ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 7, July 2016

A Hybride Filtering Approach for Surface Reconstruction

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***Abstract*— Surface reconstruction means that to get back the data by scanning an object using a device such as laser scanner and construct it employing computer to gain back the soft copy of data on that particular object. Surface reconstruction is reverse method. It is very appropriate when on a particular object original data is missing without doing any backup. . We establish a system for image reconstruction from scattered cloud points. Crust algorithm with umbrella and partical Filtering will be implemented. Crust algorithm shows an important role due to its guaranteed quality of triangular mesh generation. Crust algorithm monitors many parameters of mesh generation and evaluates the performance of the algorithm by calculating parameters. The main goal of the algorithm is to filter out left insignificant data while sustain an acceptable level of output quality.**

Keywords_ Surface Reconstruction, Crust Algorithm,Partical Filtering, Umbrella Filtering, Point Clouds, 3D..

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I. INTRODUCTION

1.1 Defination

Surface reconstruction is process in which atoms at the surface of a crystal consider a different structure i.e the bulk. Surface reconstructions are important they help in the understanding of surface chemistry of different materials, especially in the case of where another material is adsorbed onto the surface.

1.2 Basic Principles

The equilibrium position of infinitecrystal of each individual atom is determined by the forces applied of all the other atoms of the crystal, resulting of a periodic structure. If the surface is introduced to the system by achieveing the crystal given a plane, forces are altered, changing the equilibrium positions of the remaining atoms. This is most notable for the atoms of near the surface plane, as they now only experience inter-atomic forces from one direction. This is unbalance results in the atoms near surface assuming positions with different spacing and symmetry from the bulk atoms and genrate a different surface structure. This change in equilibrium positions close the surface can be accumulation either a relaxation or a reconstruction.

Manuscript received July,2016.

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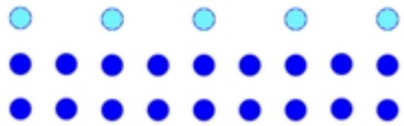

Example Reconstruction

Relaxation is used to change the position of total layers of atoms relative to the bulk positions. Often this is strictly normal relaxation i.e the surface layers go in a direction normal to the surface plane, normally resulting of smaller than interlayer spacing. This makes unlogical sense, as a surface layer that experiences no forces of open region can be expected to the contract upwards the bulk. Most metals experience has type of the relaxation.[1] Some surfaces also experience of relaxation of the lateral direction as equally the normal, so that the upper layers is shifted to further layer in order to minimize the positional energy.

Surface Reconstruction is the process to change of the two dimensional structure from the surface layers, in addition of changes in the position of the complete layer. For example, in a cubic material of the surface layer might restructure itself to speculate a smaller two dimension spacing between the atoms of the forces from adjacent layers are decrease. The general symmetry of a layer may also change, in the case ofPt (100) surface, which reconstructs of a cubic to a hexagonal structure.[2] A surface reconstruction can be affect one or more layers at the surface and either conserve the total number of the atoms in a layer (a conservative reconstruction) have a greater and lesser number in the bulk (a nonconservative reconstruction).

A 3D object surface reconstruction from the sample of points has a wide range of applications like computer aided design (CAD), medical imaging, virtual reality, and movie industry. The sample of points used for reconstruction can be explained as structured or unstructured depend on the connectivity information between points, according to the sampling device used [1]. We concentrate to the unstructured approach, where the input data are point clouds in the space. A real surface and a set of points sampled from it is given, the aim is to create a surface model approximating the real model. Hence, the desirable surface reconstruction algorithm should be able to recover both geometry and topology to fit the data correctly.

Fig. 1 shows computational flow diagram.In this, First, the input sample points (assumed to be without any information is present to grid cells, employing cloud in cell (CIC) interpolation (first step in Fig. 1).(Step 2) execute aggregation of the sample points from computing standardize-membrane potentials on the grid.Alabeling algorithm, which move increasing paths of the scalar field (begning from the bounding box and marching from the data points) are used to compare the grid points into outside and inside of the surface, thus defining an implicit surface (step 3). Prior of polygonization, we take diffusion potentials, but at this time with the purpose of producing a smooth implicit surface. Then, employing Bloomenthal's polygonizer to turn implicit surface into triangulated one (step 4), and take a mass spring system, improvement with a bending energy minimizing term, in the order to obtain a larger degree of surface smoothness (step 5)[4].

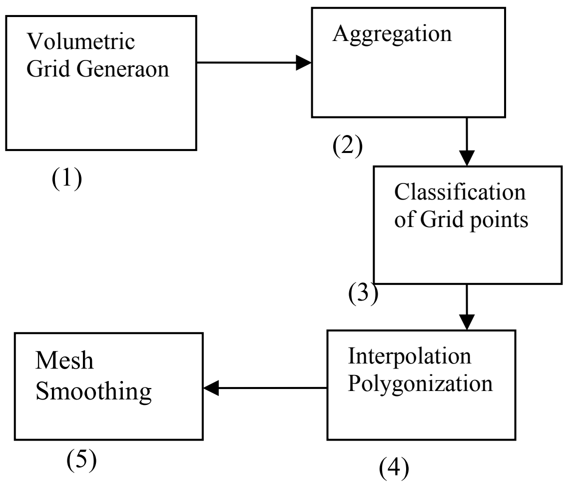

Figure 1.1 : Flow diagram for proposed surface reconstruction method.

The past few decades have more applications of 3D data acquisition technologies. For example, in the computer graphics is needed to capture complex 3D shapes on site employing portable laser scanner for computer modeling and animation. X-rays, Computed Tomography and Magnetic Resonance Imaging (MRI) scanning are difficult data acquisition applications in the medical field. In all applications, data sources of different data acquisition devices consist discrete sampling data, which could be divided into different categories are unorganised data, contour data, volumetric data and range data . Convert discrete sampling data of the physical object into the continuous surface of digital in computer is called surface reconstruction[8].

The discrete sampling data has more resolution to shows the scanned model surface, surface reconstruction would be retrieve topology and geometry of model surface. The general pipeline to the 3D data acquisition and processing of the first physical object in the real world to the final digital model in computer-world is represents in Figure 2. The first stage include acquisition of discrete sample from a physical object by 3D data acquisition system .The geometric model in place, different application limited modeling and the digital processing can be launched in the third stage. The stages of the data acquisition and processing, surface reconstruction stands out the more significant and challenging task is obtaining the digital model by the physical object[8].

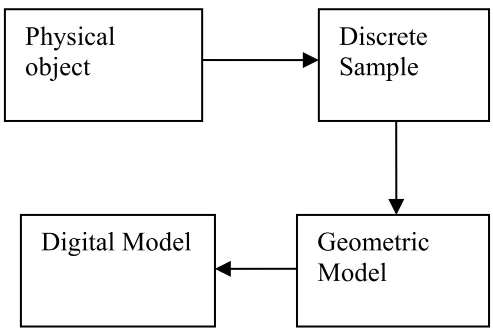

Figure 1.2 : The General Pipeline of 3D Data Acquisition and Processing.

II. METHODOLOGIES

Mesh Viewer:

The Mesh Viewer is an easy to use light weight application for display three dimensional models (triangular meshes) from variety of the file formats. Triangular meshes can be displayed texture mapped (optional using bilinear filtering), solid or a wire frame (all lines or just the front lines). The surface normals of the triangles can be showed optionally. Loaded models can be rotated ,retranslated and scaled (all done with the mouse). The model is lighted through multiple light sources. Viewpoints can be saved. Screen shots of the model can be taken.

The GNU Compiler Collection (**GCC**) is a compiler system generated through the GNU Project supporting various programming languages. GCC has been adopted the standard compiler through most other modern Unix-like computer operating systems, including Linux.

Tool Used in Implementation: We can use UBUNTU 11.10 operating system to formulate our problem. Ubuntu is a computer opearating system depend on the Debian Linux distribution and distributed free and open source surface, using its own desktop environment.

PROPOSED WORK

Problem Formulation

- **Missing Some Point Normal:** The points may not be provided using point normal, which is predict the orientation of the local shape.
- **Incomplete Sampling:** The surface may not be good sampled. This commonly goes to holes, that are to be filled to additional efforts.
- **Holes:** Holes from the not enough sampled regions, may need to be filled.
- **Boundaries:** The boundary of the surface need to be preserved.
- **Non Manifold Surface:** It consider surface junctions and boundaries, which cannot be reconstructed correctly employing the surface reconstruction algorithms.
- **Fair Mesh:** The triangles of resulting mesh should be well shaped. It is need through some follow up operations of the mesh, like Finite Element Analysis.
- **Noisy Points:** The location to points may be disturbed through unknown levels of noise.
- **Sharp Features:** Sharp edges secure and corners should be preserved, still they break the assumption to smoothness[8].

Proposed Work

Surface reconstruction is to find a surface from a given finite set of geometric sample values. In more applications, the sample values are points. Reverse engineering to geometric shapes is the process of convert a large number of measured data points into concise and consistent computer representation. The "feature points" techniques are used to produce mesh from the extraction points. The present work is to genrate a system for image reconstruction from scattered cloud points. Many algorithms like crust algorithm and Delaunay algorithm will be presented and compared of time taken by the algorithm for surface reconstruction.

The objective of the thesis work is to produce a system of image reconstruction from scattered cloud points. Crust algorithm with particle & umbrella Filtering will be utilized and compared for time taken through the algorithm for surface reconstruction. The main task is to reduce computational time.

IV. RESULTS AND ANALYSIS

This approach is implemented in C language and the software used is ubuntu. The output is produced in geomview software which is employed for displaying 3 dimensional objects. In my thesis initially calculate the number of bad poles by using enhance crust algorithm with particle & umbrella Filtering will be implemented and compared for time taken by the algorithm of surface reconstruction. The main task is to reduce space complexity. After that applying the filtration to produce the smooth surface.We can determine the

ISSN: 2278 – 909X
International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)
Volume 5, Issue 7, July 2016

smoothness of the surface when number of bad poles reduces to the minimum value of R.

Table 4.1 Computation of Bad Poles using Crust Algorithm of Image Bunny.

	SIZE
Original Size	5313931
R	File Size in KB
0.1	3510632
0.2	4875884
0.3	5194996
0.4	5262854
0.5	5294721
0.6	5309082
0.7	5312626

This table shows that the original value of Bunny image and the different noise threshold value R is used to estimate whether vornoi cells are well shaped or not .As the threshold value increases the number of bad poles decreases and . As the number of bad poles reaches to minimize which shows that the surface is smooth and filter out the insignificant data.

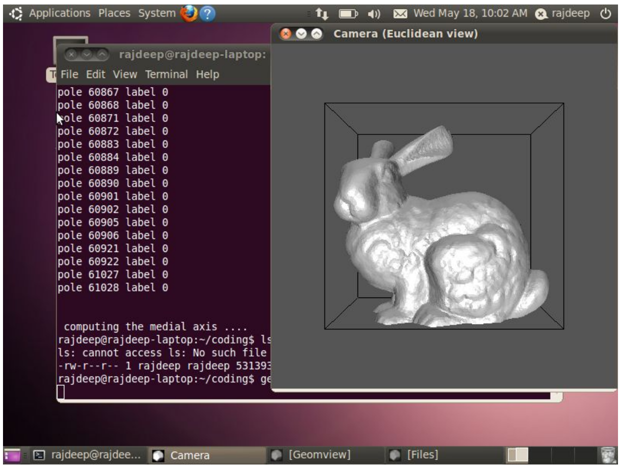

Figure 4.1 : Snapshot of Image bunny original size is 5313931.

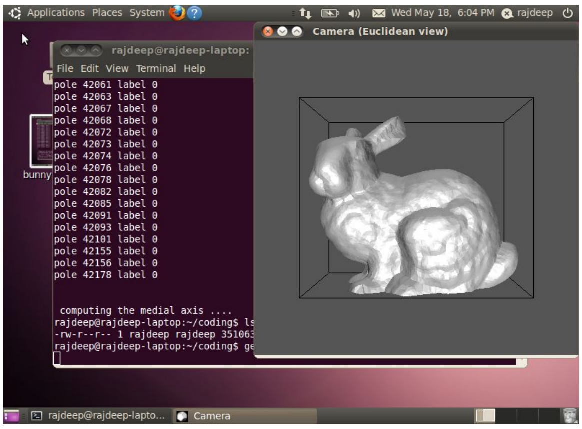

Figure 4.2 : Snapshot of Image bunny where R value is 0.1 3510632 .

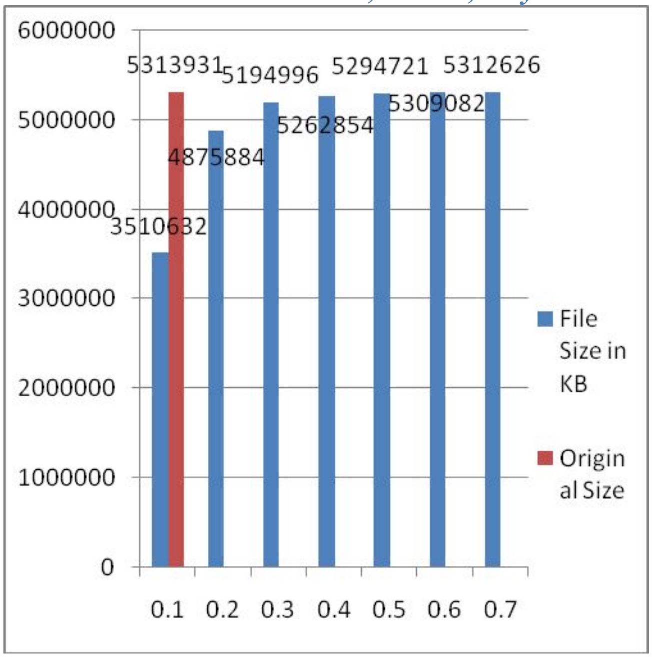

Figure 4. 3 : Performance Evaluation of Number of Bad Poles of Image Bunny.

This graph shows the number of bad poles compared with value of noise threshold. Initially the image is noisy and number of bad poles is very large. After filteration the value of threshold increases the number of bad poles decreases and reduces to minimize which represents that surface is smooth on the threshold value 0.1 .

Table 4. 2: Computation of Bad Poles using Crust Algorithm of Image knot.

	SIZE
Original size	390289
R	File size in kb
0.3	3743
0.4	153784
0.5	279770
0.6	388920
0.7	390286
0.8	390287
0.9	390288
1	390288

This table shows that on the different noise threshold value the number of bad poles changes .The threshold value increases the number of bad poles decreases. As the number of bad poles reaches to minimum which shows that the surface is smooth and filter out the insignificant data.

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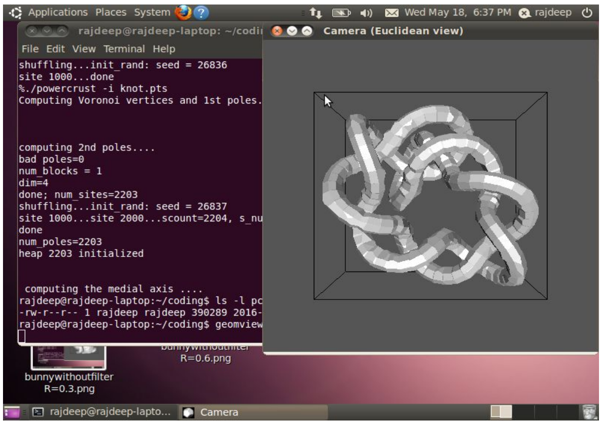

Figure 4.4 :Snapshot of image knot original size is 390289.

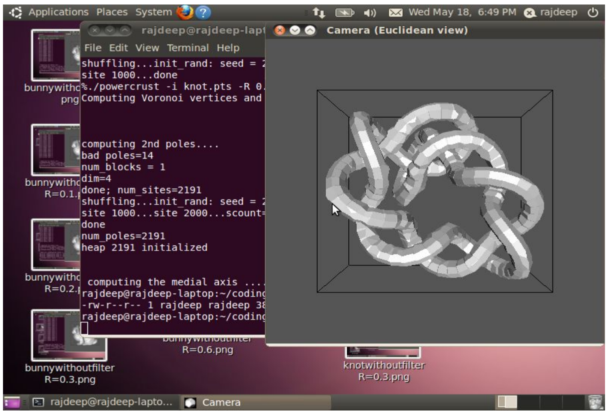

FIGURE 4.5 : R VALUE IS 0.6 AND SIZE IS 388920.

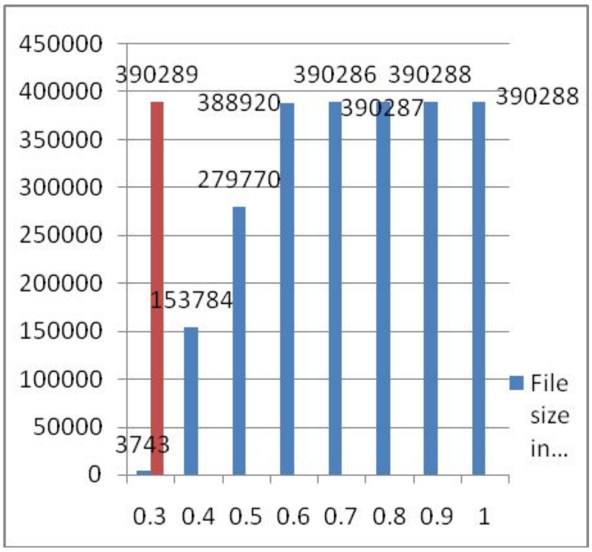

Figure 4. 6: Performance Evaluation of Number of Bad Poles of Image knot.

This graph represents the number of bad poles compared with noise threshold value. Initially the image is noisy and number of bad poles is very large. After filteration the value of threshold increases the number of bad poles decreases and reduces to minimize which represents that surface is smooth on the threshold value 0.6 .

Table 4. 3: Computation of Bad Poles using Crust Algorithm of Image hotdogs.

	SIZE
Original size	2103140
R	File size in kb
0.1	428562
0.2	2035057
0.3	2100255

This table shows that on the different noise threshold value the number of bad poles changes .The threshold value increases the number of bad poles decreases. As the number of bad poles reaches to minimum which shows the surface is smooth and filter out the insignificant data.

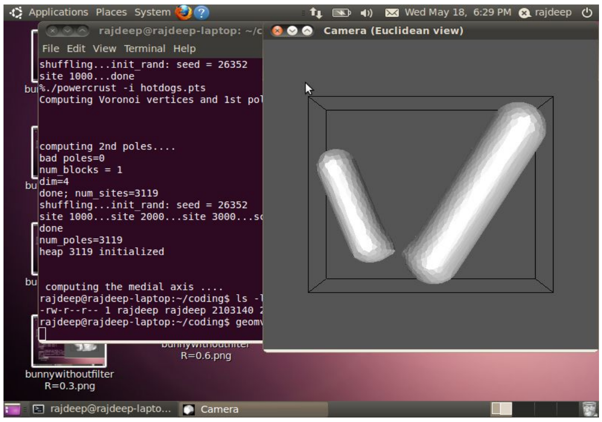

Figure 4.7 : Snapshot of image hotdogs without using R and size is 2103140.

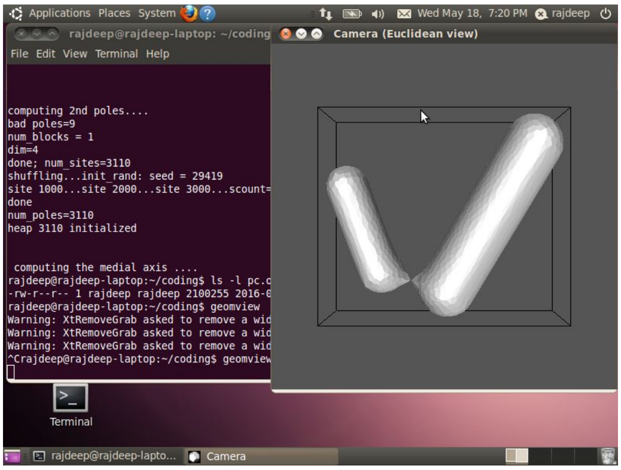

Figure 4.8 : R value is 0.3 and size is 2100255.

ISSN: 2278 – 909X
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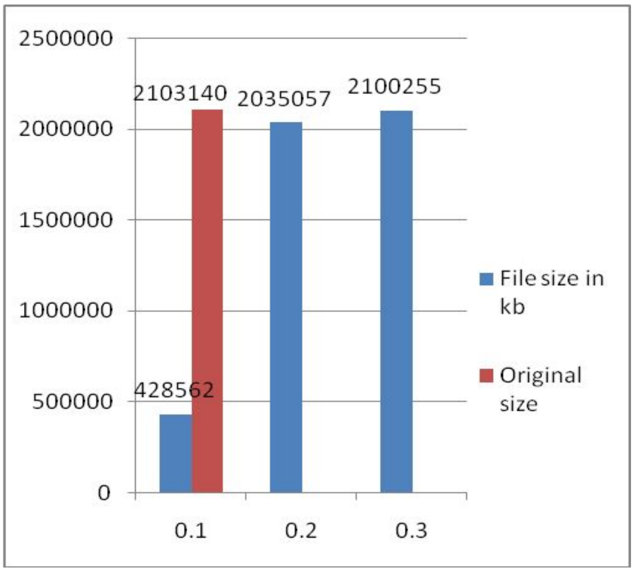

Figure 4.9: Performance Evaluation of Number of Bad Poles of Image hotdogs.

This graph shows the number of bad poles compared with noise threshold value. Firstally the image is noisy and number of bad poles is very large. After filteration the value of threshold increases the number of bad poles decreases and reduces to minimize which shows that surface is smooth on the threshold value 0.3 .

V. CONCLUSION AND FUTURE PERSPECTIVE

CONCLUSION

Crust algorithm optimizes the mesh reconstruction system from 3D point cloud and it presents the settings and execution of times. Crust algorithm plays an important role due to its guaranteed quality of the mesh generation. It declare optimization of mesh reconstruction system from 3D cloud point.

Crust algorithm monitors the various parameters of mesh generation and calculate the performance of the algorithm by calculating parameters. The main goal of the algorithm is to filter out left insignificant data while preserving an acceptable level of output quality.

Crust algorithm computes orientation of the image. After filteration the number of bad poles can be calculated depend on the number of original size can be improved. Smooth surface can be obtained when the number of bad poles reaches to minimize.

FUTURE ASPECTS

In this thesis we use geomview software which support only .off extension file format which is the main limitation. We can enhance algorithm by applying other image extensions used so that the algorithm is reliable.

VI. REFERENCES

[1] Agostinho de Medeiros Brito Júnior, “An Adaptive Learning Approach for 3-D Surface Reconstruction From Clouds”, IEEE Transactions on Neural Networks, 2007.

[2] Andrei C. Jalba and Jos B. T. M. Roerdink Senior Member, “Efficient Surface Reconstruction using Generalized Coulomb Potentials,” IEEE Transactions on Visualization And Computer Graphics, Vol. 13, No. 6, November/December 2007.

[3] Agostinho de Medeiros Brito Júnior, Adrião Duarte Dória Neto,, “An Adaptive Learning Approach for 3-D Surface Reconstruction From Point Clouds”, IEEE Transactions On Neural Networks, 2008.

[4] Andrei C. Jalba and Jos B. T. M. Roerdink, “Efficient Surface Reconstruction From Noisy Data Using Regularized Membrane Potentials”, IEEE Transactions On Image Processing, Vol. 18, No. 5, May 2009.

[5] Vikas Chauhan, Manoj Arora, “Comparison of Delaunay Algorithm and Crust Algorithm for the Optimization of Surface Reconstruction System”, Advances in Applied Science Research, 2011, 2 (6):483-487.

[6] Shitu Bala, 2Gianetan S. Sekhon, “A Comparative Study of Surface Reconstruction Algorithms based on 3D Cloud Points Delaunay and Crust Triangulation”, ISSN : 0976-8491(Online) | ISSN : 2229-4333(Print) IJCST Vol. 2, Iss ue 4, Oct . - Dec. 2011.

[7] Yi-Ling Chen, Student Member, “An Orientation Inference Framework for Surface Reconstruction From Unorganized Point Clouds”, IEEE Transactions On Image Processing, Vol. 20, No. 3, March 2011 .

[8] Shivali Goel1 & Rajiv Bansal2 “Implementation Of Surface Reconstruction Using Scattered Point Cloud With Crust Algorithm”, International Journal of Computer Science and Engineering (IJCSE) ISSN 2278-9960 Vol. 2, Issue 4, Sep 2013, 185-190.

[9] Min Wan, Yu Wang, “Reconstructing Open Surfaces via Graph-Cuts”, IEEE Transactions On Visualization And Computer Graphics, Vol. 19, No. 2, February 2013.

[10] Matthew Berger1 Andrea Tagliasacchi2, “State of the Art in Surface Reconstruction from Point Clouds”, EUROGRAPHICS 2014/ S. Lefebvre and M. Spagnuolo.

[11] Peter Ondr´uˇska, Pushmeet Kohli, “MobileFusion: Real-time Volumetric Surface Reconstruction and Dense Tracking On Mobile Phones”, DOI 10.1109/TVCG.2015.2459902, IEEE Transactions on Visualization and Computer Graphics.

[12] Mincheol Yoona, Yunjin Leea, “Surface and normal ensembles for surface reconstruction”, Science Direct , Computer-Aided Design 39 (2007) 408–420 , February 2007.

[13] Ravikrishna Kolluri, “Spectral Surface Reconstruction from Noisy Point Clouds” , Eurographics Symposium on Geometry Processing (2004).

[14] Ran Gal, “Surface Reconstruction using Local Shape Priors” , EUROGRAPHICS ’0x / N.N. and N.N. The Eurographics Association 2007.

[15] Michael Kazhdan. “ Poisson Surface Reconstruction”, Eurographics Symposium on Geometry Processing (2006) .

[16] Joaquim Peir, “Automatic reconstruction of a patient-specific high-order surface representation and its application to mesh generation for CD calculations”, Medical and Biological Engineering and Computing manuscript.

[17] TODD E. ZICKLER, “Helmholtz Stereopsis: Exploiting Reciprocity for Surface Reconstruction”, International Journal of Computer Vision 49(2/3), 215–227, 2002.

[18] Ady Ecker, “Semidefinite Programming Heuristics for Surface Reconstruction Ambiguities” , D. Forsyth, P. Torr, and A. Zisserman (Eds.): ECCV 2008, Part I, LNCS 5302, pp. 127–140, 2008.

[19] Yunbao Huang, “Dynamic B-spline surface reconstruction: Closing the sensing-and-modeling loop in 3D digitization”,Science Direct Computer-Aided Design 39 (2007) 987–1002.

[20] Deep Chandra Chaurasiya, “B-Spline Surface Reconstruction by Control Point Optimization using Genetic Algorithm”, International Journal of Mechanical and Industrial Technology (IJMIT) Vol. 1, Issue 1, pp: (31-39),March 2014.