

Development of Moving Object Detection Using Vision System

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ABSTRACT

This paper describes a functionality and test results of moving object detection based on vision system. Moving object detection is realized by just adding image processing software to the vision system with no additional sensor. Moreover, by usage of around view monitor system as vision system, existence of moving objects surrounding the subject vehicle can be informed to support the driver in the parking maneuver.

KEY WORDS: object detection, vision system

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1. INTRODUCTION

Many vision systems including a rearview monitor system are already in markets for purpose of driving assistance mainly in parking maneuver. In addition to this type of vision system, a new type of vision system, which provides a driver with a comprehensive image surrounding the subject vehicle, has been launched. On this vision system, it is necessary to use a unit with image processing functions including image correction, eye-point conversion of images, combination of images and so on. Based on this type of vision system, new functionality that detects objects moving surrounding the subject vehicle has been developed with no additional sensor by just adding software for this function to the image processing unit. This paper describes the system configuration, functionality and the test results about moving object detection.

2. SYSTEM CONFIGURATION

Fig.1 shows the system configuration of moving object detection. The system consists of four cameras, an image processing unit and a display.

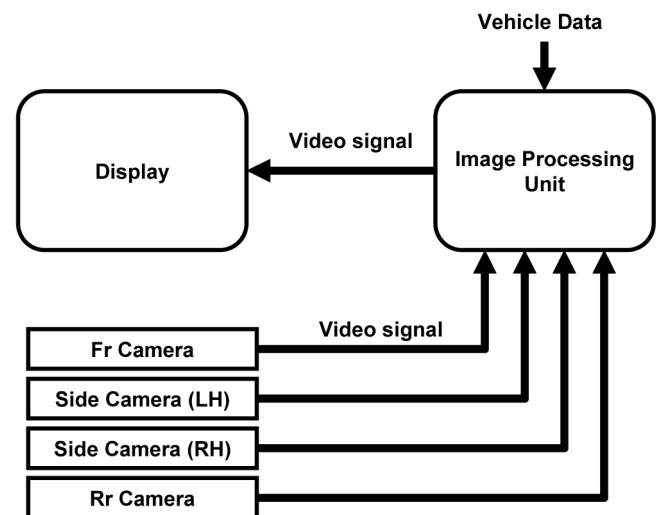


Fig. 1. System Configuration

The four cameras gather images surrounding the subject vehicle and send each video signal to the image processing unit. Fig.2 shows the camera layout example. One of cameras is installed near the front grille. Two cameras are installed inside the left side door mirror as well as the right side door mirror. For the rearward, a camera is installed near the license plate in the rear of the subject vehicle like the rear view monitor system.

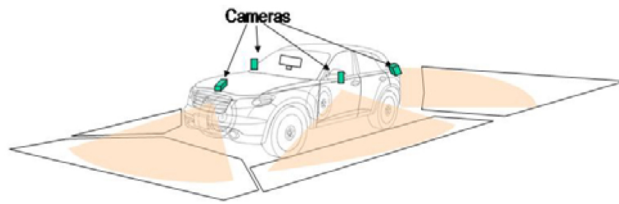


Fig. 2. Camera Layout

The image processing unit receives video signals from each camera and vehicle data including vehicle speed, steering angle and so on. The unit has two main functions. One is around view monitor, and the other is moving object detection. The details of these functions are described in later sections.

The display unit receives a video signal from the image processing unit and shows the image to a driver.

The image processing unit and the display are installed in the cabin.

3. AROUND VIEW MONITOR FUNCTION

Newly developed function of moving object detection is based on around view monitor system. The outline of the around view monitor function is described in this section.

Fig.3 shows the outline of the image processing to create around view from four camera images.

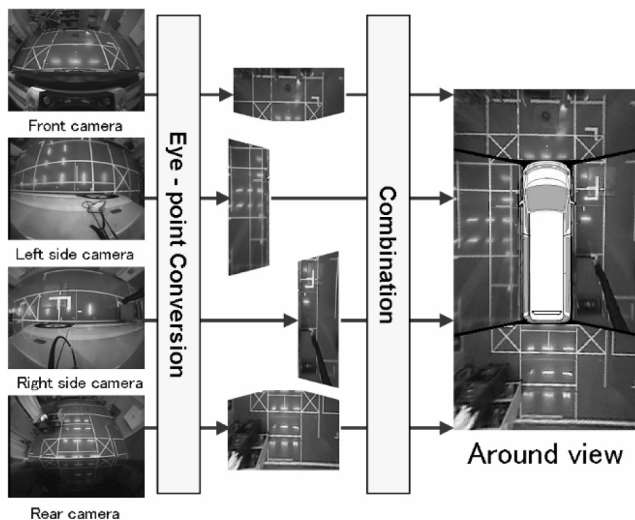


Fig. 3. Process of Creating Around View¹⁾

As the first step, eye-point conversion is done for each image from each camera to create an image that is virtually captured from the above. As the second step, these converted images are combined to create one comprehensive image surrounding the subject vehicle. This calculation is done in real time. Finally, the comprehensive image is transferred to the display to show the driver.

Fig.4 shows an example of the displayed image to the driver. In this situation, the driver is parking the subject vehicle in parallel parking space. The combined image from four cameras is shown in the left side of the image. On the other hand, an image from the rear camera is shown in the right side of the image. In the rear view image, the estimated vehicle path that is calculated base on the vehicle speed and the steering angle is overlaid with the solid line.



Fig. 4. Example of Displayed Image

By providing the driver with both the around view image and the rear view image, the driver can easily know the situation surrounding the subject vehicle and park the subject vehicle.

The image example in Fig.4 is shown in the display when the gear is in reverse. If other gear is selected, for example, drive position, the right side image is the front view image from the front camera.

4. MOVING OBJECT DETECTION FUNCTION

As described in the previous section, the comprehensive image consisting of the around view image and the front/rear view image is created using the image processing unit. Newly developed moving object detection is realized by image processing of this comprehensive image with this image processing unit with no additional sensor. Moving object detection is classified into two functions.

- i. Moving object detection surrounding the subject vehicle using the around view image
- ii. Moving object detection in frontward/rearward using the front/rear view image

These two functions are realized basically using the same algorithm. Fig. 5 shows the flowchart of moving object detection.