congestion. Suggested crowd sourcing can be one of the best options for Adaptive traffic control system for Ind

IshantSharma,Dr.PardeepK.Guptaetal.(2015)[3], it propose store place existing traffic signals with a system that monitor the traffic flow automatically in traffic signal and sensors are fixed in the system so the time feed is made dynamic and by processing the live detection

3. BLOCKDIAGRAM:

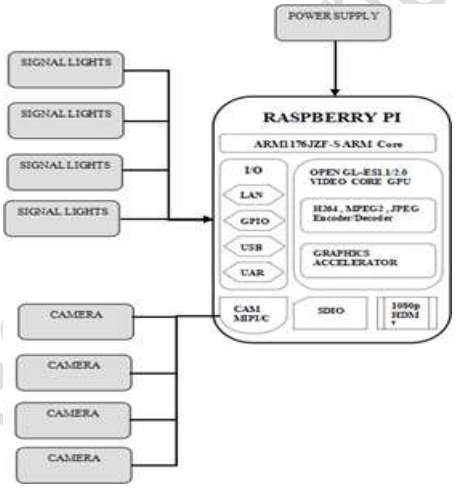

fig 3.1 Block diagram

3.1 BLOCK DIAGRAMDESCRIPTION

Four cameras are connected with raspberrypi for every direction, Lights in each signal are connectedto GPIO pins of Raspberrypi. The power supply shouldbe given to raspberrypi for the Signal light can be given using external power supply using relayswitches (Herewe areusingLED'sassignallights

3.2CIRCUITDIAGRAM

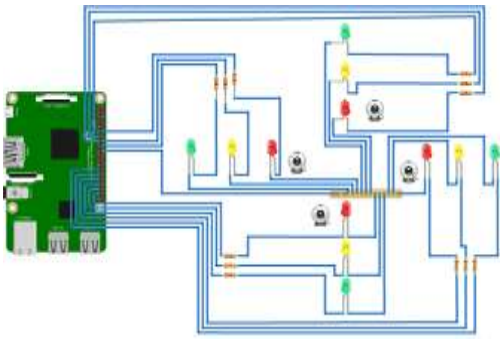

Fig 3.2 circuit diagram

3.2 PROJECT DESCRIPTION

Each camera should be faced in each direction to monitor the traffic density by having a number of boundaries of each vehicle on the road. When the traffic density of one direction is high, green signal will turn in that direction and rest will be in red. Similarly, by analyzing the order of traffic density traffic signal should be changed in every direction. So that traffic signaling system becomes automatic using image processing through open CV andpython.

4.HARDWAREREQUIREMENTS:

4.1**RASPBERRYPI**

Raspberry pi 3 is a development board in the raspberry pi series. It is often considered as a one board computer that works on LINUX operating system. The board not only has many features but also has high processing speed making it suitable for advanced applications. Raspberry pi is mainly designed for those who are interested in LINUX systems and IOT (Internet of Things). The Raspberry Pi 3 has 6 times greater processing

Fig 3.2 RASPBERRY PI

capacity compared to those of previous models. This third-generation Raspberry Pi has an improved Broadcom BCM2837 processor, which is considered as a strong-ARM Cortex-A53 based quad-core processor that runs at 900MHz speed. The board also features a rise in memory capacity to 1Gbyte. The below figure 3.3 represents raspberry pi 3board.

5.SOFTWARE REQUIREMENTS:

5.1RASPBIANOS:

Raspbian is an open source operating system supported Debian optimized for the Raspberry Pi hardware. Raspbian operating system is the set of fundamental programs and utilities that makes Raspberry Pi run. However, Raspbian provides quite more than a pure operating system: it comes with more than 35,000 packages. It is a pre-compiled software setup in a nice format for easy installation on Raspberry Pi. Raspbian operating system still remains under active development with the significance on improving the stability and performance of as many Debian packages aspossible.

5.2 OPENCV:

Open CV stands for Open Source Computer Vision. Open Source Computer Vision Library includes open source computer vision and machine learning software library. OpenCV currently underpins an assortment calculation related to Computer vision and Machine Learning as is growing step by step. Being a BSD-licensed product, OpenCV makes it easy to change the code. The library has nearly 2500 optimized algorithms, which incorporates a comprehensive set of both classic and state-of-the art computer vision and machine learning algorithms. These algorithms are used to often detect and recognize faces, classify human actions in videos, track camera movements, identify objects, combine images together to produce a high-resolution image of an entire scene, etc. OpenCV consists of C, C++, Python, Java and MATLAB interfaces and supports Linux, Windows, Android and Mac OS. OpenCV leans mostly towards real-time vision applications and takes advantage of MMX (Multimedia Extensions) and SSE (Streaming SIMD Extension) instructions when available. OpenCV is written initially in C++. OpenCV features a modular representation, which means that the package includes several shared and static libraries.

53.INSTALLINGLIBRARYPACKAGESINRASPBERRYPi

Generally, we install applications and libraries based on the user requirements on every platform like windows, Linux or IOS based systems. We need some applications for e.g., Python language for programming and libraries for e.g. urllib for the URL based programming functions, since, raspberry Pi is a Linux based system. To install such type of applications and Library packages we need to start by clicking on the terminal icon on the top of the Raspberry Pi window.

APT (Advanced Package Tool) command can be used for installing packages. Every Linux based

OS has apt-get command. If any package is not available in APT command, those packages and libraries can be installed by using PIP command (Python Package Index). To install applications and libraries, every command should be typed in terminal. In every command given below sudo means that "super user do". It shows "Permission denied" error if command is given without "sudo".

List of Libraries that have to be installed

- OpenCV for python2
- Fswebcam
- PyautoGUI
- Tkinter
- Xlib
- PyQt4
- Xrdp
- Matplotlib

6.Implementation of the Algorithm in our Project:

Thevehiclesaredetectedaspointsandthepythoncodeiswrittenaccordinglyto comparethedensitiesallthefoursides(Directions)and resultsareshownas below:

7.CONCLUSION AND FUTURSCOPE

7.1CONCLUSION

This system makes the traffic signaling system automatic, by providing the vehicle density measurement intelligence to the system. So that there should not be any difficulties in traffic handling. In this modern era as the population is increased rapidly the usage of vehicles has also increased tremendously.The cause of it is heavy traffic. In order to avoid this problem it is better that we flow new communication methods such as image processing based intelligent traffic controlling and monitoring system using Raspberry Pi. By using this method we can get the details about information about vehicles in particular junctions through internet access. This is more beneficial for the emergencytravelling.

7.2 FUTURESCOPE

This project can be enhanced in such away as to control automatically the signals depending on the traffic density on the roads using sensors like IR detector/receiver module extended with automatic turn off when no vehicles are running on any side of the road which helps in power consumption saving. This project also allows better priority to certain vehicles like ambulance. when the IR detector receives this type of signals then it automatically transit to green. It acts as a life saving device.

Real time traffic information update on traffic department web server,Automatic tracking of defaulters,Detection of emergency vehicle,Real Time Traffic Information can be updated on Traffic Dept Website, Automatic Generation of

Results:

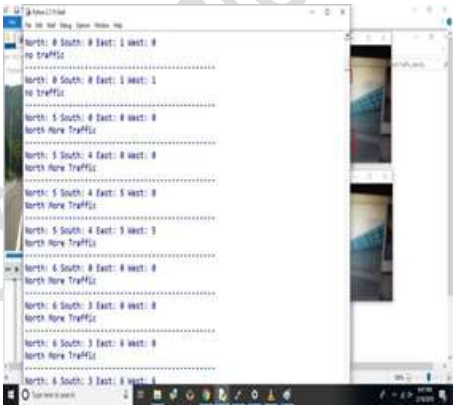

Fig 6.1 OUTPUT

E-challans for the vehicles not obeying the Traffic Principles,Automatic Tracking of Traffic Laws Defaulters,Implementation of the above system during nights using Thermal Cameras etc..

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