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Accident Avoidance by Using Road Sign Recognition System

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Abstract - *The increase in the number of vehicles has led to a number of traffic signs. Therefore, a system that can automatically recognize the traffic signs is being needed to reduce traffic accidents and to drive more freely. Traffic Sign Recognition (TSR) systems employ vehicle mounted cameras that identify traffic signs while driving on these road. Typically, these systems recognize speed limit signs, stop signs and warning signs such as pedestrian crossing, railroad crossing etc. Their primary function is to inform the driver of recent traffic signs that may have been missed due to distraction or inattentiveness. A camera scans the roadside for traffic signs. The Raspberry Pi is a credit card sized single computer or SoC that uses ARM1176JZF-S core SoC, or System on a Chip, is a method of placing all necessary electronics for running a computer on a single chip. Raspberry Pi needs an Operating system to start up. In the aim of cost reduction, the Raspberry Pi omits any on-board non-volatile memory used to store the boot loaders, Linux Kernels and file systems as seen in more traditional embedded systems. Rather, a SD/MMC card slot is provided for this purpose. After boot load, as per the application program Raspberry Pi will get execute.*

Key Words: Traffic Sign Recognition (TSR), Raspberry Pi, ARM11, System on a Chip.

INTRODUCTION

Vehicle driving has become more common in the life of people. Thus, traffic security is very important. Traffic signs are used for traffic warning, regulation, routing and management of important information for autonomous vehicle. These signs are intended to affect the behaviour of drivers. Due to the tremendous increase of road vehicles all over the world, the number of road accidents has also increased significantly. Among different causes of accidents, some major causes are ignorance of the road sign, occlusion of the road sign and distraction of the drivers. Our work describes the design of an embedded system for the "The Avoidance of Accidents Using Road Sign Recognition".

Traffic sign is a computer vision technique of driving assistance system in automatically recognition roadside traffic signs. Traffic sign detection and recognition (TSR) is an important research topic that continuously keeps wider interest to the research in the field of intelligent transport system because of its application in the driver assistant system that helps to regulate the traffic, indicate the state of the road, guiding and warning drivers and pedestrians. In resent past a lot of research is carried out for the robust TSR system in literature. Many of them used colour and shape segmentation for traffic sign detection. A driver assistant system like TSR helps the drivers to recognize the traffic signs and alert them to keep them safe from road accidents.

NEED

With this mechanism, safety is ensured to drivers as well as pedestrians since our system is more reliable and lifesaving. This is because traffic sign recognition and detection is made easy and reliable. Traffic sign is detected with image processing techniques and the detected traffic sign is given to traffic sign recognition algorithm as a parameter. Speed limit signs, stop signs and warning signs such as pedestrian crossing, railroad crossing etc. are detected.

The detected traffic signs are recognized using an image processing system that uses segmentation algorithm. The resulting image is processed with Open CV. Another important need is that, even if the driver neglects the road sign while driving, the system can save the life of the driver and others by recognizing the road sign and altering the speed of the vehicle. The speed of the vehicle is changed according to the road sign detected with the help of Raspberry Pi.

INTENT

The main objectives of the system are:

- Providing accuracy by using Open CV.
- Providing an alarm system for alerting the driver in case he neglects the traffic sign.
- Ensuring safety by changing speed of the vehicle according to the road sign detected.

LITERATURE SURVEY

In a study, some image processing techniques are used to detect traffic signs and Fuzzy Integral is used to recognize traffic signs. [1]. Another paper represents road sign

detection and recognition system based on speeded up robust feature (SURF) descriptor that is invariant to rotation, skew and occlusion of the sign and artificial neural network (ANN) classifier [2]. The third paper considers the case of a single controllable ego vehicle surrounded by several uncontrollable target vehicles, without communication. Only a map with the current position and velocity of the target vehicles are assumed to be known, but no pre-defined crossing order is given. [3]. In another paper, they have developed a novel two-stage approach to detect vehicles and recognize brake lights from a single image in real-time. [4].

PROPOSED SYSTEM

The traffic avoidance system detects and recognizes speed limit signs, stop signs and warning signs such as pedestrian crossing, railroad crossing etc. The proposed method consists of 3 stages. These stages are Image Acquisition, Traffic Sign Detection and Traffic Sign Recognition. RGB format image that is taken from camera is primarily given to traffic sign detection algorithm as an input parameter. Traffic sign is detected with image processing techniques. In the traffic sign detection stage, RGB format image is firstly converted to NTSC format image. Then, some filter techniques are applied to image. These filter techniques are respectively Unsharp filter, Average filter, Dilate filter and Erode Filter. The signs on the road image are made significant by applying these filter techniques. Then the detected traffic sign is given as input to traffic sign recognition system and traffic sign classification is done by using Fuzzy Integral. Then the speed of the vehicle is changed according to the road sign detected with the help of Raspberry Pi.

Advantage

- More safety as the system is more reliable and lifesaving.
- Even though the driver neglects the sign, our system can save the life of the driver and others by recognizing the sign and altering the speed of the vehicle.
- Our system is more accurate due to the fact that is made with open CV.
- Image sign detection is more reliable and easy.

Modules

The major modules in the proposed system,

- Camera feature extraction.
- Image recognition.
- Database feature extraction.
- Motor speed alteration.

Overall Function

The accident avoidance system uses a camera in order to capture the road sign that has been missed while driving. This captured image is sent to the ARM 11 processor which recognizes the road sign. The recognized image is given to Raspberry PI controller which alerts the driver of the missed road sign through the display and also via a voice alert. In addition the speed of the vehicle is also altered depending on the detected road sign.

Methodology

Our project uses the segmentation algorithm. Image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity or texture. Adjacent regions are significantly different with respect to the same characteristics.

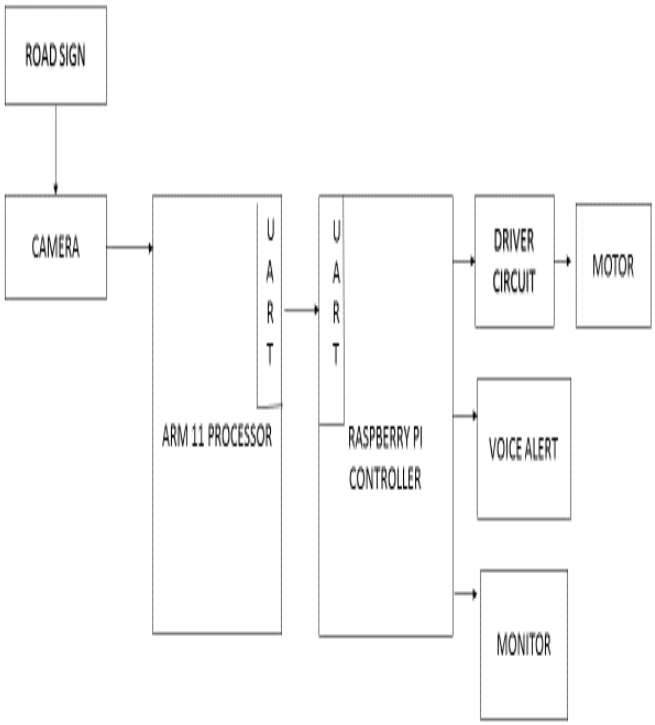

Fig-1 The overall diagram of the proposed system.

MODULE DESCRIPTION

Camera Feature Extraction

In this module, a micro-cam is placed in the vehicle. This cam observes the road signs. Whenever a road sign passes, it takes pictures of them. These images are sent to the image recognition system. The image recognition system recognizes the image.

Image Recognition

The images are received from the Camera feature extraction module. These images are recognized and identified using image processing system with open CV. The algorithm used is segmentation of images using open CV. The main reason of using this algorithm is to accurately identify these images so that proper action is done.

Database Feature Extraction

After identifying the images, the image processing system refers the database. The database contains collection of actions that needs to be done for the appropriate signs.

Motor Speed Alteration

In this module, proper action is taken according to the details contained in the database. Then according to the action the motor speed is altered using Raspberry Pi.

RELATED SYSTEMS

The related systems involved in the proposed system are described in detail as follows.

ARM processor

It stands for Acorn RISC Machine or Advanced RISC Machine. It is a RISC architecture for computer processors that is configured for various environments.

Raspberry Pi

It is a series of small single-board computers. The main reason for employing Raspberry Pi as it provides in-built Wi-Fi and Bluetooth. An additional advantage it also has a Random Access Memory (RAM).

GPU

It stands for Graphic Processing Unit. It is an electronic circuit to manipulate memory for producing output for display.

UART

It stands for Universal Asynchronous Receiver/Transmitter. It is a computer hardware device for asynchronous serial communication in which data format and the speeds can be variable.

SYSTEM SPECIFICATION

Software Specification

Operating System	:	Raspberry Pi
Programming Languages Used	:	Python

Hardware Specification

Sensors	:	Camera
Microcontroller Unit	:	Raspberry Pi and ARM 11

CONCLUSIONS

The proposed system automatically detects signs that are missed while driving and the vehicle speed is altered accordingly. In addition a voice alert is also given in order to intimate the driver that he has missed a traffic sign. This project is an initiative to merge technology for safety to provide a better living environment.

FUTURE WORK

There is scope to modify our proposed system by better refinement. We propose a novel image search re-ranking approach, named spectral clustering re-ranking with click-based similarity and typicality (SCCST).

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