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Original Research Article

3D RECONSTRUCTION USING LASER CAMERA O3D200[1]

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Abstract- In this paper, we do the 3D reconstruction for volume computation of an object by using distances of object obtained from O3D200 laser camera. This process requires 3D view of the object from the O3D200 laser camera and high resolution 2D image of the object. In this we use scaling technique in which the two images are superimposed on each other and common points are matched and the missing points are interpolated.

Keywords - 3D camera, O3D200, 2D camera, 3D view, interpolation, correspondence, volume, reconstruction.

I. Introduction

This project aims at 3D reconstruction of any desired object using the IFM O3D200 camera. Using the 3D view we can compute the volume of any desired object or area. 3D view is also important in industrial applications and automated systems. Today in India large amount of water gets wasted due to misestimating of trench and channel capacity.

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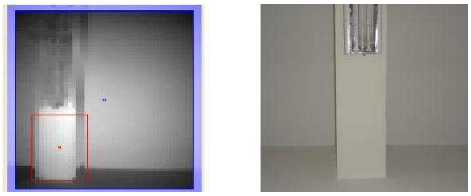
So a technique is required to be developed which requires minimum efforts for obtaining measurements.

3D reconstruction is matching or correspondence of points and interpolation of missing points in two images. The 3D reconstruction technique first considered was Triangulation[2] in which we take images of the object from two different views. Then the points are matched in the two images and we calculate the distances from the coordinates of the matched points. These distances are called as disparities.

But by using 03D200 camera we directly get the distances of the object from the camera and the drawback of triangulation i.e. calculation of disparity is removed.

II. 3D Reconstruction Method



a) 3D Image b) 2D image

Fig. 1: 3D image a) and 2D image b) of a beam and ceiling

From the two images we can clearly see that the image obtained from the 3D camera is of much lower resolution than the image obtained from the 2D camera. If the image obtained from the 3D camera was having resolution as high as that of the image obtained from 2D camera there was no need to go for 2D camera. But as the resolution of 3D camera is much lower, we require high resolution 2D camera.

A. Image Registration[3]

Image registration is the process of aligning the two images i.e. the 2D and 3D image. It involves integrating the images to create a composite view and extracting information that would be impossible to obtain from a single image.The most important steps for registration of an image are feature detection and feature matching.

a) Clear sky b) Detailed sky c) image registration

Fig. 2: Clear sky a), detailed sky b) and combination of the two images c) image registration

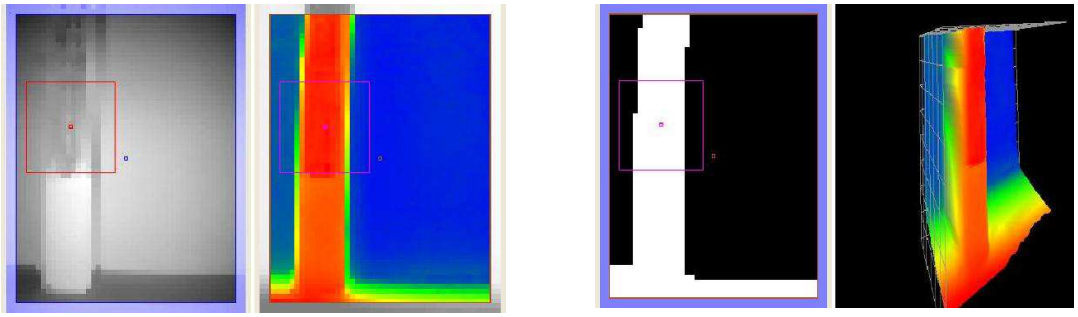
The first image is of the clear sky and a roof top, in second image the details are added to the sky. The two images are integrated together in third image. This is called as image registration. Image registration allows adding up of details.

B. Interpolation

In the figure 1, the image from 2D camera is of resolution 1000x800 pixels while the image from 3D camera is of 64x48 pixels. So the 3D image must be enhanced 14 times to match its resolution with the 2D camera. The differences in resolution of the images can be overcome by interpolation of depth at the in between points i.e. around 14 points have to be interpolated. This helps us to get the fine details of the object and we get a highly refined 3D image which can be used for volume computation, estimation of capacities etc.

III Experimentations and Results

Using the 3D Laser camera and the efector pmd3D software we obtained the 3D views of many objects and the distances of the objects from the camera.



a) intensity image b) distance image c) segmentation d) perspective image

Fig.3: Different formats of the images of a beam and ceiling

In the distance image the different colors indicate the different distances. The red color specifies the parts closer to the 3D camera while the blue color specifies the parts farther from the 3D camera. We also obtained the distances of objects from the O3D200 camera in the .csv format.

IV. Conclusion

O3D200 camera gives us distances of the object from the camera this makes the z co-ordinate available which in turn makes the 3D reconstruction simpler. In case this wouldn't have been available we would require many images from different angles and the conversion of this data into a 3D model would be very difficult task.

V. References

1. "O3D2xx Programmers Guide - programming guidance", by ifm.
2. "Triangulation based 3D imaging and processing method and system", by Ronald J Svetkoff - a technique for reconstruction (Patent No: 5546189 Filing date: May 19, 1994)
3. "http://en.wikipedia.org/wiki/Image_registration".