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Vision Based Obstacle Detection and Range estimation: A Literature Review

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***Abstract* - Obstacle detection is a main key of autonomous vehicles. When communicating with huge robots in unstructured background, resilient obstacle detection is required few of the existing methods are mainly suited for the backgrounds in which the ground is comparatively flat and with roughly the same color throughout the terrain. A novel procedure proposed in the work presented here uses a monocular camera for real time performance.We compute the homography between two successive frames by computing the fundamental matrix between the two frames.Depth maps from multiple angles for a given set of identified We examine a difficulty intrinsic to any fundamental matrix based outlook to the provided task and show how the discussed way can resolve this difficulty by a huge level An obstacle detection and distance estimation system based on visual particular attribute and stereo vision is hence discussed in the presented work.**

***Keywords:* obstacle detection, aerial map generation, stereovision, color quantization depth calculation, reconnaissance.**

I. INTRODUCTION

Obstacle detection is an important task for many mobile robot applications. Most mobile robots rely on range data for obstacle detection. Popular sensors for range-based obstacle detection systems include ultrasonic sensors, laser range finders, radar, stereo vision, optical flow, and depth from focus. Because these sensors measure the distances from obstacles to the robot, they are inherently suited for the tasks of obstacle detection and obstacle avoidance. However, none of these sensors is perfect. Ultrasonic sensors are cheap but suffer from specular reflections and usually from poor angular resolution. Laser range finders and radar provide better resolution but are more complex and more expensive. Most depth from X vision systems require a textured environment to perform properly. Moreover, stereo vision and optical flow are computationally expensive.

While small objects and different types of ground are difficult to detect with range sensors, they can in many cases be easily detected with color vision.

Ground Plane Obstacle Detection (GPOD) measures the ground plane using measurements of disparity and includes an initial calibration stage in which the ground plane parameters are extracted. GPOD works in image coordinates and compares the disparity values in a new image pair with the expected ground plane disparity to detect differences. Hence calculate the depth.

The algorithms proposed in this paper involve simpler and more accurate approaches to the existing techniques such as disparity calculation, depth calculation, integrating image information from multiple camera angles and measurement error correction.

II. RELATED WORK

We first discuss collision-avoidance techniques. Several approaches only consider static obstacles while choosing actions leading the vehicles towards the goal.

Daniel maier. [1] present an approach to obstacle detection for the collision-free, efficient humanoid robot navigation based on monocular images and sparse laser range data.Autonomous navigation is challenging task. In this paper, presented an approach to combine sparse laser data and visual information for the avoidance of obstacle on a humanoid robot. His method allows the robot to train classifiers for detecting obstacles in the camera images in a self-supervised fashion. Based on this information, the robot can navigate more efficiently and avoid obstacles. Our approach projects detected objects from the camera angle and learns the classifier that consider color and texture information.

Khouloud Meskaldji. [2] apply a comparison of color histograms is one of the most widely used techniques for Content-Based Image Retrieval. Content based image retrieval technique is a technique which uses various attributes such as color,texture ,shape for search of images. Before establishing a color histogram in a defined model such as RGB, HSV or others, a process of quantization is often used to reduce the number of used colors. The technique appeared as an answer to automation annotation of images.we present the results of an experimental investigation studying the impact of this process on the accuracy of research results and thus will determine the number of intensities appropriate for a color quantization for the best accuracy of the research through tests applied on an image database of 500 color images.

Iwan Ulrich and Illah Nourbakhsh. [3] presents a new vision-based obstacle detection method for mobile robots. Each individual image pixel is classified as either to an obstacle or the ground based on its color appearance. The method uses a single passive color camera and provides a binary obstacle image at high resolution.All range based obstacle detection system has all difficult detecting objects on ground. Range sensors can be used to distinguish between different types of ground surfaces.The different types of ground are difficult to detect with range sensors.Obstacles are object which different from object in appearance from ground.

Yoko watanabe. [4] describes a vision-based navigation and guidance design for UAVs for a combined mission of tracking and collision avoidance with unforeseen obstacles using a 2-D vision sensor. This paper summarizes the design of a vision-based relative navigation and UAV to achieve 3-D waypoint tracking with vision-based obstacle avoidance. This obstacle detection method based on pixels.Any pixel that differs in appearance is an obstacle.

Margrit Betke and Esin Haritaoglu. [5] describes real-time vision system has been developed that analyzes color videos taken from a video camera in a car driving. The system uses a combination of color, edge, and motion information to recognize and track the road boundaries, lane markings and other vehicles on the road.Cars are recognized by matching templates which are cropped from the input data online and by detecting highway scene features and also evaluating. They are related to each other. Cars are detected by temporal differencing and by tracking motion parameters that are typical for cars. The system recognizes and tracks road boundaries and lane markings using a recursive least-squares filter. Experimental results demonstrate robust, real-time car detection and tracking over thousands of image frames. The data includes video taken under difficult visibility conditions. We have developed and implemented a hard real-time vision system that recognizes and tracks lanes. The vision algorithms employed combination of brightness, hue and saturation information to analyze the highway. Under reduced visibility conditions, the system works well on highways. when there are many city lights in the background, the system has problems finding vehicle outlines and distinguishing vehicles on the road from obstacles in the background. The goal of our research is to develop an intelligent and camera assisted car.Research on vision performed in whole world .Our vision system utilizes hard real time system.

D santosh, CV jawahar, Supreeth achar . [6] apply an image-based navigation paradigms. Image-based navigation paradigms have recently emerged. we augment the existing image-based navigation approaches by presenting a novel image-based exploration algorithm. The algorithm facilitates a mobile robot equipped only with a monocular pan-tilt camera to autonomously explore a typical indoor environment. The algorithm infers frontier information directly from the images and displaces the robot towards regions that are informative for navigation. In this paper, frontiers are detected using a geometric context-based segmentation scheme exploits natural scene structure in indoor environments. A graph of the workspace is built in terms of images which can be utilised for tasks of the localisation, path planning and navigation. Experimental results on a mobile robot in an unmodified laboratory and environments demonstrate the validity of algorithm.

Pradeep kumar and Vikas gupta. [7] describes various algorithms. These algorithms are used to solve this problem with different environment. This paper proposes procedure to detect any obstacle in the textual path on the basis of some learning techniques. These learning techniques makes easy to detect any obstacle in Textual path. These separate part matches with the environment by using learning. Local Edge Pattern will be used for efficient matching. Learning is used to take decision about the obstacle appearance. As improvement is required, complexity increases.This method detects the obstacles by learning images.Color Histogram describes the global distribution of pixels of an image.The histogram calculates the pixels of an image.This measurement is used to match the parts of image.

Raphael Labayrade, Didier Aubert,Jean philippe Tarel. [8] proposes robust method for detecting the obstacles.This method is able to cope with uphill and downhill gradients of the vehicle. Our approach is based on the construction and investigation of the ”v-disparity”1 image which provides a good representation of the geometric content of the road scene. This detection is performed without any explicit extraction of coherent structures such as road edges or lane-markings in the stereo image pair. This paper begins by explaining the construction of the ”v-disparity” image and by describing its main properties. On the basis of this image, we then describe a robust method for road obstacle estimation of the relative height and pitching of the stereo sensor with respect to the road surface. The longitudinal profile of road is estimated and the objects located above the road surface are then extracted subsequently, the accurate detection of road obstacles, in particular the position of tyre-road contact points is computed . The whole process is performed at frame rate with a current-day PC. Their experimental findings and comparisons with the results obtained using a flat geometry hypothesis.The two image planes of stereo sensors are used.The detection process is based on construction and processing of image.This detection is performed without any explicit extraction.

Stephen se and Michael brady.[9] extended a stereo vision-based algorithm. a stereo vision-based algorithm is extended to detect small obstacles for TAPS. Obstacle detection are investigated probabilistically. A technique is developed objects by matching their edges with some heuristic criteria. Experiments show that obstacle edges are extracted much better with our dynamic approach and that objects can be found successfully by the edge matching technique. However, Cameras attached to shoulders of person in TAPS move up and down.Dynamic calibration is used to obtain a better estimate of ground plane for slopes or non flat ground.

Wajid Ali.[10] presents a classification based tree detection method for autonomous navigation in forest environment. The fusion of color and texture has been used to segment the image into tree trunk and background objects. The segmentation of forest images into tree trunk and background objects is a challenging task due to high variations of illumination, effect of different color shades, non-homogenous bark texture, shadows and foreshortening. The attempt have been made in researching the methodology to detect trees and estimate the distance between forest vehicle and base of trees. Color and texture were combined to yield an optimal performance than individual could accomplish and the fusion of LBP and Color Histogram features have shown an best performance.This method is used to evaluate all sub types by increasing number of samples to achieve more speed and accuracy.

S.V. Amarasinghe , H.S. Hewawasam and W.B.D.K. Fernado . [11] proposes a solution to the problem through a stereo vision based on obstacle detection and depth measurement method. For objects with sharp edges, the aerial map was generated based on corners identified using a corner detection algorithm. A prototype of the system was implemented and tested in a controlled environment. The results show that percentage estimation error was significantly reduced after the depth calculation was refined using the proposed error model.

III. CONCLUSION

Obstacle detection and generation of an aerial map of the area is highly important for the navigation of a mobile agent in an unknown territory and for planning of the path. Using an inexpensive low resolution camera, optimum obstacle detection is possible for a range of distances from 25cm to 2m. For object detection, available techniques of boundary tracing and corner detection were used. simpler and more accurate algorithms are introduced for depth calculation and aerial map generation to optimize the data processing and accuracy of the results. The error model introduced has significantly improved the accuracy of the results in terms of the depth calculation.

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