

Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world, and all there ever will be to know and understand.

- Albert Einstein

Q4'16

DATA VISUALIZATION

SCIENTIFIC & STATISTICAL APPROACH

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Motivation of initiating

One thing we have thought for making of this: "Augmented Mental Workspace" (combination of two words from CS & Biology). Mental Workspace is that part of Human Brain that do Visual calculations, deals with Perceptions, co relates Objects and their Data. In short, it is responsible for how Data can be Visualized. No doubt, Mental Workspace is evolved greatly with time, but making of its Augmented Version may be worthy. Thus, our Project title was " Data Visualization - Scientific & Statistical Approach "

Our Approach

This title and modules were selected with a reason "If CS project is designed on IT base, then some components of CS (Algorithms & Math) should be included in project to let a project be part of CS ".

Brief: **Data Visualization** is viewed by many disciplines as a modern equivalent of visual communication. It involves the creation and study of the visual representation of data, meaning "information that has been abstracted in some schematic form, including attributes or variables for the units of information".

Data Visualization:

- Statistical Data Visualization
 - Cricket Statistics
 - Hawk-Eye
 - Wagon Wheel
 - Field View
 - Population Globe (3D)
 - Transparent/Non-transparent
 - Universal/Location based
 - 3D Bar Graph
 - Two fields-plotting
- Scientific Data Visualization
 - Mathematics (3D Plotter)
 - $f(x, y)$ equation form
 - Parametric form
 - Physics
 - The Earth Magnetic Field
 - Biology
 - DNA: Genome representation

[Modules-Submodules of inclusion]

Data Visualization: [Detailed]

- Statistical Data Visualization

- Applied in any of applications of representing data system. This can be used to make comparison among different datasets. Visually, which is useful enough to analyze data with single glance.

- Cricket Statistics

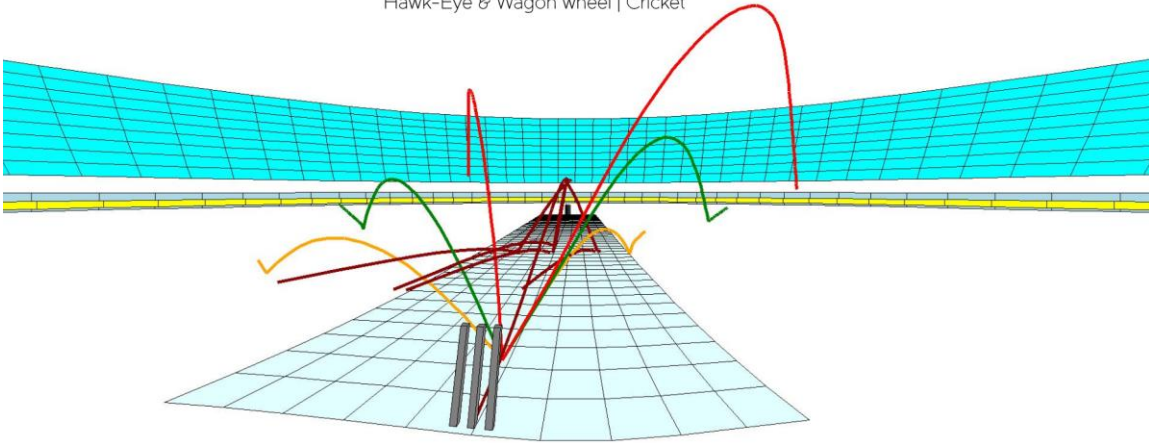
- Hawk-Eye

- *The Hawkeye feature gives an indication of the balls trajectory and whether or not it would hit the stumps*
 - Its major use in cricket broadcasting is in analyzing leg before wicket decisions, where the likely path of the ball can be projected forward, through the batsman's legs, to see if it would have hit the stumps.
 - also used to show delivery patterns of bowler's behavior such as line and length, or swing/turn information. At the end of an over, all six deliveries are often shown simultaneously to show a bowler's variations, such as slower deliveries, bouncers and leg-cutters. A complete record of a bowler can also be shown over the course of a match.
 - Batsmen also benefit from the analysis of Hawk-Eye, as a record can be brought up of the deliveries batsmen scored from.

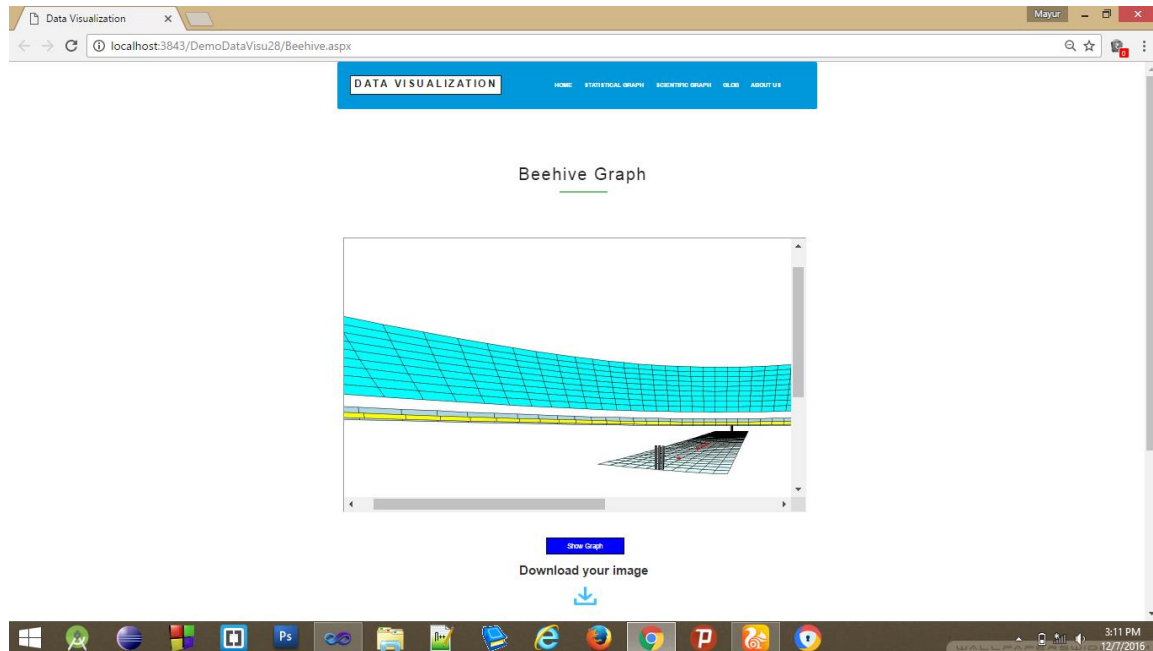
■ Wagon Wheel

- *The wagon wheel feature shows the areas where the batsman has scored his runs.*
- A Wagon wheel is also called as a Batting shot placement.
- This is a graphic that represents the top view of a cricket field. Lines are drawn from the batsman's position towards the field that portrays the path of the balls hit by the batsman.
- After viewing the wagon wheel, it can be concluded that in which part of the field the batsman has scored runs more frequently.

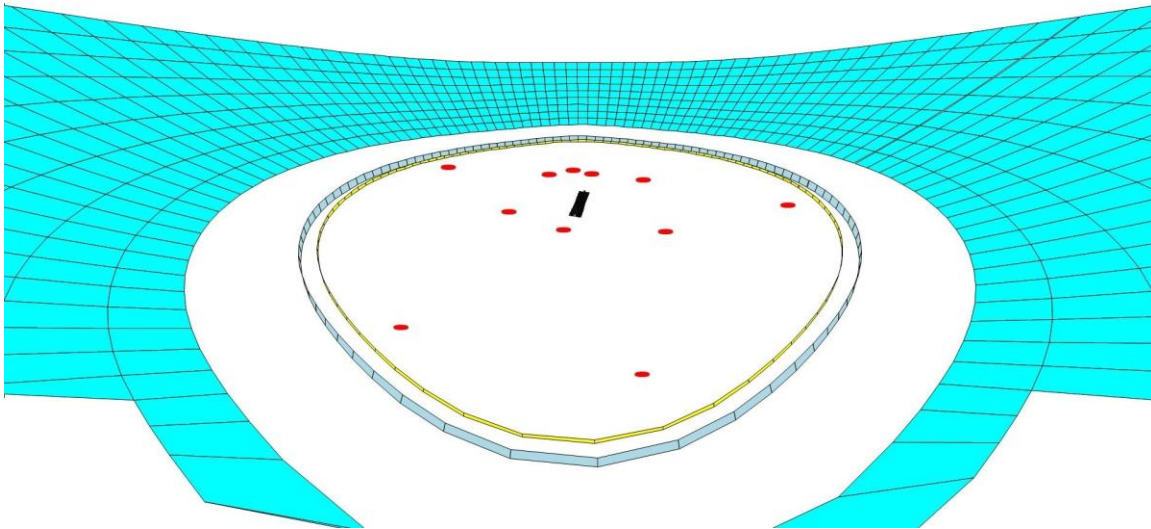
Data Visualization : Scientific & Statistical approach
Hawk-Eye & Wagon wheel | Cricket



- Bee-hive
- The beehive feature shows the pitch map of bowlers.



- The image thus obtained is helpful for bowlers in identifying the length of the deliveries bowled by them.
- Field View
- The Field View shows an animated view of the fielding positions at a given instance in the field.
- The positions of fielders can be changed with respect to their numbers.



- The bowler is supported by a wicketkeeper (behind the batsman) and by nine other fielders who occupy some (but only nine) of the fielding positions marked on the diagram.

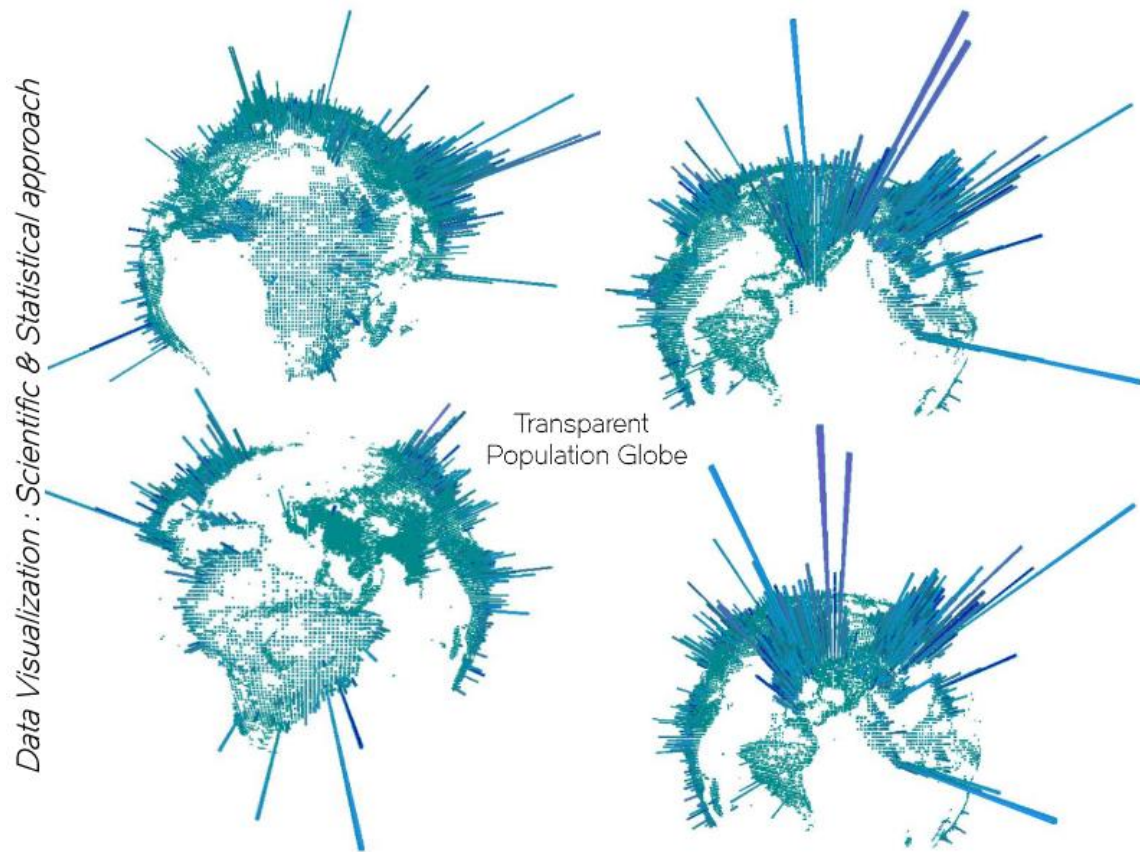
○ Population Globe (3D)

- It is representation of the world's population in form of bars coming out from 3D Globe. These bars are located in basis of values of Longitude & Latitude. Length of bar represents Population at that area of Longitude & Latitude, longer bar, more population.

▪ Universal/Location based

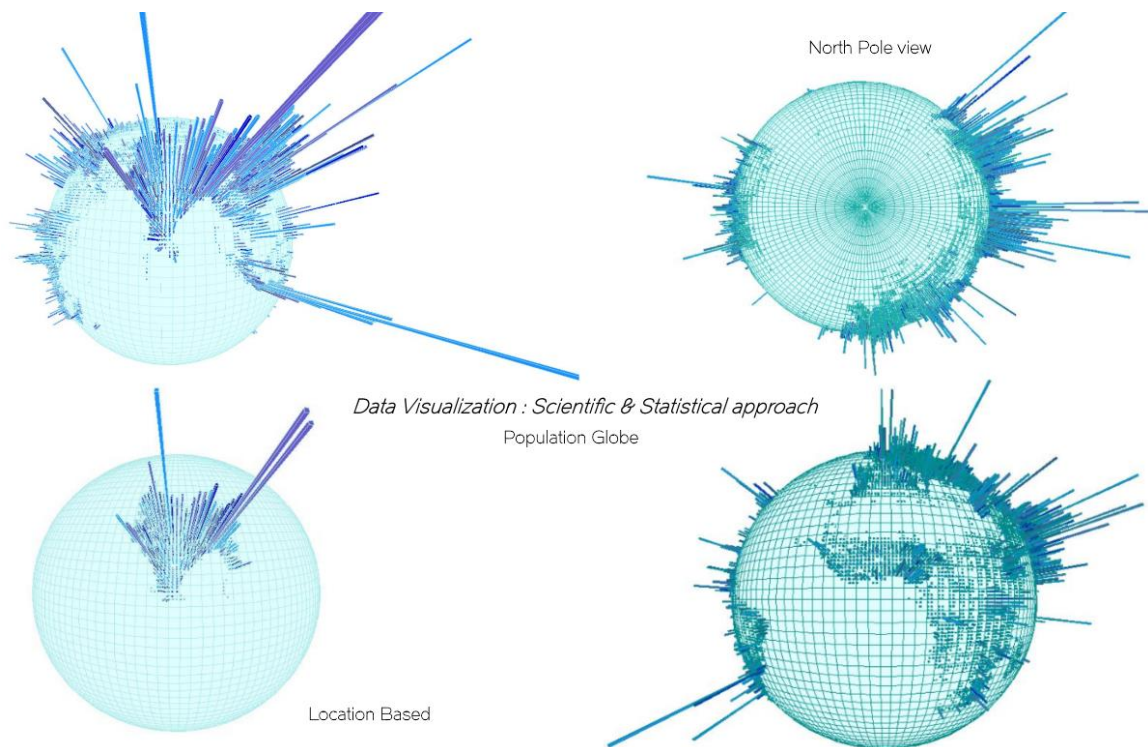
- In Universal view, population of whole Earth is shown.
- In Location based view, particular area of the earth is targeted to show using range decided by Longitude & Latitude.

- Transparent View



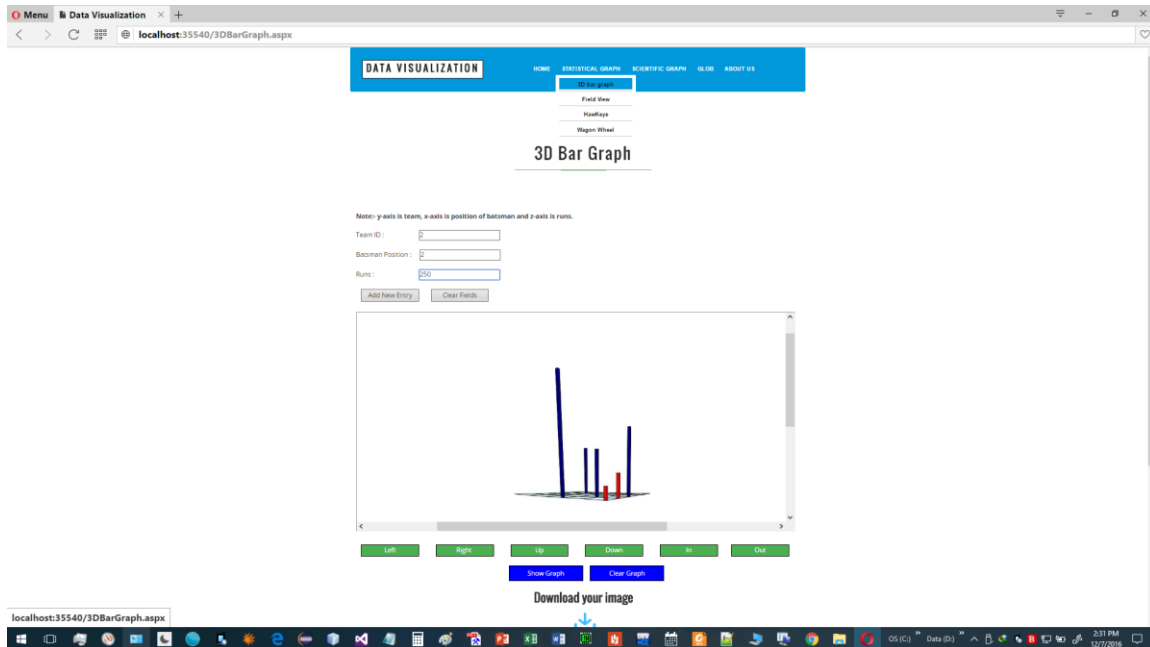
- In Transparent View, boundary of the earth is not preserved that's why, we can visualize the population of other side of the earth from where we are watching actual view.

- **Non-transparent View**



- In Non-transparent view, boundary is preserved and that how we will obtain the population view of area from which we are observing.

- 3D Bar Graph
 - Two fields-plotting



● Scientific Data Visualization

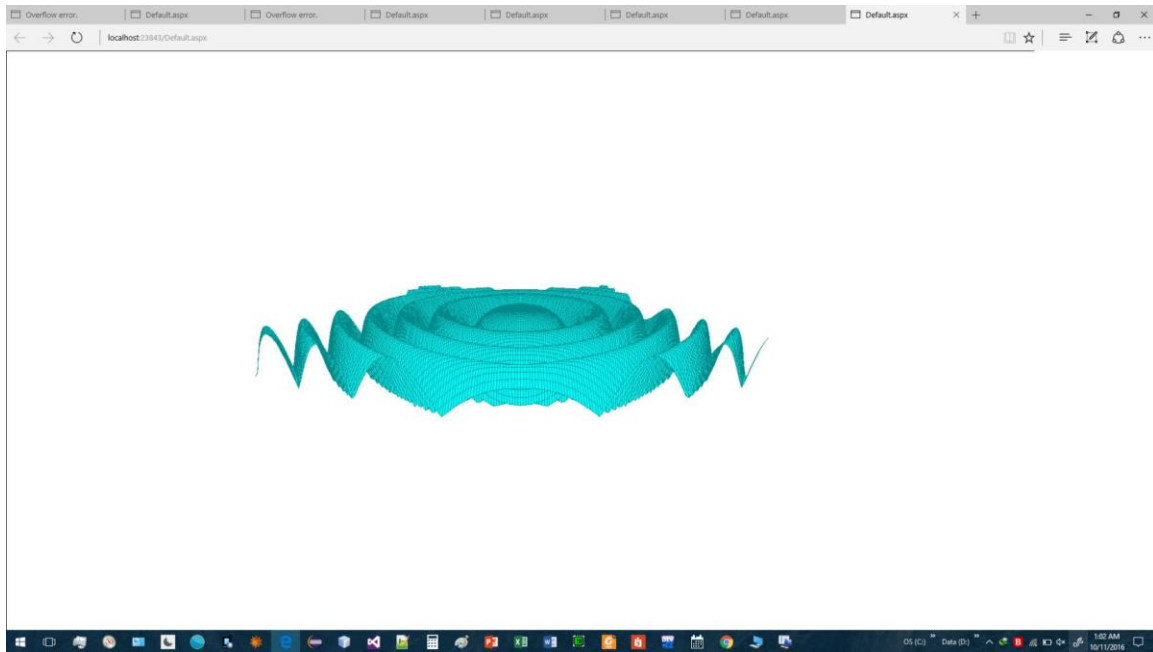
- is an interdisciplinary branch of science, it is "primarily concerned with the visualization of three-dimensional phenomena (architectural, meteorological, medical, biological, etc.), where the emphasis is on realistic renderings of volumes, surfaces, illumination sources, and so forth, perhaps with a dynamic (time) component". It is also considered a subset of computer graphics, a branch of computer science. The purpose of scientific visualization is to graphically illustrate scientific data to enable scientists to understand, illustrate, and glean insight from their data.

- Mathematics (3D Plotter)

- A three-dimensional graph is the graph of a function representing effect of several variables.

- $f(x, y)$ equation form

- Provided that x , y , and z or $f(x, y)$ are real numbers, the graph can be represented as a planar or curved surface in a three-dimensional Cartesian coordinate system. A three-dimensional graph is typically drawn on a two-dimensional page or screen using perspective methods, so that one of the dimensions appears to be coming out of the page.



It is output of one mathematical equation.

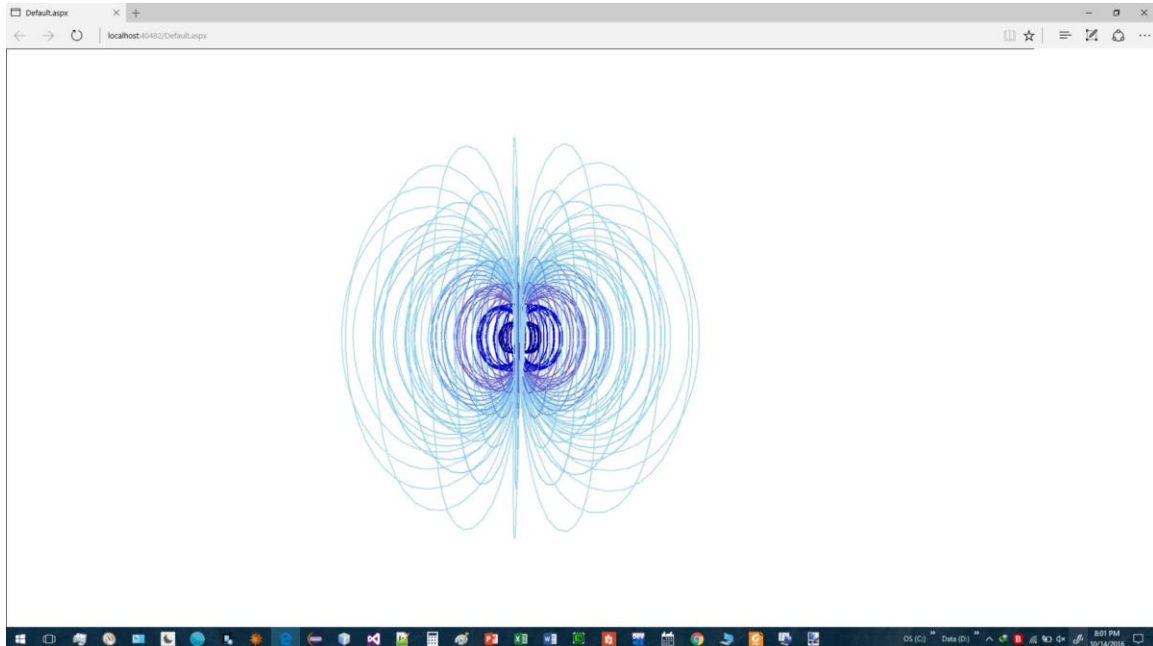
- **Parametric equation form**

- In mathematics, parametric equations define a group of quantities as functions of one or more independent variables called parameters. Parametric equations are commonly used to express the coordinates of the points that make up a geometric object such as a curve or surface, in which case the equations are collectively called a parametric representation or parameterization of the object.
- It is represented in making of The Earth Magnetic Field and DNA: Genome representation.

- **Physics**

- **The Earth Magnetic Field**

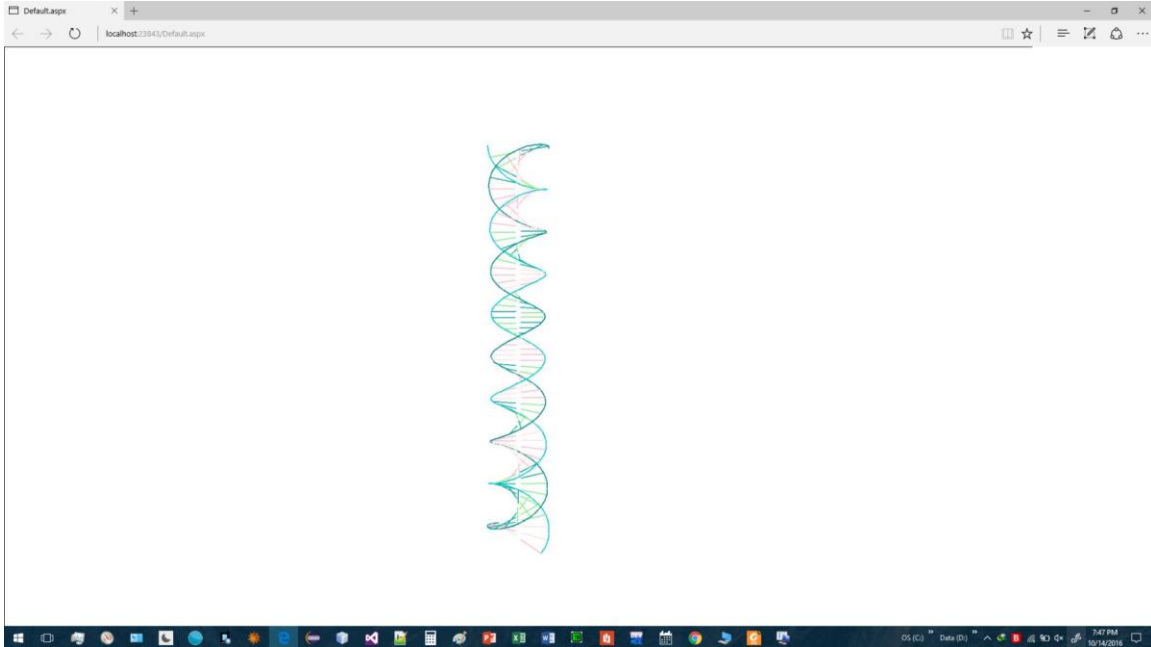
- Magnetic fields are discretely represented with respect to radius and their intensities.



Magnetic fields are shown on discrete radiuses.

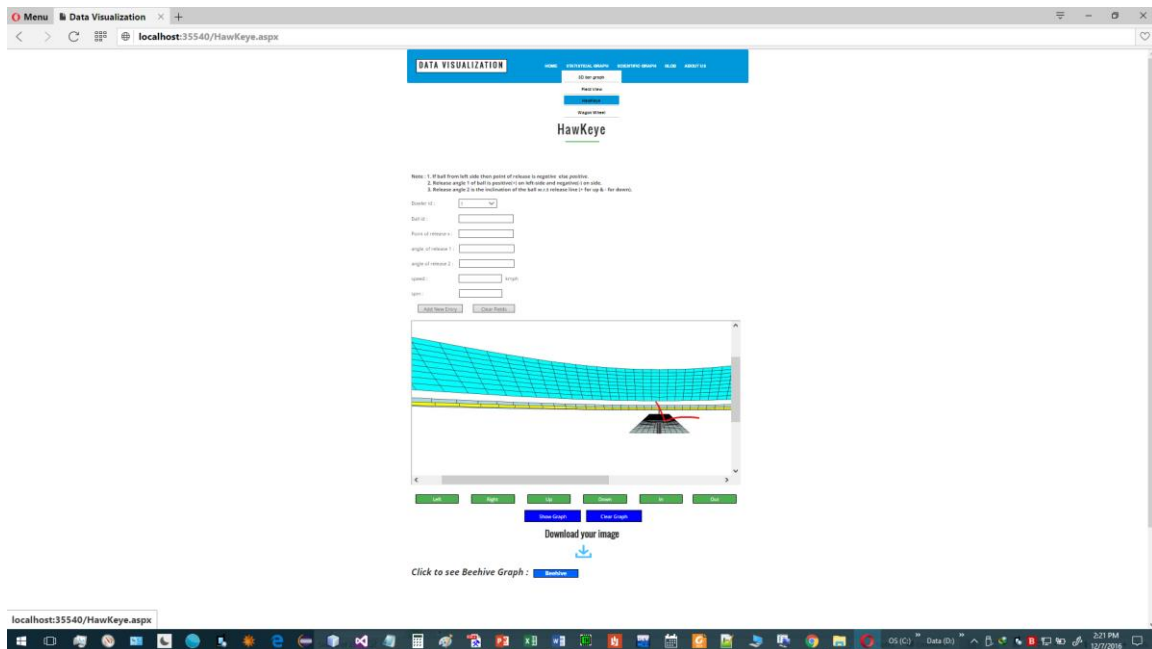
○ Biology

- DNA: Gnome representation
- Genome of DNA is taken as a string and its 3D representation is shown.

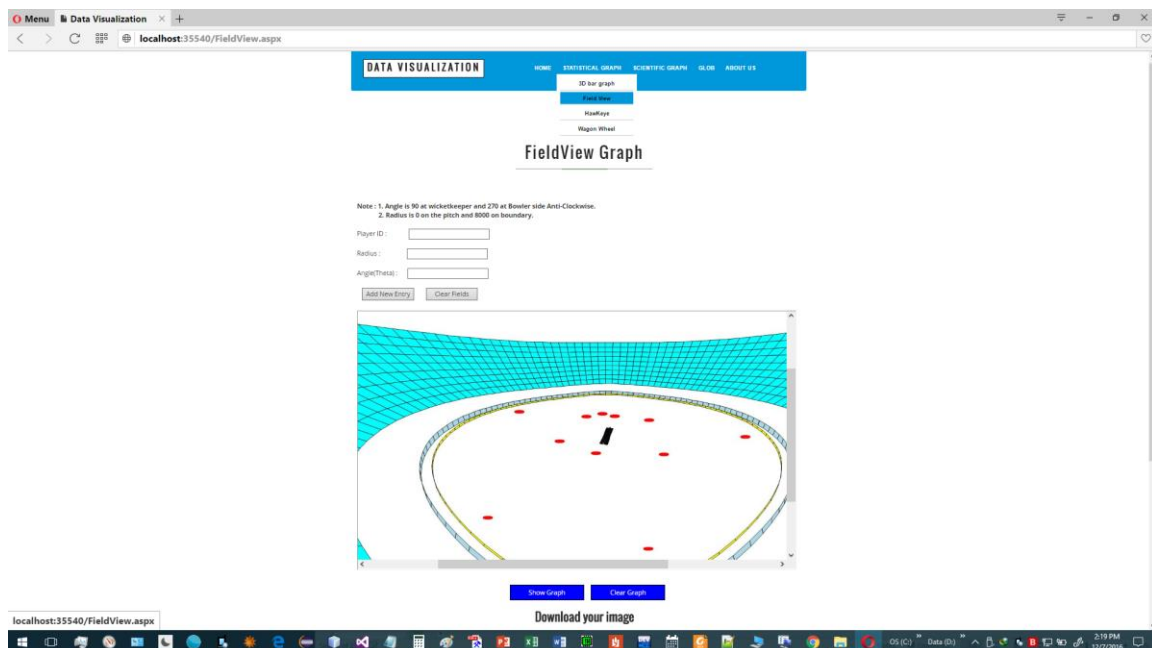


This is output of a Genome string – ATGCCGAGTC...

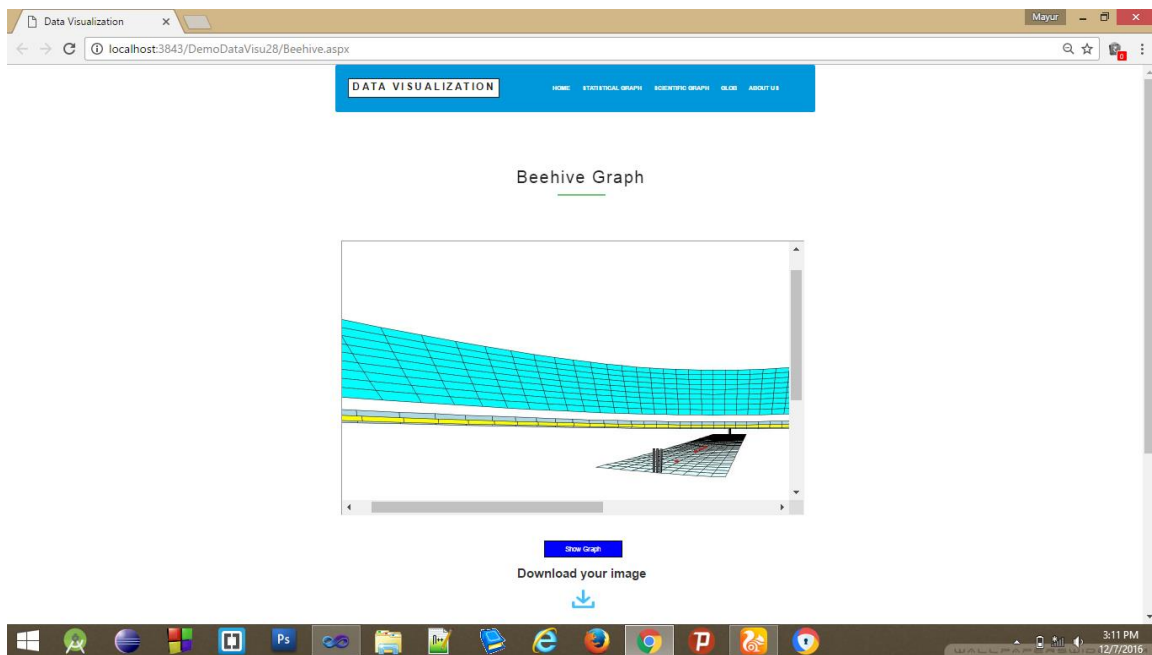
Website Screenshots



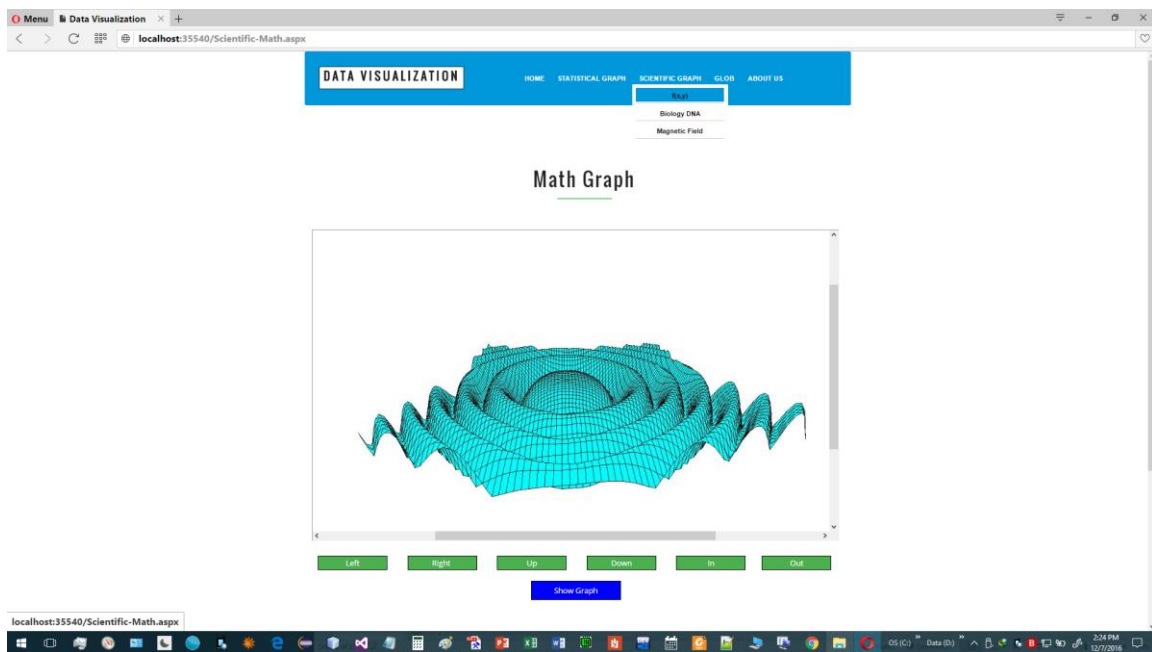
Hawk-Eye



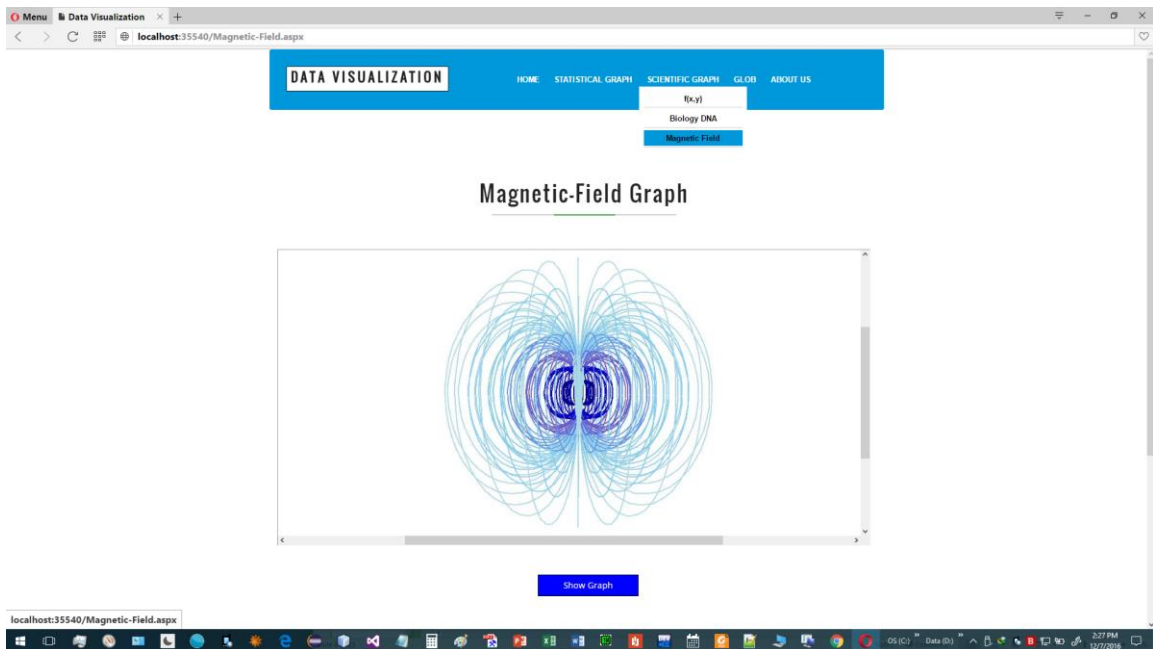
Field View



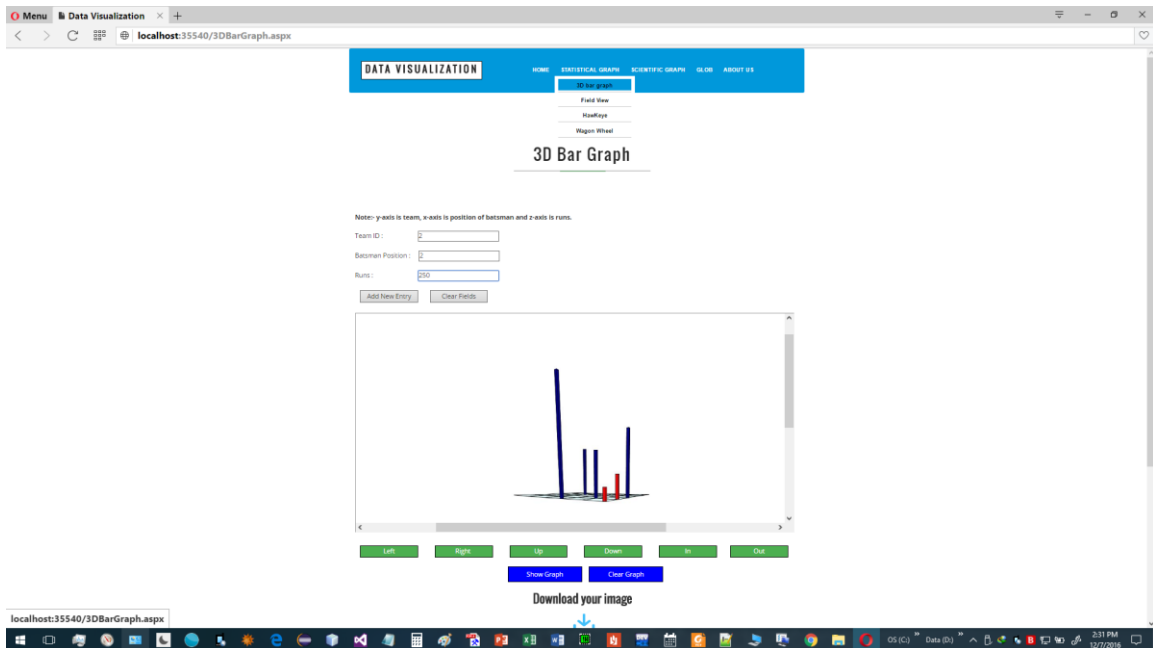
Beehive



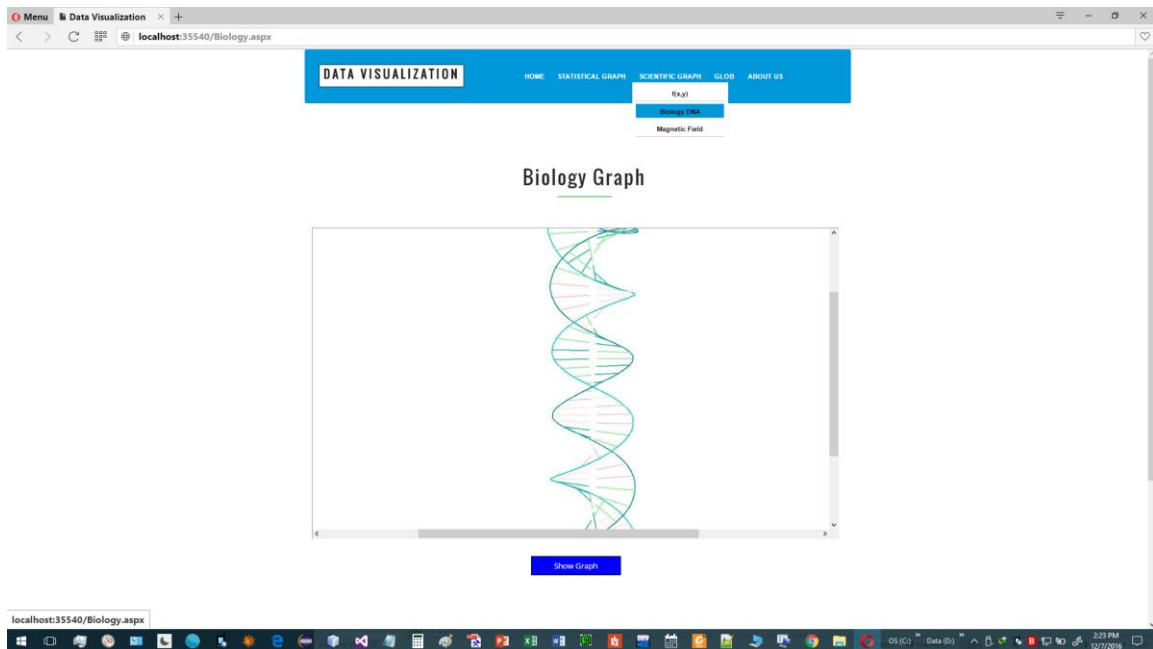
Math graph of form $f(x, y)$



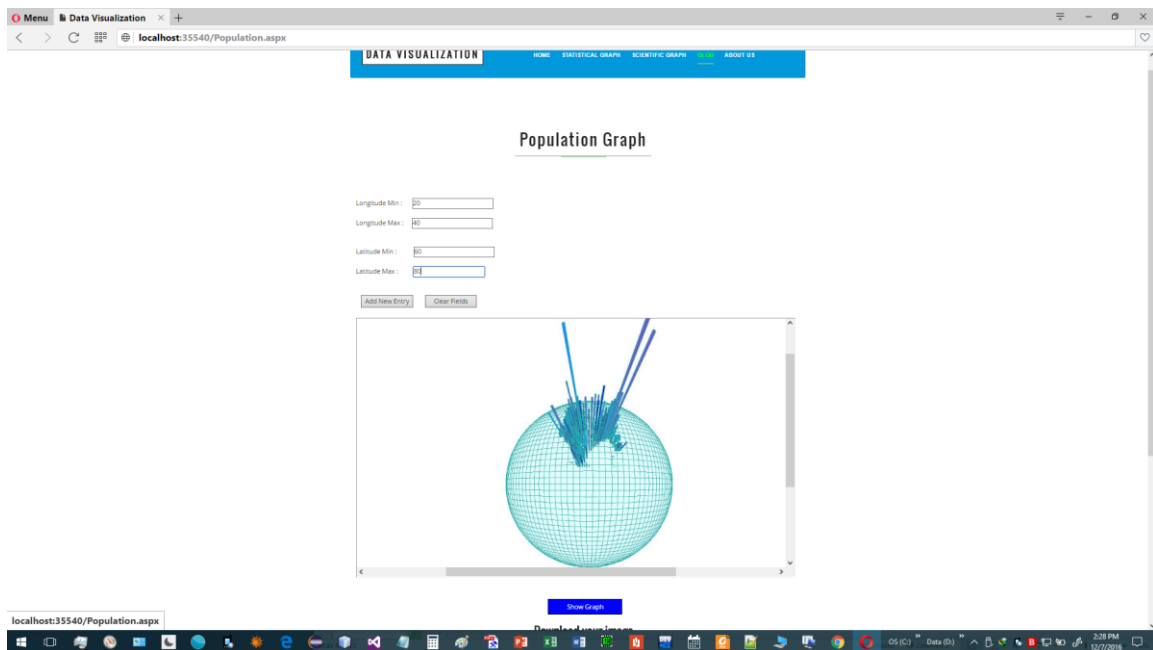
Magnetic Field



3D Bar Graph



DNA: Genome representation



Population Globe (3D)

Tools

Software

1. Visual Studio 2010
2. Microsoft SQL Server 2008
3. Recommended browser: Microsoft Edge

Tools and Techniques from Visual Studio:

Standard

1. Button
2. TextBox
3. DropDownList
4. HyperLink
5. ImageButton
6. Label
7. LinkButton

Data

1. SqlDataSource

Validation

1. RequiredFieldValidator
2. RegularExpressionValidator
3. RangeValidator
4. CompareValidator

HTML

1. Button
2. Label

Data Dictionary

1) *3D bar graph*(team_id, batsman_position, runs)

2) *Ball_Event*(ball_id, pt_of_contact_x, pt_of_contact_y, Event)

Here, pt_of_contact_x,y can be derived using equation of parabola and data from Ball_bowler.

3) *Ball_bowler*(ball_id, bowler_id, release_x, release_y, release_z, angle_of_release_1, angle_of_release_2, speed_of_ball,spin)

4) *Field Setting*(player_id, p_x, p_y)

5) *Ball_batsman*(ball_id, batsman_id, bat_angle_1, bat_angle_2, magnitude,end_point)

6) *DNA*(id,genome)

7)*Population_tab*(Logmin,Logmax,Latmin,Latmax)

8)*Save_Image*(id,verify_bit)

THE END