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A Review: 3D Image Reconstruction From Multiple Images

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***Abstract:* In this paper we proposed a method to construct a 3D image from the multiple images. We will take two or more image from different angle of a object and then we will construct 3D image with the help of those images. When we take images with single camera then we cannot discriminate that which object is far and which object is near. But when we use multiple camera then we can differentiate that which object is near and which object is far by determining the distance between objects. Basically this method is called Triangulation. By triangulation method we can construct 3D images.**
Keywords: 3D images; Triangulation;

I. INTRODUCTION

Stereovision is a technique for inferring the 3D position of object from multiple views of a scene. To calculate the distance of various points in the scene relative to the position of camera is the most important task for stereovision. When we want to make a 3D image of a scene then we take simultaneous views of the scene with two or multiple cameras. After taking multiple views of scene we determine the distance of various points of the scene with respect to the camera by method of triangulation so that we can differentiate that which point of the scene is near and which point of the scene is far from the camera. By this method we construct the 3D image of scene from multiple simultaneous views.

Calculating the distance of different points in the scene relative to the position of the camera is one of the important tasks for a computer vision system. To calculate the relative distance of the different points in the images we use the principle of triangulation. In this method we use the images from multiple cameras or from single cameras from different angles. At present there is a camera available for commercial use to take picture from different angle and the name of camera is RGB-d camera. This camera works on the principle of triangulation. This camera can differentiate the relative distance of different points on the images. By using RGB-D camera we can get the slices of images and by combining those slices we can make a complete 3D image. So in the process of making 3D structure from multiple 2D images the principle of triangulation is very much important.

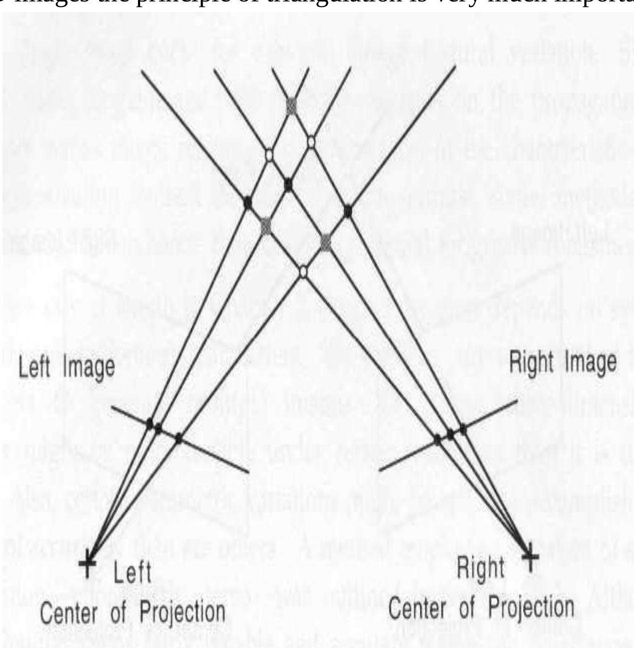

Fig. 1 Triangulation

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Fig. 2 RGB-D Camera

A. The methodology for making 3D image from multiple 2D images can be subdivided into four major steps

1) Obtaining Lambertian Images.
2) Calculating the depth map (Range Image).
3) Generation of Implicit Surface.
4) Generation of actual 3D model.

II. OBTAINING LAMBERTIAN IMAGES

Lambertian images are those set of images which are used to make complete 3D model. These are the images we take from different angle of that object of which we want to make a complete 3D model.These images contains important feature which are very important to construct complete 3D model. We can get Lambertian Images by two methods:

A. Keep the object stationary while rotating the camera around it.
B. Keep the camera stationary while rotating the object about it's center.

The first method is better method than second because it gives better accuracy. Because if we disturb the object then we have to face large drift between the points and then there is more chances to get large error.

III. CALCULATING THE DEPTH MAP (RANGE IMAGE)

Calculating the relative distance of different points of the object is called the process of calculating the depth map. If we take the picture without calculating depth map then we can not differentiate the which point of object is near from the camera and which point of the object is far from the camera. This is used to make illusive pictures but a 3D model can not be obtained.
So to calculate depth map we use the principle of Triangulation. By using this method we calculate the relative distance between different points of the object and then we can get a complete 3D image in which we can differentiate that which point of the object is near from the camera and which point is far from the camera.

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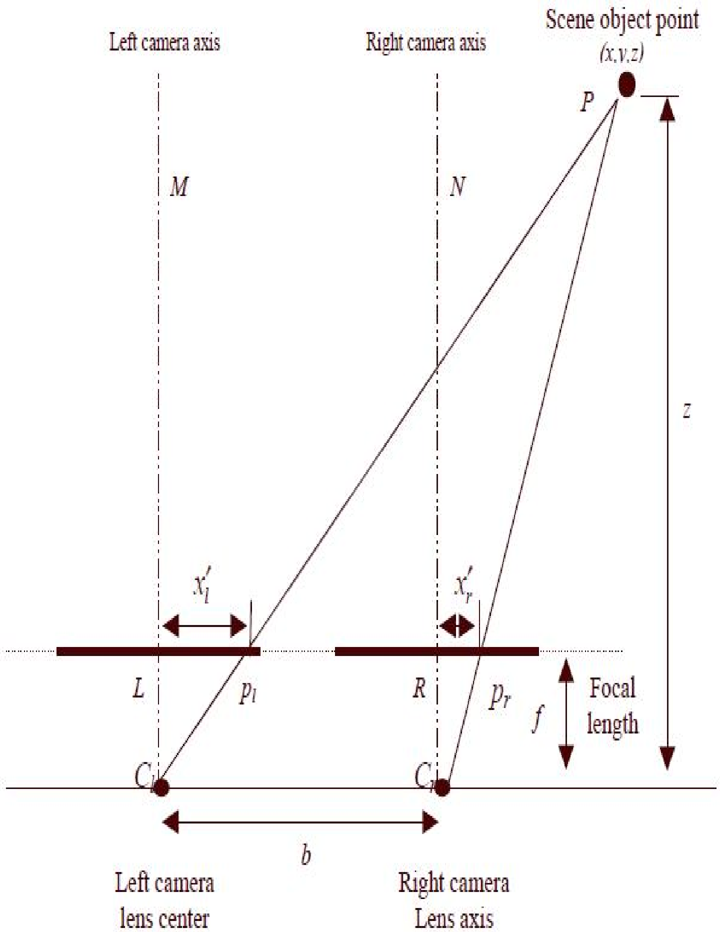


Fig. 3 Calculating depth map

In Figure 2.the scene point *P* is observed at points *pl* and *pr* in the left and right image planes, respectively. Without loss of generality, let us assume that the origin of the coordinate system coincides with the left lens center. Comparing the similar triangles *PMCl* and *plLCj*, we get

$$\frac{x}{z} = \frac{xl'}{f}$$

Similarly, from the similar triangles *PNCr* and *prLCl*, we get

$$\frac{x - b}{z} = \frac{xr'}{f}$$

Combining these two equations, we get

$$z = \frac{bf}{xl' - xr'}$$

IV. GENERATION OF IMPLICIT SURFACE

In this section, we create a large hypothetical cube and we assume that our complete 3D model will be inside this cube. We will combining all the points of the object inside this cube according to their relative distance. We assume the a complete 3D model is a part of this cube and this assumption helps us to combine all the important points of the object and we get a complete 3D image by combining all those points.

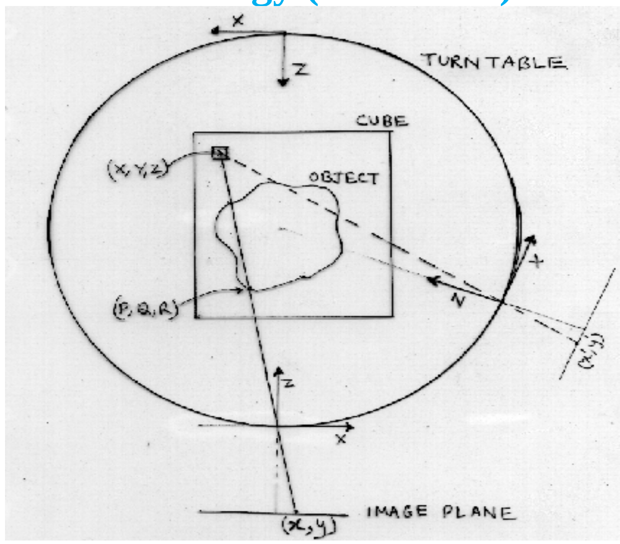
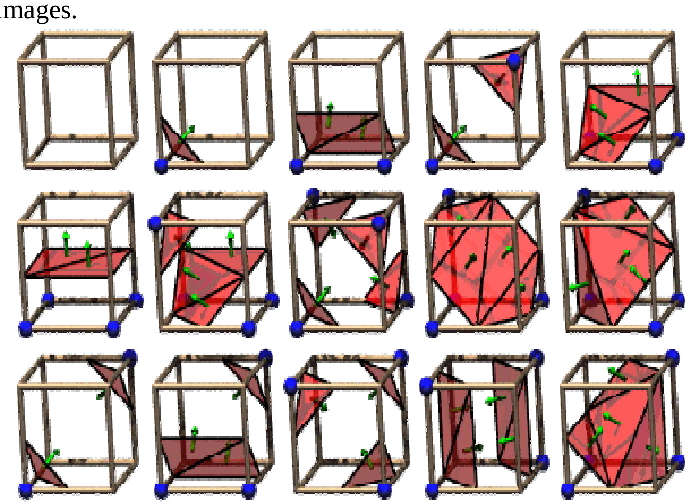


Fig. 4 Implicit Surface

V. GENERATION OF ACTUAL 3D MODEL

This is the final step. In this step we have all the set of lambertian images and we have also the hypothetical implicit surface. Now we combine all these set of lambertian images according to their relative distance and we get a complete 3D object.

We combine all the different portion of the images inside the implicit surface because we assume that the complete 3D model is covered by the implicit surface. This hypothetical implicit surface increase our accuracy and decrease the error in the process of making 3D image from multiple images.



The 15 Cube Combinations

VI. CONCLUSION

This paper proposes a 3D image construction system using the feature information from the front and side 2D images of a image. The integrated system for constructing 3D image involves feature extraction, shape deformation and 3D model construction. After taking 2D photographs, a image feature extraction algorithm was developed to obtain feature points and collect image dimensions. Based on the obtained image dimensions, a 3D template image can be identified for shape deformation. Thus, a customized 3D image can be constructed. In order to evaluate the effectiveness of the proposed system, 15 subjects were scanned and their 3D images were also constructed by using the proposed system. Comparing the constructed 3D images with the original 3D scanning images, the results support the effectiveness and robustness of the proposed system. Additionally, the mechanism of interactively morphing of 3D image was developed. Moreover, the constructed 3D image can further be used for customized product design and dynamic virtual simulation.

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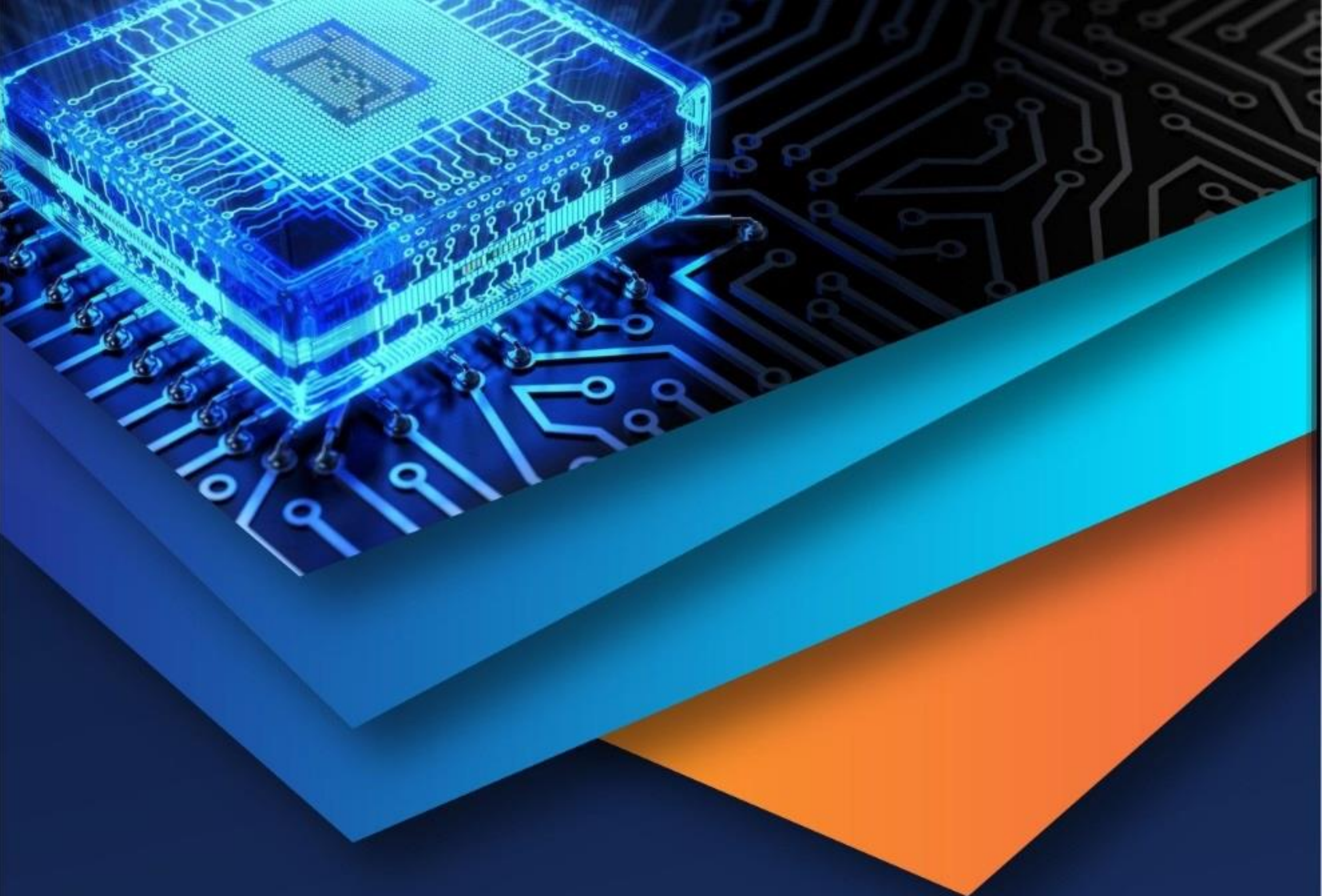

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