Laboratory of Natural Information Processing

DA-IICT Gandhinagar

3DNA PRINTER

User Manual

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Credits & Team

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Acknowledgements

General Information

Introduction

3DNA Printer is a software that can be used to generate any arbitrary 3D DNA structures using structured algorithmic self-assembly. In this software user have to just import any 3d .obj file which can easily be obtained from any software like Autocad, Maya etc. In this we have default used M_13 scaffold for the structures but the user can use any of the random sequence in place of it. Using this software we have successfully modeled various complex structures like tetrahedron ,octahedron etc.

This manual assumes that the user is familiar with the basics of DNA base pairing. The reader should refer to Designer nanoscale DNA assemblies programmed from the top-down approach for further technical details on the language semantics.

Installing 3DNA

The software can be installed from the website **http://www.guptalab.org/3dnaprinter**

Getting Started

Once you have successfully installed the software, open 3DNA Printer by double clicking on the application, you will be prompted with a welcome screen with different options on the menu bar.
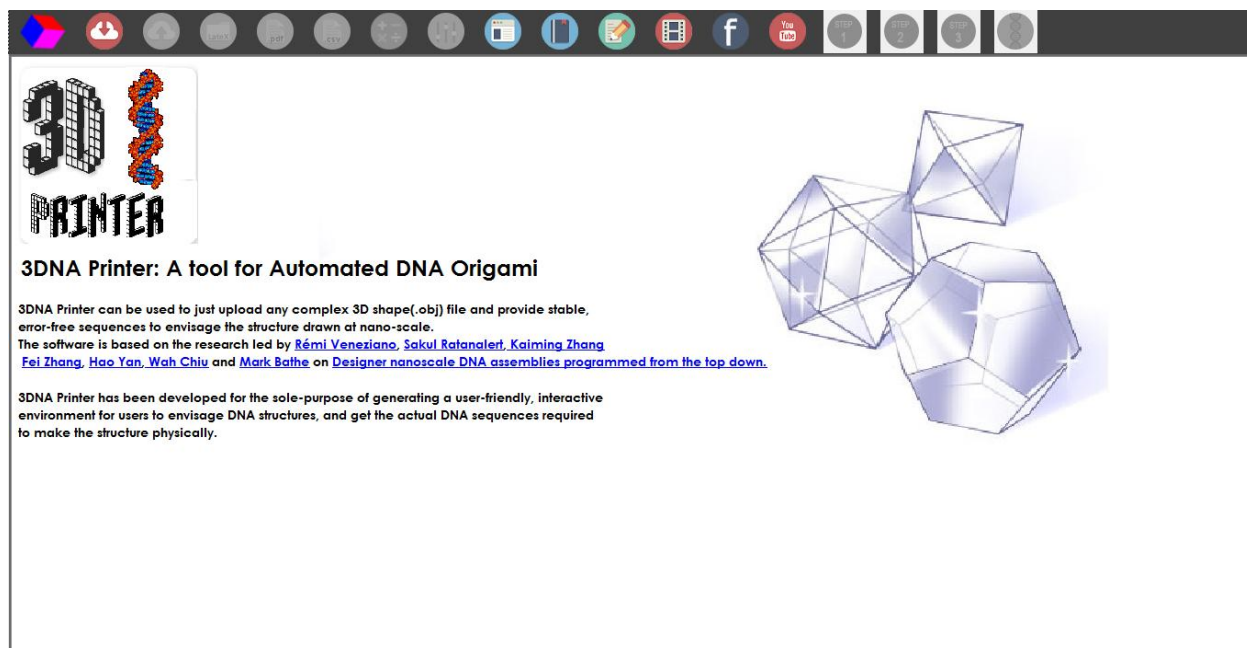

Figure 1: 3DNA Printer Welcome Screen

The main features that the software provides the user with and which are spanned across these four options on the menu bar are:-

- Polyhedra mesh generation.
- Step 1 (Spanning tree generation of the Polyhedra mesh)
- Step 2 (Eulerian Circuit Generation)
- Step 3 (Generate DNA Sequences)
- Generate Sequences Directly
- Fare Estimator
- Social Media Options

Polyhedra Mesh Generation

This option can be selected by clicking on the "Import File" button on the top left side of menubar which can be seen in figure below. After selecting the proper (.obj) extension file of any 3d object, we can see the corresponding 3D object on the screen and also can rotate it as shown in figure below.
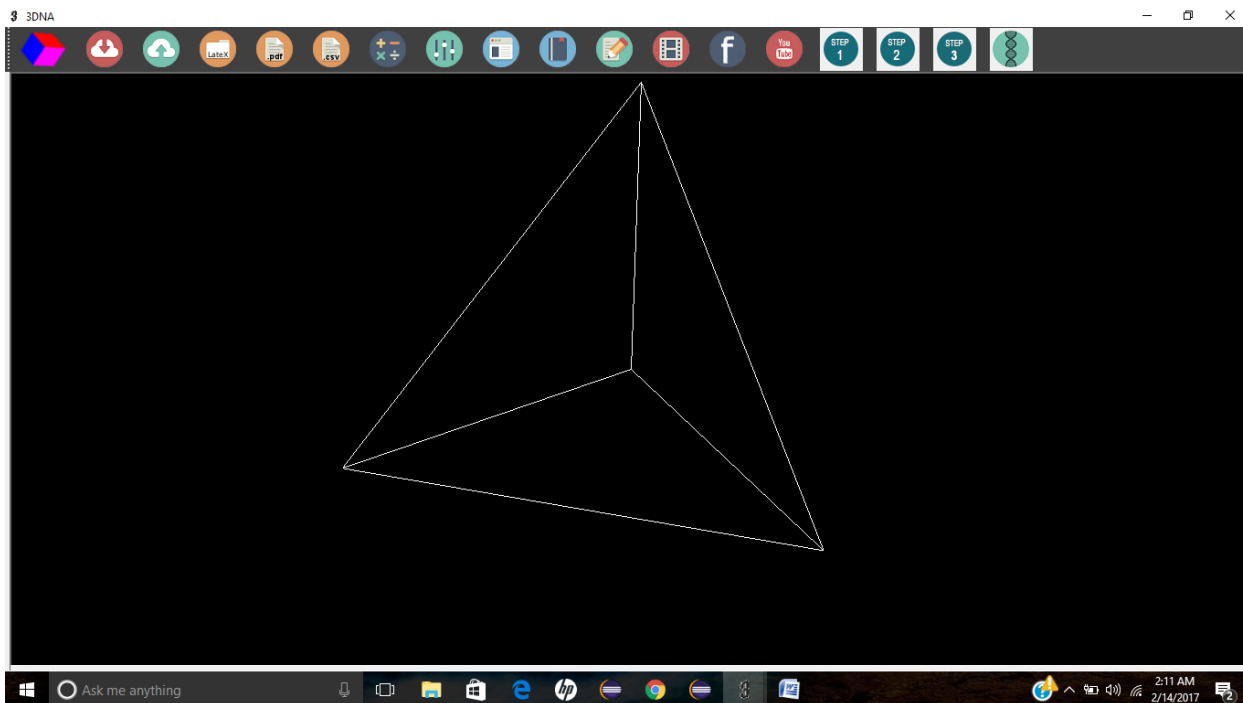

Figure 2: Importing file and generating polyhedral mesh

Spanning tree generation of the Polyhedra Mesh

This option can be used by clicking the "Step 1" option as shown in the figure below. Below we can see the spanning tree generated for tetrahedron. The edges which are colored green are part of the spanning tree.
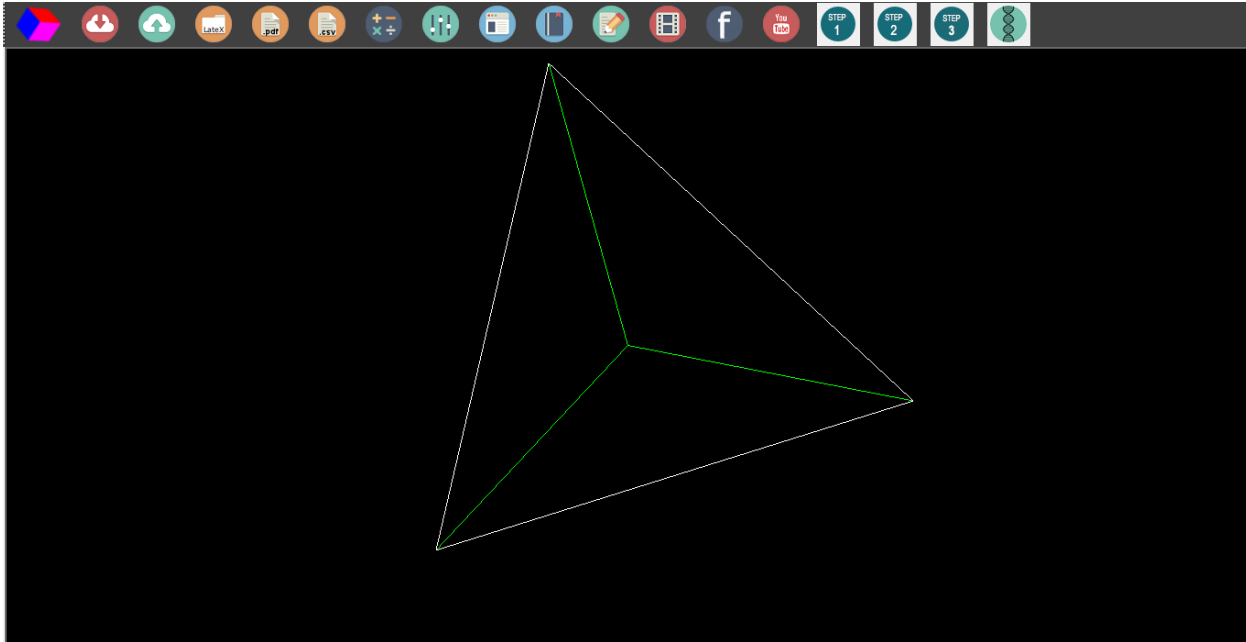

Figure 3: Green Edges in the figure are the spanning tree edges

Eulerian Circuit Generation

This option can be used by clicking the "Step 2" option as shown in the figure below. The edges that were part of the spanning tree remains as it is but the remaining edges are cutted into half to form a Eulerian circuit which can be seen in figure below. Also pseudo nodes are added at each vertex.

Figure 4: Eulerian Circuit Formation

Generate DNA Sequences

This option can be used by clicking the "Step 3" option as shown in the figure below. By default we have taken M_13 scaffold here but the user can enter any scaffold of his choice. The M_13 scaffold is scaffolded across the Eulerian circuit with starting edge shown in red and the next edge shown in green which can be seen in fig below. After this step the DNA Sequences corresponding to the given 3D steucture can be found in Output_Sequences.xls file present at _____(Location to decide).
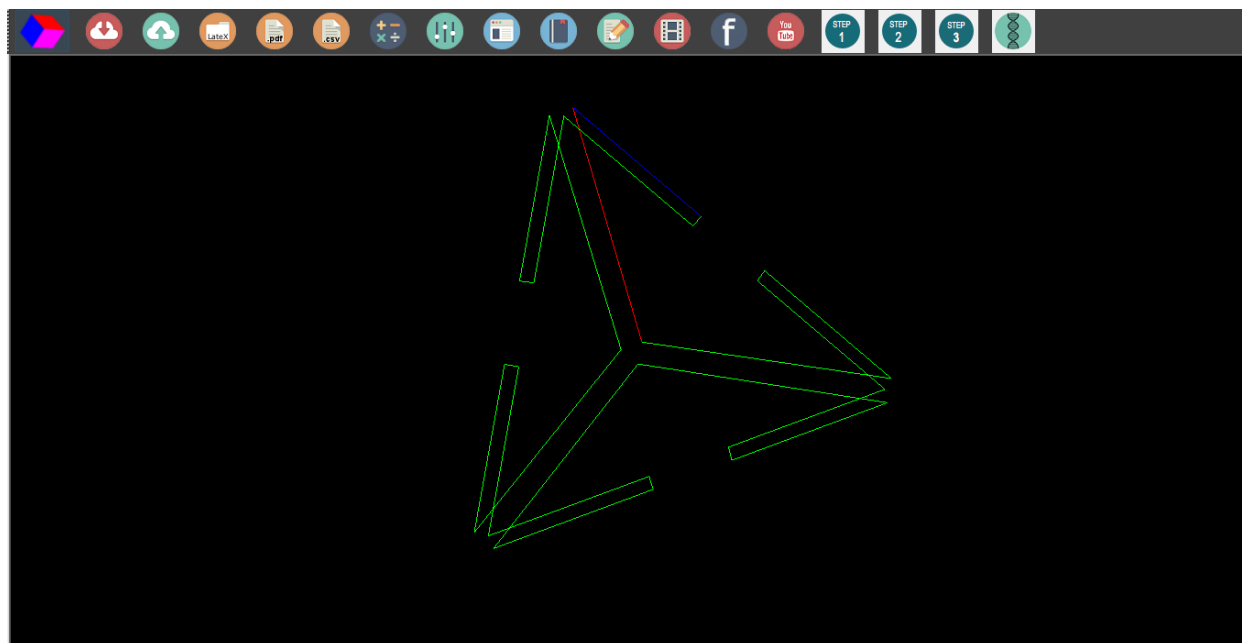

Figure 5: Red edge shows from where to start scaffold routing and blue shows the second one

Generate Sequence Directly

This option can be used by selecting the rightmost option in the menubar which can be seen in fig above. What it does is similar to the above "Step 3" button. This can be used if the user does not want to see all the above steps after **importing the file** and generate DNA Sequences directly.

Fare Estimator

By clicking this button, you will be asked to enter the cost/bp. After entering this you can get the total cost resembling to the total no of bp used in the structure formation.

Support and Feedback

Users are requested to contact team at the feedback page on the website www.guptalab.org/3dnaprinter for any issue with the software. Only one platform specific installers (Windows) is available on the project home page .