A New Approach For 3D Image Reconstruction From Multiple Images

Rahul Dangwal
(M.E. Student),
Department of E.C.E, PEC University of Technology
Chandigarh-160012, India.

Dr. Sukhwinder Singh
(Supervisor),
Department of E.C.E, PEC University of Technology
Chandigarh-160012, India.

Abstract
In this paper we explained a new algorithm for reconstruction of 3D image from multiple 2D images. In this algorithm we match the feature of each points of different 2D images and then we construct the complete 3D model by combining those points of all the required 2D images. In this paper, we explained a very accurate process to combine various point clouds by SIFT (scale invariant feature transform). This method will decrease the drift problem in the 3D image reconstruction. In this process firstly we take set of 2D images which are captured from different angles of the object and then we make an array of those 2D images. Now we extract the feature of each point of those images and compare different points of all the images. After this we refine the images means we remove all the irregularities of those 2D images and remove unwanted points from those 2D images otherwise there may be some error in 3D model. This method is very effective because by using this method we remove the drift problem which we face during the reconstruction of 3D model of any object.

I. INTRODUCTION
In the present age, importance of 3D image reconstruction from the real world 2D images are becoming very popular. Reconstruction of 3D image from 2D image is
very complex process. Basically in this process we find the feature of each points of required 2D images. To get the exact position of any point we use the principle of Triangulation. In triangulation we capture the 2D images from different angle and then we find exact 3D co-ordinates of any point of the image. In this paper, we explained a very accurate process to combine various point clouds by SIFT features. This method will decrease the drift problem in the 3D image reconstruction. The process of making a 3D model consists of various steps such as collecting 2D images, refinement of images, generation of point cloud, feature extraction and then generate the complete 3D model.

When we make a complete 3D image from multiple 2D images then firstly we take a set of 2D images. These 2D images are taken by a special camera called RGB-D camera. This camera works on the principle of triangulation and by using this camera we can find the exact 3D co-ordinate of any point. If we take image from a simple camera then we cannot find the exact 3D co-ordinate of any point so we cannot find that which point of object is near from the camera and which point of the object is far from the camera. Basically RGB-D camera gives the relative distance of different point of the object. Determining the 3D co-ordinate of any point of object is called the depth measurement.

The reason behind popularity of 3D image reconstruction is its immense use in the field of medical, graphics, movies, animation, digital image processing, 3D photography etc.

![Fig. 1 Flowchart of the general 3D reconstruction system using a hand-held RGB-D camera](image)
II. DEPTH IMAGE REFINEMENT

Depth image refinement is basically a process of determining the exact relative distance between 2D images which are taken from different angle. Sometimes due to noise we are unable to determine the exact distance between two points due to which we suffer from drift problem in 3D model.

To remove any drift in 3D model it is very necessary to determine the exact relative distance between two images. This process is done by the Triangulation principle.

![Fig. 2 Triangulation](image)

This process is done by RGB-D camera. RGB-D camera is basically the combination of two or more than two cameras. It capture the images from different angle of the object and then we fine the relative distance between different points and merge them to make complete 3D model.

![Fig. 3 RGB-D Camera](image)

III. 3D WRAPPING

This is the process of wrapping all the images into an 3D array. In this process we combine all the 2D images according to their position and then we check the dimensions of all the images. The dimension of all the images should be perfect
otherwise we will get distorted image because if the dimension of images is not identical then we cannot combine the point of different images and we will get large amount of drift.

Basically wrapping is the process of image refinement because in this process we make the size of images identical so that we can compare all the common points and by determining the relative distance between points we merge those all the points and get a complete 3D model.

IV. POINT CLOUD

After getting the array of all 2D images we extract the informative points from the array of 2D images. These are the points which will be used to make actual 3D model and information about these points are very important to construct a complete 3D image. When we take images from different angle then due to noise there are so many irrelevant points in the images. Those irrelevant points are not necessary for us. So we use only necessary points and extract the information about only relevant points.

When we combine all the important points of the object then we get a dense set of points which are used to construct a 3D model. This dense set of point is called Point cloud.

In this point cloud all the points are arranged according to the exact relative distance which is determined by the Triangulation principle with the help of RGB-D camera. The most important thing about point cloud is that it should consists of only informative points which are necessary to make 3D model otherwise we will get some error due to unwanted points.

V. 3D MODEL REGISTRATION

In a point cloud we get a set of points which are very important to make 3D model of object. In the process of 3D model registration we compare the position of neighbor points of each other and we match the feature of those points. If any point is not in the exact location then we refine those points and set those points in their exact location.

While matching the feature of those points if we find that any point is not in the exact position we shift that point and we set that point at appropriate location.

Basically in this process each point of point cloud registered in their actual 3D position according to measurement of the RGB-D camera.

When we compare adjacent point then we check that variation between the adjacent points should not be large. If the variation between the adjacent point is very large it means the is presence of noise or there may be some missing point or may be points are displaced from their exact position. If we do not remove this problem then we will face the large drift problem in complete 3D model of object and the accuracy of our process will be very low.
VI. 3D MODEL REPRESENTATION
After getting exact position of each point of all the images now we combine all the points of point cloud to make a complete 3D model. We merge all the important informative points and get a complete 3D model of the object.

Fig.4 Reconstructed 3D model

VII. CONCLUSION & FUTURE WORKS
In this paper we explained a new approach to make 3D model of an object by SIFT feature algorithm. This method solved the object drift problem by reducing the error which are generated by unwanted points (noise). But the major disadvantage of this approach is that this process does not remove the error in color pattern. If there is any error in the color contrast then it cannot be removed by this approach. So we can work further to remove this problem by applying some modification.

REFERENCES


