IMAGE PROCESSING APPLICATION IN SURROUND VIEW SYSTEM

[1]Trivedi.T.H.M, [2]Dr.R.Nagaraja
[1]Mtech Student, [2]Professor and PG Coordinator
[1]Information Science and Engineering
[1]Bangalore Institute of Technology, Bangalore, India

Abstract : The advanced driver assistance system is the emerging technology which assist driver to park the vehicle safely. The surround view system is an 360 degree surround view of an vehicle, where a driver can see a bird eye view generated by the system. This system normally consist of four cameras mounted at the different sides of the car. That is one on the bumper of the vehicle, other two on the side mirrors a the last one on the rear side of the vehicle. The inputs from the four cameras are used to get a 360^0 view of an vehicle. This paper presents a surround view system which process on three key algorithm: Image pre-processing, template generation and comparison. This solution provides an seamlessly a stitched bird eye view of the vehicle.

Keywords: ADAS, Surround view system, Image preparation, template preparation and capture compare.

I. INTRODUCTION

The main goal of the Advanced driver assistance system is to make the traffic comfortable and safer. ADAS is a growing market, which adds a new features year by year and one among them is bird eye view system. The 360^0 surrounding of the vehicle is provided by the surround vision monitoring system, which is an emerging automatic ADAS technology. The system normally consist of four fish eye cameras mounted at the different parts of the vehicle, this system helps the driver in safe parking and also assist the driver while parking. It can also detect the blind spots which are not visible to the normal human eye and thus helps the driver to get rid of any blind spots while parking. The ultrasonic sensors works in finding out the obstacles or the blind spots and helps the driver in finding out the obstacles. The proposed system helps in safe parking of the vehicle and also helps in blind spot detection by making use of the various sensors mounted at the different parts of the car.

In this system the obstacle detected by the sensors will be displayed on to the dashboard of the vehicle along with an alarm. Figure 1 illustrates an example four surround view camera system and different positioning of cameras around the vehicle. The different views generated from SVS helps the driver in parking. That is the cameras mounted at different parts of the cars, collect the data and some pre- processing is done and finally the 360^0 view of the vehicle will be displayed on the dashboard of an vehicle. This paper is organized as fallows: Section II describes idea and concept of the proposed system and implementation details. Section III gives the results discussion. Last section concludes the paper and algorithm gives idea about future enhancement.

Objectives:

- The main objective is to provide a clear view of the surrounding of an vehicle
- To help in assisting the drivers, for parking
- To help in road safety along with a vehicle safety
- To detect the blind spots and helps in parking safely

The below shown Figure 1 indicates the surround view system camera and ultrasonic sensors installation. That is the system consist of four cameras mounted at the different parts of an car. The front view camera is mounted on the bumper of the car, other two are mounted on the side mirrors of the car, and the last camera will be mounted at the back end of the car. The 3 ultrasonic sensors are mounted in the front and other two on the back side of the car. This system helps in real time parking of the vehicle and thus provides the road safety and as well as car safety. It works while the driver enable the parking assist application and helps him by displaying the complete surround view of the vehicle and also helps in blind spot detection

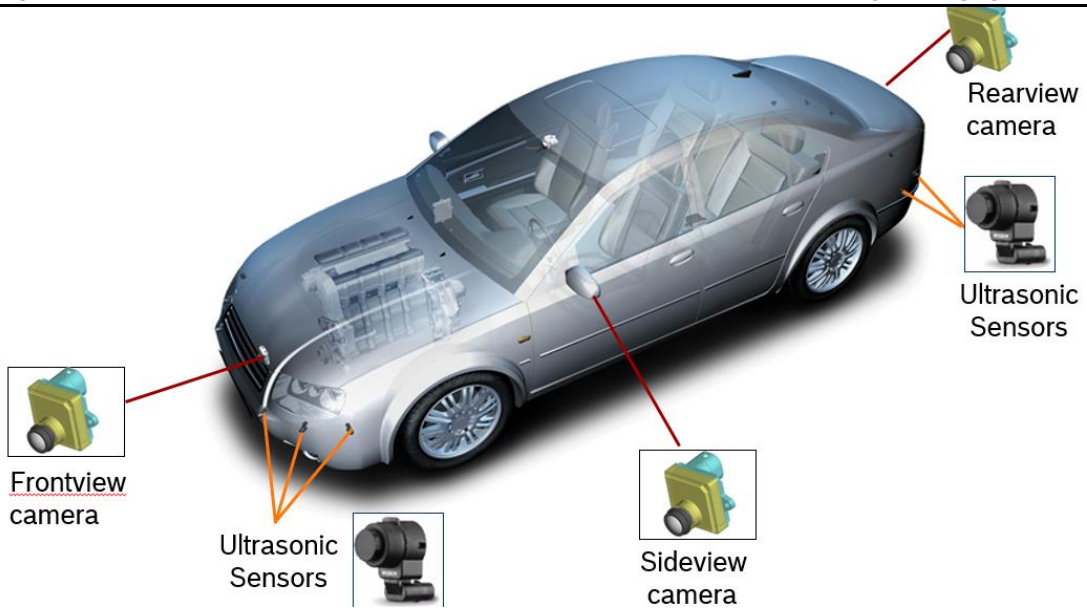

Figure 1: The surround view system with cameras and ultrasonic sensors

II. BIRD EYE VIEW CONCEPT AND IMPLEMENTATION

The basic requirement for the SVS system are the ability to do real time performance and to view the vehicle from all angles(3D). The solution for this includes wide-angle camera and ultrasonic sensors, mounted on four sides of the vehicle. The ultrasonic sensors are mainly used for better environment perception. It is implemented using Anaconda to meet the requirement. Figure 2 shows building blocks of the bird eye view concept. The first step is image pre-processing, that is processing of the images captured through camera in order to remove the noise out of an image, the second stage is template preparation that is resizing of the template images. The next stage is comparing the images captured through camera with the template ones. And if the test passes the images are displayed on the dashboard as a output. To get a proper bird eye view image stitching is very important step. Finally the output will be the surround view of a vehicle along with the bird eye view.

A) Image pre-processing

The image pre-processing algorithm mainly concentrates on removing the unnecessary noise and distortion out of an image. Initially the images provided by the cameras are taken as input for this algorithm. The first step here it is the iterative averaging of captured images, that is removing the basic noise out of an images and then it will check whether averaging is done for all the images are not. If so it will continue otherwise the same loop will execute. After averaging the pixels of the images are compared to the threshold values, if its high then the pixel content are remained same, otherwise it will be set to zero nothing but black. This step is done to take a basic required part out of an image. After that the images are converted from RGB mode to HSV in order to make easy for comparison with the brightness threshold. The image brightness pixels are compared with the threshold value, and if they are greater than threshold value set the pixel value as one otherwise zero. After that the images are convert from RGB to Grey scale mood to make easy for further comparisons. That is how the typical image pre-processing algorithm works.

B) Template image processing

The template image processing is the second major algorithm, which considers the images captured earlier as a reference. This images are taken from the input and did some pre-processing in order to make them easy for comparison in further steps. The initial step here is inputting the template images from the database and then a basic shifting of an images is done which is nothing but re-sizing of an image. This step is necessary to make them fit into the dashboard size. Later the images are converted from RGB mode to grey- scale to make them easy for comparison.

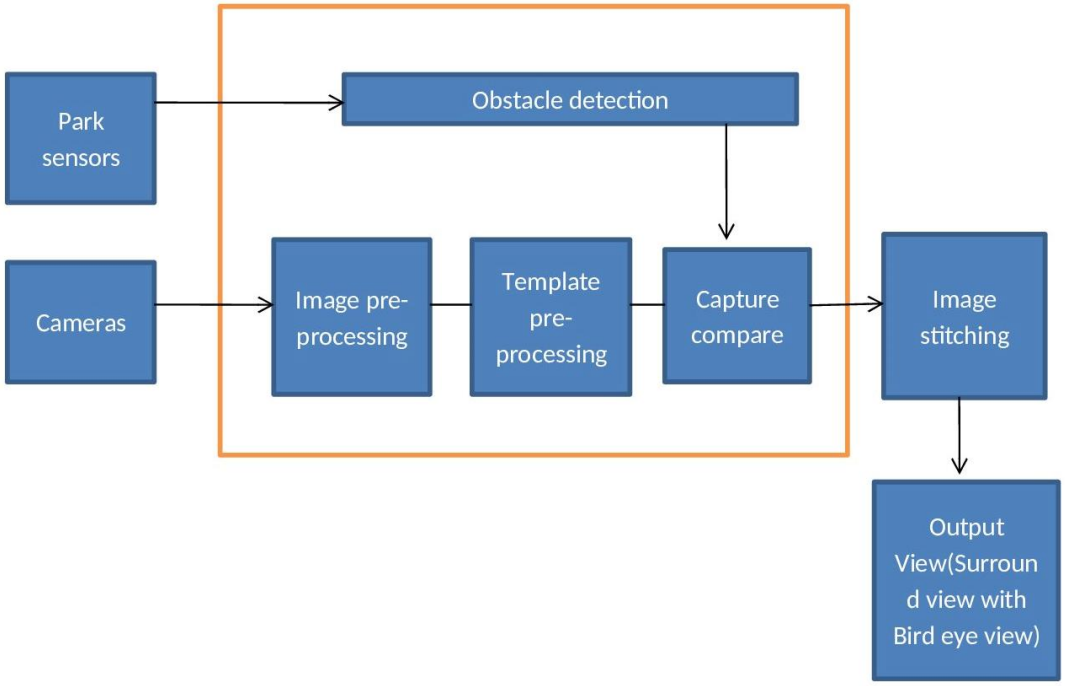

Figure 2: Bird eye view concept

C) Capture compare

The capture compare algorithm considers both the images generated as output from the image pre-processing and template-pre-processing algorithms. And then a pixel by pixel comparison is made between this images in order to make a better comparison each pixel of an image is considered. After that the images are compared to the threshold value, if the pixel contents are above the value then its matching and otherwise its not matching. The images that are matched are allowed to display on the images.

D) Image stitching

This phase explains about how the outputs from cameras can be simultaneously stitch and making one corresponding 3D world. All cameras outputs are processed via Anaconda to reach the maximum hardware requirements. An additional processing is required for the outputs of the wide-angle camera, that is they must be converted to RGB format to make them visible on the dashboard. The ADTF tool is used for this process and the output from this will be the bird eye view of the vehicle along with all the sides of the vehicle.

ADTF: The ADTF stand for Automotive data and time triggered framework is a tool for the development, validation, visualization and test of driver assistance and automated driving features. This tool is flexible, efficient, extendable, and stable. It consist of an development environment with an interactive work environment. This environment has the advantage of a stable measurement framework, and can adopt typical bus data as well as raw data from any sources.

Features:

- Proven and stable framework for ADAS application
- helps in integration of customer specific hardware interfaces
- Real time reproduction and visualization of the collected data

III. Application of parking assistance system

- Automatic parking space measurement
- More effective utilization of tight parking spaces
- Comfortable parking and parking out
- No more annoying repairs caused by bumps and scrapes
- Supports both when parking and parking out

IV. Result discussion

This system has been developed on automotive development platform, the wide- angle cameras and the parking sensors are mounted at the different angles of the car. The algorithm specified in this paper works in the real time and provides an 360^0 view along with a bird eye view of the surroundings of an vehicle or a car. The wide angle camera gives a high quality output at 640p. this system gives comparable results with other bird eye view or same type of solutions available today. The results shown in the below figure indicates the surround view system prototype and the bird eye view generated on the HMI unit.

Figure 3: The surround view system prototype and bird eye view

V. Conclusion

In this paper we implemented an surround view system, which provides an 360^0 surrounding view of an vehicle or a car, and this system helps the driver in parking and thus provides the parking assistance to the driver. Unlike others systems this system will not be affected by the weather conditions. This system is fast, portable and optimized as compared to the others systems. And this system can be easily extend to fit for more than four cameras as well.

The future enhancement can be made on HMI unit, which makes the user more comfort to use. That is the next work would be to work on HMI unit so that it makes easier to operate it.

REFFERENCES

[1] Mengmeng Yu and Guanglin Ma, “A Visual Parking Guidance for Surround View Monitoring System” , IEEE Intelligent Vehicles Symposium (IV), 2015

[2] Buyue Zhang, Vikram Appia, Ibrahim Pekkucuksen, Aziz Umit Batur, Pavan Shastry, Stanley Liu, Shiju Sivasankaran, Kedar Chitnis, “A surround view camera solution for embedded systems”, IEEE Conference on Computer Vision and Pattern Recognition Workshops, 2014

[3] F. Lu, S. Lee, R. K. Satzoda and M. Trivedi, "Embedded Computing Framework for Vision-Based Real-Time Surround Threat Analysis and Driver Assistance," *2016 IEEE* Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), Las Vegas, NV, 2016, pp. 901-909.