

DONUT CHART: A CUSTOMIZED NG-PIGEON DATA VISUALIZATION ELEMENT FOR DATA-DRIVEN WEB APPLICATIONS USING PIGEON-CHART

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Abstract: Data visualization is a basic graphical or pictorial representation of raw data, which makes communication of the information to the audience from the data visualization element, much clearer and more efficient. Commonly known data visualization elements are tables, charts, graphs, etc. In the era of the web, it is considered that communicating the data through a web application covers a wide pool of audience, the data consist of a government survey, cricket statistics, shares in the market, etc. The web applications are developed with the web technologies that have evolved exponentially and offered simpler ways for web application development. This evolution is not beneficial for all the web developers, especially the fresher's face a lot of issues mainly because of rapid changes, complicated documentations and the steep learning curve of these technologies. The solution introduced was a custom-defined HTML element, pigeon-chart, Pigeon-chart allows web developers to embed visualization i.e. charts into a web application with data obtained from MySQL databases in a much simpler manner. In this paper, we introduce another element, a donut chart, to the family of pigeon-Chart.

IndexTerms - Data visualization, ngPigeon, pigeon-chart, Donut chart.

I. INTRODUCTION

A humongous amount of data is being generated every second, the data coming from social media such as our messages, images, videos, chats, tweets, posts, status, etc., data generated by the Sensors around us present in all the devices, data generated from the transactions we make, from our images and videos, from our surveys, from credit cards or debit cards, etc., are all the sources of big data. ^[1]Big Data visualization calls to mind the old saying: "a picture is worth a thousand words." That's because an image can often convey "what's going on," more quickly, more efficiently, and often more effectively than words. Some of the most common forms of data visualization elements available are line graphs, column graphs, bar graphs, pie charts, tables, etc.

Communication of the data to the external world is an important task once the data is visualized into information, the web is perhaps the dominant form of internet communication. Web applications are the software running on remote servers and can reach people across the globe. Web applications are mainly developed with technologies such as PHP, JavaScript, etc. Visualization elements can be embedded into a web application with the help of the web technologies mentioned which are fully equipped with libraries and packages and frameworks which makes the process of web development easier and ubiquitous across all the platforms. Working with these libraries or frameworks requires proper configuration to tailor the application according to your needs, which makes the work easier for developers who are well versed with web development but this may not be the case for fresher's, or amateur developers for whom using these complex libraries and building the visualization element from scratch can be a daunting task to adopt, mainly due to lack of experience, no proper documentation available for the libraries and frameworks and also because of the steep learning curves.

To counter this steep learning curve and the difficulties faced an alternative was proposed for the fresher's and amateur web developers to ease their web development process concerning data visualization elements a project named "ngPigeon" ^[2]a web application framework was initiated for web developers who want to build a simple web app easily in a short time. It is purely based and dependent on web development technologies as listed in table 1.

Using ngPigeon it makes the work of developer much easier, the only basic knowledge the developer needs to have is of DBMS queries, the steps to configure are listed in a further section.

In this paper we have come up with another element called "Donut Chart" in addition to the existing elements of Pigeon-chart, which included the following charts:

1. Column graph
2. Bar graph
3. Spine graph
4. Multi series graph
 - a. Line graph
 - b. Area graph
5. Pie chart

Donut Chart is a revised form of a Pie chart except it has a round hole in the center which makes it look like a donut, hence the name. This space can be used to display additional data. Donut Chart is visually beautiful and more interactive as compared to a pie chart. If you consider a ^[4] pie chart, your focus will go to the center of the chart and you will consider the chart's entirety.

Doughnut charts, on the other hand, eliminates the need to compare the size or area of the slice and shifts the focus on the length of the arc, which in turn is easy to measure. Figure 1 shows the difference in physical properties of a pie chart and a Donut chart.

Table 1: Technology Dependence of ngPigeon and their uses

Technology	Uses
PHP	A scripting language used to interact with the MySQL data
MySQL	An open-source RDBMS used to store the charts data
HTML	A standard markup language for documents designed to be displayed in a web browser.
AngularJS	A JavaScript-based open-source front-end web framework
UnderscoreJS	A JavaScript library that provides a whole mess of useful functional programming helpers without extending any built-in objects
Highcharts	Makes it easy for web developers to set the charts in their web application

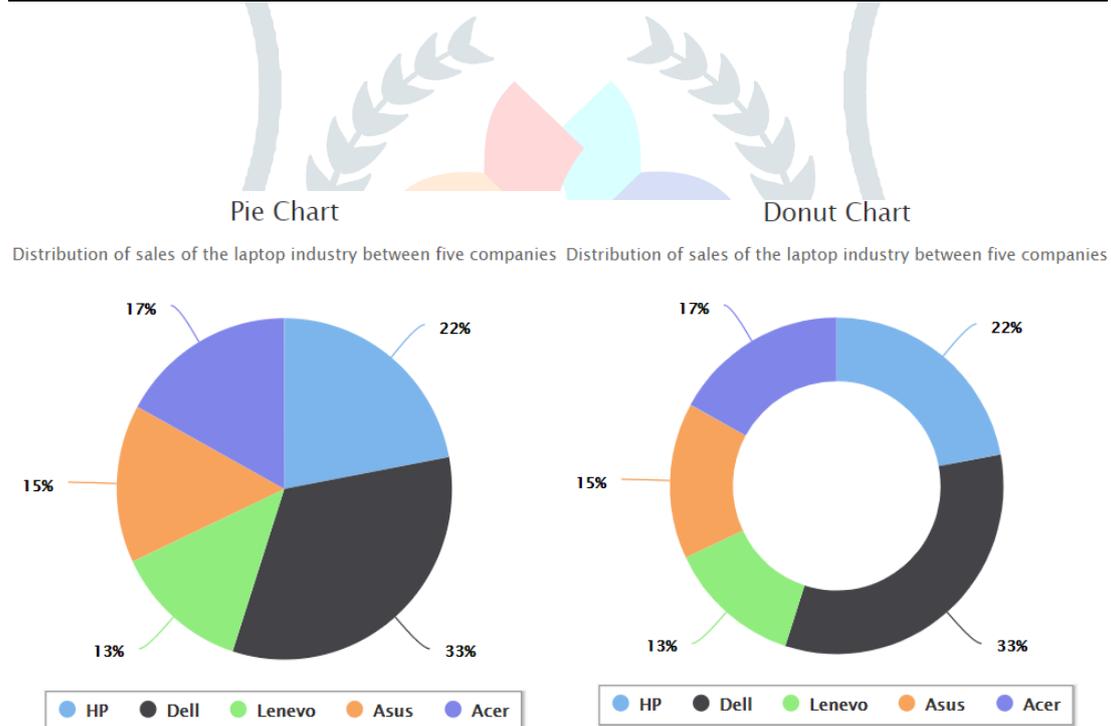


Figure 1: difference in physical properties of a Pie chart and a Donut Chart

II. ADVANTAGES

1. Donut chart is preferred over the pie chart because of its data intensity ratio and space efficiency.
2. The hole in the middle of this chart is used to convey extra or additional information, like the total number of data or labels of the arc.
3. Unlike pie charts, multiple data sets can be displayed using a doughnut chart.
4. Doughnut charts are good to use when comparing sets of data

III. LITERATURE REVIEW

So far only two custom HTML elements have been developed under the ngPigeon project which has been serving the purpose of easing the process of web development for the amateur developers with its data visualization functionality, following are the two elements under ngPigeon:

3.1 PIGEON-TABLE

Pigeon-table was the first element developed under the project ngPigeon, a tool that displays the MySQL results in table form dynamically to give a better interpretation of the data and for comparative data analysis on categorical objects. [2] By using pigeon-table module, web app developers could render table(s) with data retrieved from databases into their web application by just defining the custom HTML element tag i.e. <pigeon-table> and specify a SQL SELECT statement in the "query" attribute. Pigeon table module is dependent on Bootstrap v3.0, Angular JS v1.6.0, AngularUI Bootstrap v2.5.0.

To use Pigeon-table component in your web development project you just have to include all the dependencies, configure the DB and add the following "pigeon-table" HTML tag into your project.

```
<pigeon-table query="SELECT * FROM user_account"
  editable="false"
  control="true"
</pigeon-table>
```

Various components supported by pigeon table are listed in Table 2, which provided the ability to configure the table as per the needs of the user. [2] Figure 2 shows an example of the Pigeon-table

Table 2: Components of custom HTML element Pigeon-table

Table component	Use
Sortable	To sort the data either ascending or descending order
Searchable	To search specific data within the specified column
Excludable	To exclude the specified data along with the column
Insert (CRUD Operation)	To insert the data into that MySQL table.
Edit(CRUD Operation)	To edit the data into MySQL table
Delete(CRUD Operation)	To delete the data from MySQL table

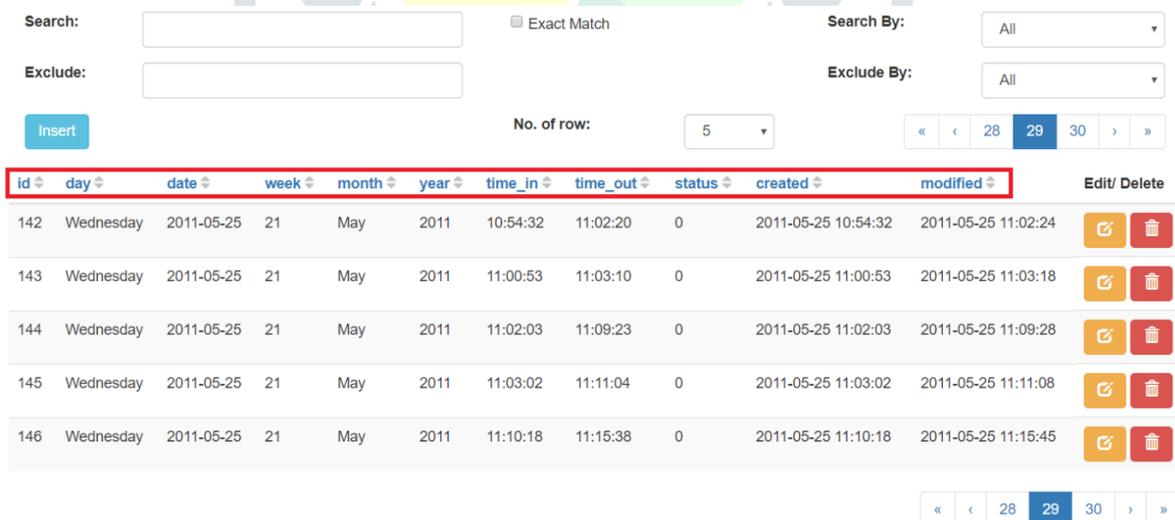


Figure 2: Example of a Pigeon-table

3.2 PIGEON-CHART

Pigeon-chart is the second custom HTML element developed under ngPigeon project, which generates interactive charts to represent raw data graphically and ease end users' experience to understand large data sets more easily. Pigeon-chart is best suited for amateur developers and outputs interactive charts which can be modified as per the needs.

Pigeon-chart module is dependent on AngularJS v1.6.4, Underscore 1.8.3, Highcharts Latest Stable Version, Highcharts Series Label Modules Latest Stable Version, Highcharts Exporting Latest Stable Version, Grouped Categories(Highcharts related JS framework) v1.1.2.

To use Pigeon-chart component in your web development project you just have to include all the dependencies, configure the dB and add the following "pigeon-chart" HTML tag into your project.

```
<pigeon-chart query="SELECT name, val FROM web_marketing"
  title="Total Visitors"
  subtitle="Web Marketing Companies"
  type="pie"
  axisy-title="Total"
  axisx-title="Web Marketing Company"
  data-data-label="false">Placeholder for generic chart
</pigeon-chart>
```

Different types of charts supported by Pigeon-chart are listed in Table 3

Table 3: Different charts supported by Pigeon-chart

Type	Use
Pie chart	to show you how a whole is divided into different parts
Line graph	show you how numbers have changed over time
Bar graphs	to show numbers that are independent of each other

IV. SETUP AND USAGE

After downloading the files from GitHub “<https://github.com/sanjeetkanekar/donut-chart-ngpigeon>” and configuring and setting up the database just include the following custom element tag in your HTML web page also you can modify it according to the requirements.

```
<pigeon-chart query="SELECT Browser_name, Browser_popularity FROM browsers"
  title="Donut Chart"
  subtitle="Popularity of browsers between people"
  type="donut"
  axisY-title="Browser_name"
  axisX-title="Browser_popularity"
  show-legend="bottom"
  show-data-label="true"
  zoom-type="xy">Placeholder for generic chart
</pigeon-chart>
```

The only change here is we add the type as “donut”, the result displayed is depicted in Figure 3

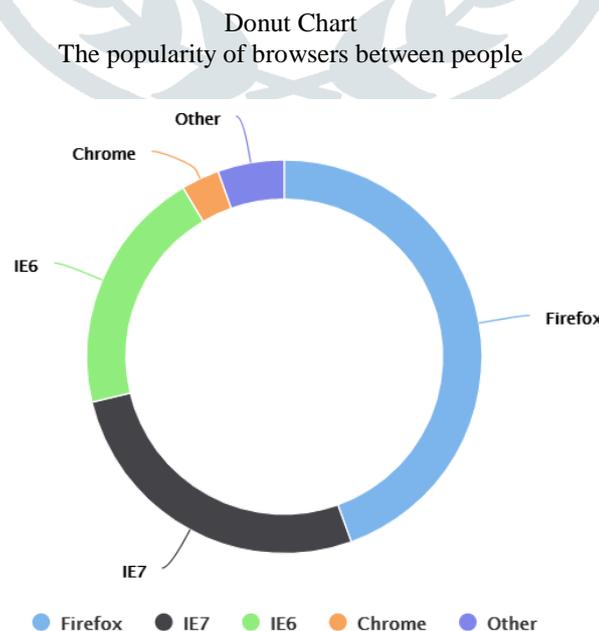


Figure 3: Example of a Donut chart from Pigeon-chart

V. APPLICATIONS

1. Widely used in the business world and the mass media to illustrate numerical proportion and best suited for categorical data.
2. It can be used to show percentage or proportional data and usually, the percentage represented by each category or arc is provided next to the corresponding arc of the donut.
3. To compare areas of growth within a business such as turnover, profit, and exposure.
4. It can be used to compare multi-series data such as the company sales for two consecutive years using a double donut chart, wherein we require two pie charts for the same.
5. Revenue generated by the sales of different company products, and also utilizing the center blank area of the donut to show total profit or revenue generated.

VI. VARIANTS OF DONUT CHART

There are two variants of the donut chart which are listed below:

6.1 Exploded Donut chart

^[7] Much like exploded pie charts, exploded donut charts display the contribution of each value to a total while emphasizing individual values, but they can contain more than one data series.

Source: <https://help.syncfusion.com/js/chart/chart-types>

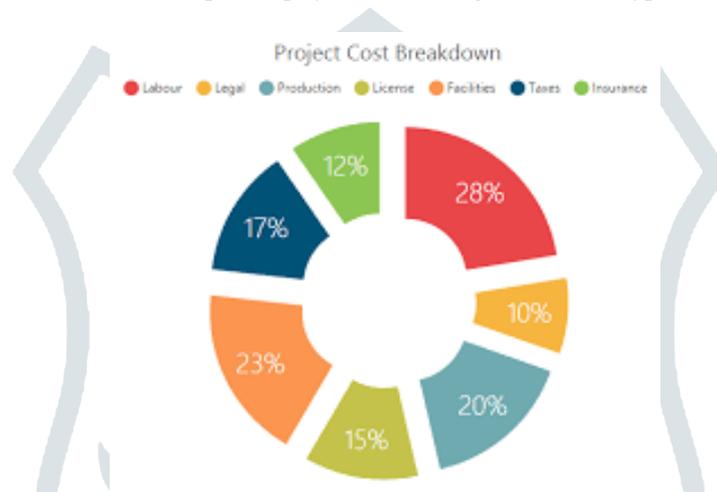


Figure 4: Example of an Exploded Donut chart

6.2 3D Donut chart

3D Donut chart is similar to the donut chart but with a 3D effect making the donut chart more lively and attractive.

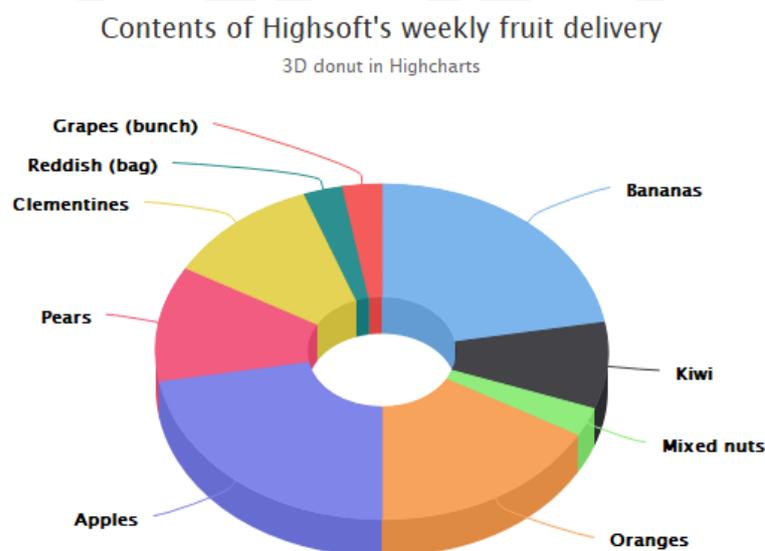


Figure 5: Example of a 3D Donut chart

VII. CONCLUSION

Data visualization is a very important aspect to convey information to people across the globe effectively. The web turns out to be the most suitable means of communicating the data to the people at a faster pace. Many libraries and packages are available online which can make the work of a developer much easier than they could ever imagine, few examples are Highcharts,

amCharts, etc., the fact that these libraries require great knowledge of JavaScript, object-oriented concepts renders these libraries inefficient for fresher's and amateur web developers, due to the lack of experience, steep learning curve, and complex configurations this option becomes difficult to adopt. In such situations, ngPegion becomes an ideal option for amateur developers wherein you require only the basic knowledge of MySQL queries, database configuration, and HTML. In addition to the existing elements of pigeon-chart, the donut chart turns out to be an improvement over the pie chart and several other charts, because of its properties such as more interactive, attractive, space-efficient, better visualization. These properties make the work of developers easy and efficient.

VIII. FUTURE SCOPE

Future work can be carried out in the following directions:

1. Addition of different variants of Donut chart.
2. Addition of other interactive charts to pigeon-chart such as funnel chart, stacked graphs, etc.

REFERENCES

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