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An Adaptive Traffic Control System Using Raspberry PI

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Abstract

By increasing of population the usage of vehicles have been increasing and controlling of traffic is one of the challenging works. The frequent traffic jams at major junctions call for an efficient traffic management system in place. The resulting wastage of time and increase in pollution levels can be eliminated on a city-wide scale by these systems. Previously the traffic control techniques used like magnetic loop detectors, induction loop detectors are buried on the road side provide the limited traffic information and require separate systems for traffic counting and for traffic surveillance. Here the project proposes to implement an artificial density traffic control system using image processing and Raspberrypi. The hardware here we are using is webcam, pc, Raspberry pi and the software used is OCCIDENTALIS and MATLAB.

In this project the camera is get interfaced with a Raspberry pi. The image sequences from a camera are analyzed using thresholding method to find the density of vehicles. Subsequently, the number of vehicles at the intersection is evaluated and traffic is efficiently managed. In this project we implemented a real-time emergency vehicle detection system. In case an emergency vehicle is detected, the lane is given priority over all the others.

Keywords: Raspberrypi, OCCIDENTALIS,MATLAB.

Introduction

Current traffic control techniques involving magnetic loop detectors buried in the road, infra-red and radar sensors on the side provide limited traffic and require separate systems for traffic counting and for traffic surveillance. Inductive loop detectors do provide a cost-effective solution, however they are subject to a high failure rate when installed in poor road surfaces, decrease pavement life and obstruct traffic during maintenance and repair.

Infrared sensors are affected to a greater degree by fog than video cameras and cannot be used for effective surveillance. In contrast, video-based systems offer many advantages compared to traditional techniques. They provide more information, combine both surveillance and traffic control technologies, are easily installed, and are scalable with progress in image processing techniques. This paper tries to evaluate the process and advantages of the use of image processing for traffic control. Implementation of our project will eliminate the need of traffic personnel at various junctions for regulating traffic. Thus the use of this technology is valuable for the analysis and performance improvement of road traffic.

Also priority to emergency vehicles has been the topic of some research in the past. A proposed system for detection of these vehicles is based on Radio-Frequency Identification (RFID). However, the use of this technology necessitates unnecessary extra hardware to be installed both at every junction and in every vehicle. There have also been studies to recognize these vehicles by analysis of the sound of their siren. However, this technology is also easily influenced by noise and requires additional hardware at every traffic signal.

Personal Computer

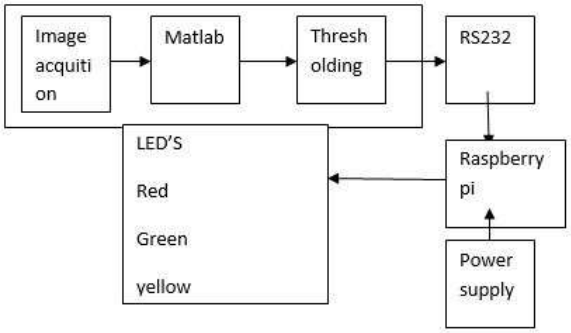

Fig: Block diagram of "AN ADAPTIVE TRAFFIC CONTROL SYSTEM USING RASPBERRY PI"

Requirements

Hardware

- Raspberry pi-model B
- Webcam
- PC

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Software

- MatLab-R2013a
- Occidentalis

Hardware implementation:

A. Raspberrypi and camera

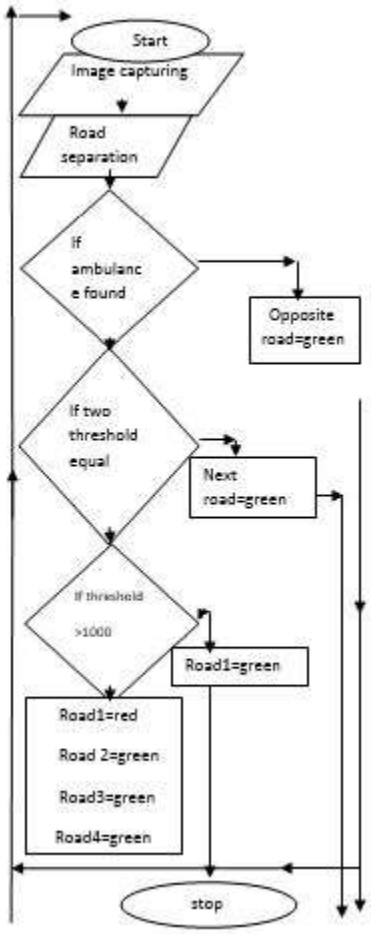
Camera is used for capturing of images.Raspberrypi is a credit card –sized.The **Raspberry Pi** has a Broadcom **BCM2835** system on a chip (SoC), which includes an **ARM1176JZF-S 700** MHz process, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB. It does not include a built-in hard disk or solid-state drive, but uses an SD card for booting and long-term storage.

The Foundation provides **Debian** and **Arch Linux** ARM distributions for download. Tools are available for Python as the main programming language, with support for BBC BASIC , C, and Perl. Model B with two USB ports and a 10/100 Ethernet controller.

Though the Model A doesn't have an 8P8C (RJ45) Ethernet port, it can connect to a network by using an external user-supplied USB Ethernet or Wi-Fi adapter. On the model B the Ethernet port is provided by a built-in USB Ethernet adapter. As is typical of modern computers, generic USB keyboards and mice are compatible with the Raspberry Pi.

The Raspberry Pi does not come with a real-time clock, so an OS must use a network time server, or ask the user for time information at boot time to get access to time and date for file time and accesing.

Software design:



MATLAB and GUI:

For this project, the MATLAB software is used to write the program. MATLAB stands for matrix laboratory which has a high-performance language that used for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation . MATLAB can solve many technical computing problems very quickly than it would take to write a program in a scalar non-interactive language such as C, JAVA or FORTRON.

Raspbian:

After cycling through several recommendations since just before the hardware was first made available, the Raspberry Pi Foundation created the New out Of Box System (NOOBS) installer, and as of July 2013 suggests using it to install the Debian-derived Raspbian. The Foundation intends to create an application store website for people to exchange programs.

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Raspbian is a Debian-based free operating system optimized for the Raspberry Pi hardware. It is the current recommended system, and was officially released in July 2012, although it is still in development. It is free software and maintained independently of the Raspberry Pi Foundation. It provides some available deb software packages, pre-compiled software bundles. A minimum size of 2 GB SD card is required for Raspbian, but a 4 GB SD card or above is recommended. The downloaded Raspbian "wheezy" image file has to be unzipped and then written to a suitable SD card, formatting it for use.

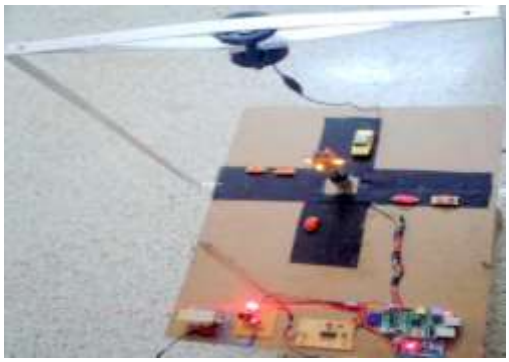
Implementation

Thersholding:

Segmentation involves separating an image into regions corresponding to objects. We usually try to segment regions by identifying common properties. similarly, we identify contours by identifying differences between regions .

The simplest property that pixels in a region can share is intensity. So, a natural way to segment such regions is through thresholding, the separation of light and dark regions. Thresholding creates binary images from grey-level ones by turning all pixels below some threshold to zero and all pixels about that threshold to one. If g(x, y) is a threshold version of f (x, y) at some global threshold T. g is equal to 1 if f (x, y) ≥ T and zero otherwise.

Result



Conclusions

This project presents An Artificial Density Based Traffic Control System using image Processing and Raspberrypi implemented using MATLAB.Here we implemented a real-time emergency vehicle detection system. In case an emergency vehicle is detected, the lane is given priority over all the others.

Table:

Case1:R1=highest priority

S.NO	ROADS	DENSITY	LED		
			RED	GREEN	YELLOW
1	R1	1200	on	off	off
2	R2	700	off	off	on
3	R3	400	off	off	on
4	R4	300	Off	off	on

By considering the road R1 side the highest priority is given then the red light will glow and the other road sides the green light will glow depending up on the density values.

Case2: R2= highest priority

S.NO	ROADS	DENSITY	LED		
			RED	GREEN	YELLOW
1	R1	1200	off	Off	On
2	R2	1500	on	Off	Off
3	R3	300	off	Off	On
4	R4	400	off	Off	On

Here the road R2 is given the highest priority so that based on the thresholding value the red light will glow and for the remaining roads depending the density values the green light will glow.

Similarly the process will continuously takes place if we consider the highest priority for the road R3 and R4.

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Case3:R2,R4=Highest priority

S.NO	ROADS	DENSITY	LED		
			RED	GREEN	YELLOW
1	R1	1200	off	off	On
2	R2	1500	on	off	Off
3	R3	300	off	off	On
4	R4	1500	Off	off	On

In this case for roads R2 and R4 are having the highest priority then based on the sequence of (R1,R2,R3,R4) the operation will be performed here first priority is given to road R1 red light will glow and for remaining roads green light will glow.

Case4:R2=Emergency vehicle

S.NO	ROADS	DENSITY	LED		
			RED	GREEN	YELLOW
1	R1	2000	off	off	on
2	R2	1500	off	off	on
3	R3	300	on	off	off
4	R4	400	On	off	off

In this case the road R2 is having an emergency vehicles for this the green light will glow and for the remaining roads depending upon the density values the red light will glow.Here the emergency vehicles are given the highest priority.

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