Review on Image Processing Techniques to Measure Dimensions of an Object

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Abstract- Image processing is a widely used technique, based on which a number of applications have been developed. One such applications is to measure dimensions of a an object. The methods to measure the dimensions of an object through image processing vary with the features object, size, object shape, object movement, object color and environmental factors. These factors must be considered before applying any method for extraction the dimensions of object through image processing. In this review paper, study of some of such techniques have been discussed.

Keywords: *Dimensions measurement; Object size; RAD; image processing*

I. INTRODUCTION

Numerous applications of image processing have been developed these days, related to find distance of the object and measurement of its size. To reckon the distance and size of an object is useful in many ways like navigation, automated measurement of trees and building, localization of the mobile system.

To avail particular size and distance of an object from an image, a number of researches have been done. Some methods use single vision sensor while some use multiple vision sensors. For an instance, a distance measuring system availing single camera which can calculate distance from camera to person. It is based on the eye-distance technique [6]. When the distortation between camera to person distance occur, the calculations of that distance are reckoned on the basis of variation in pixels of eye distance. A unique method was proposed by Kim et al. who used a rotating mirror along with single camera [1]. A serious of reflected images can be used to acquire the images of an object by placing a camera in front of rotating mirror. Then image processing is done to obtain distance from the images. The technique on which this method relies is that the pixel which at longer distance rotates at a higher speed.

Recently, it had been observed that multiple sensors are being used for the purpose of image acquisition. Most of the researchers used stereo vision technique for multiple sensors. One such example is the method proposed by A-Lin *et al.*, where safe driving distance was calculated by stereo vision [10]. Disparity of the front car has been considered to calculate the distance.

All the above techniques are implemented on object distance, whereas, there are comparatively less techniques to measure the dimensions of the objects in different environmental conditions. To know the object dimensions is equally important as object distance in autonomous system's localization and navigation. Apart from that, it can also be used for the purpose of short term object identification. Three such techniques will be discussed further.

II. OBJECT SIZE MEASUREMENT TECHNIQUES

1. STEREO VISION

The foremost step of this technique is to capture images using stereo vision. Two cameras are required for this purpose with same specifications [11]. They should be placed at fixed distance from each other and should capture images at exactly same instance of time. The methodology used in this technique is as follows:

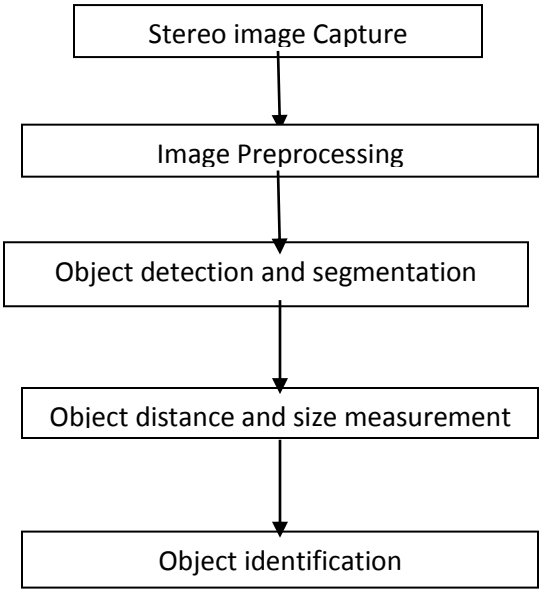

Fig.1. Work flow of methodology of stereo vision

Two video cameras are used for Stereo image acquisition. Also, they should be parallel to each other in fixed position. Calibration of both the cameras has been done to match their properties. These properties are described as lightening

conditions, size and space of color. As soon as the object enters the overlapping view of the cameras, distance and size of objects can be measured.

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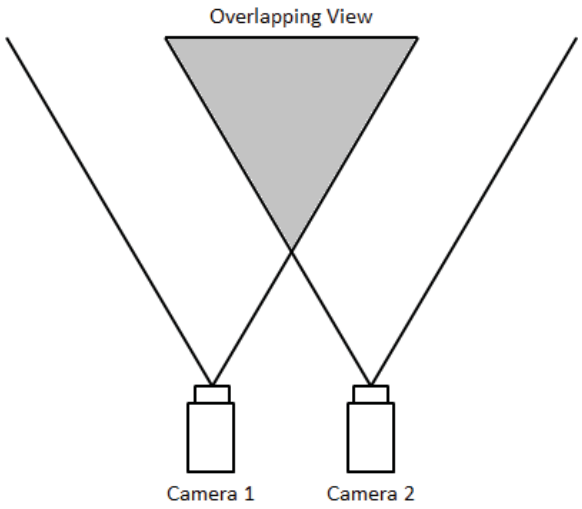

Fig.2. Stereo image capture

Advantages:

1. Simple algorithm is used in the proposed method.
2. The processing speed of algorithms is very fast.
3. The simple techniques like background subtraction and disparity of objects is used. Accuracy of distance and size is precise.
4. 65ms is the average time taken per cycle.

Disadvantages:

- Constant lightening environment is required always.
- Dependency of accuracy on the resolution of camera.
- Difficult to implement in outer environments.

2. TREE HEIGHT MEASUREMENT

In this method, a measuring method of tree height has been introduced which is based on digital image processing technology [7]. Ordinary camera was used to get the tree photos. At the root of the tree and one meter higher, marks were made with red color. Through the digital image processing, the computer extracted the coordinates of the two marker points. Tripod was also fixed at a particular height so that it should be perpendicular to ground. Finally, triangle similarity theorem and direct linear transformation were used to measure the height of the tree.

Tested tree is represented by ABC. Top of the tree is considered to be A. Red marks are represented by points B and C. Whereas, abc is the image plane. So, dimension of the tree is: H = AB + BC

Apart from this, if consideration of lens distortion is not assumed, then the height of the tree in image plane is: h= ab+bc

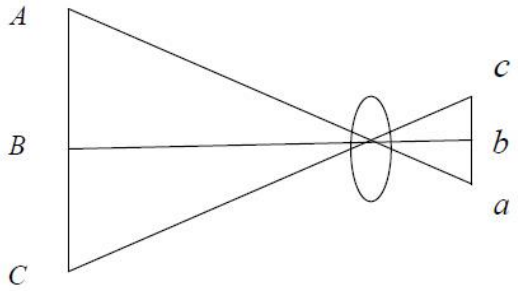

Fig.3: Schematic diagram of tree and camera

Advantages:

- Compared with the manual methods, a digital camera is simple, cheap and easy to avail.
- . This automatic system reduced workload of computers to great extent
- Easy approach on the basis of calculation and storage of data
- Labor work is reduced

Disadvantages:

- Precision of the result depends on the image acquisition and extraction of the coordinates.
- If the background of the tree is complex, the method was not precise enough
- Consideration of the distortion of the lens was also included.

3. Ridge based Distribution Analysis

The concept of the RAD image segmentation relies on the distributions created by a single-colored object which have physically determined form in color histogram-space. A picture is generated by a group of dominant colors (DC), whereas every dominant color is stated by a distribution in histogram-space. In an image, each DC is presented to a linguistics object. RAD is considered as one of the largely quick formula which can extract dominant colors precisely, from bar graph house. This formula has following steps. First, extract ridges as a representative of a DS. Then, a flooding method is performed and DSs from its ridges are seek out [20].

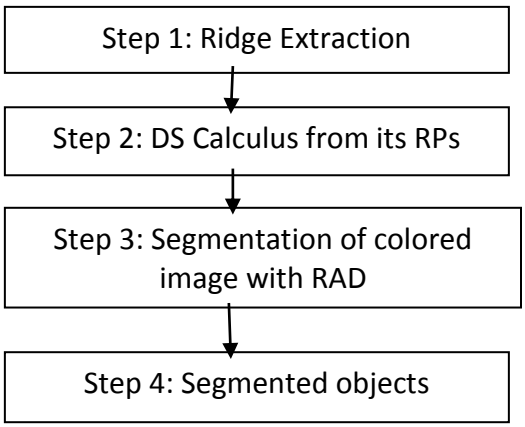

Fig.4: Work flow of RAD segmentation

The proposed algorithm has been divided into four steps. In the first step, buildings images are acquired with the digital camera. In second step, images are preprocessed and enhanced using color enhancement method and median filter. Third step is to segment the images to find out the region of interest using RAD. Height, width, color and size features are extracted in third step. Finally, the dimensions are calculated using Ratio method which is derived from triangle similarity theorem.

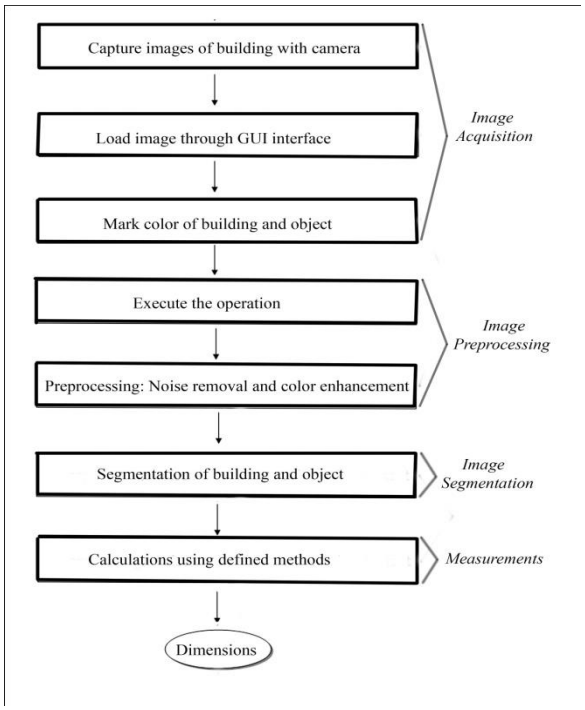

Fig.5: Work flow of the dimension measurement system with RAD

Advantages:

- Considered as better approach of segmentation in the presence of shadows, highlights and other environmental factors.
- High overall accuracy rate of 98.4% and 99.5% corresponding to height and width respectively.
- Simple algorithm and implementation.

Disadvantages:

- Difficult to operate on the buildings with complex structures and backgrounds.

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