A Custom Dashboard

Dashboard Name: Rex Dash Board

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The System Developed in this Project is part of internship program in Envoke Tech Pvt. Ltd.

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1. Introduction

Data are the basic building blocks in computer world and better the way to observe and analyze them we can deduct better understanding of the fundamentals within the certain system being studied. And, a term to better visualize the data to extract meaningful information is known as data visualization. Here, the data visualization of a Bike sharing dataset is done to better understand the movement on how bike renting or sharing system is ongoing. Data visualization is also referred to as the art of displaying our data and information in the form of graphs, charts or maps (sisense, 2022).

A well-known platform Dash is used to encapsulate the dashboard of data visualization for the bike sharing dataset in the system. The system developed is a custom dashboard which offers variety of chart types to the user such as Bar chart, line chart, area chart along with the content type like mean, sum, count, median; operations to be performed on the dataset provided and create a graph according to the selected requirement from the user. Additionally, a tabular inspection of the data that are being plotted into the graph can be checked with the feature provided with the dashboard. The system is built further flexible where user can choose the content column for the data to be plotted along with other variable such as x-coordinate and hue/ color variation based on which column of the data set to be done. Moreover, the design aesthetics were carried keeping on mind which do not degrade the aesthetics of the plot itself rather provide a sense of organized system and convenience to the user. Furthermore, a section for the description of the dataset being used and its details is provided at the bottom of the page in the dashboard to keep the user aware of the data being plotted within the graphs.

As all dashboard basic features should be, the system developed here is very user friendly and easy to maneuver and understand what one is doing without proper training or courses whatsoever. Similarly, the system’s main function to plot a data or dataset properly with clearly visualization is done well to provide user with efficient dashboard.

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2. System Demonstration

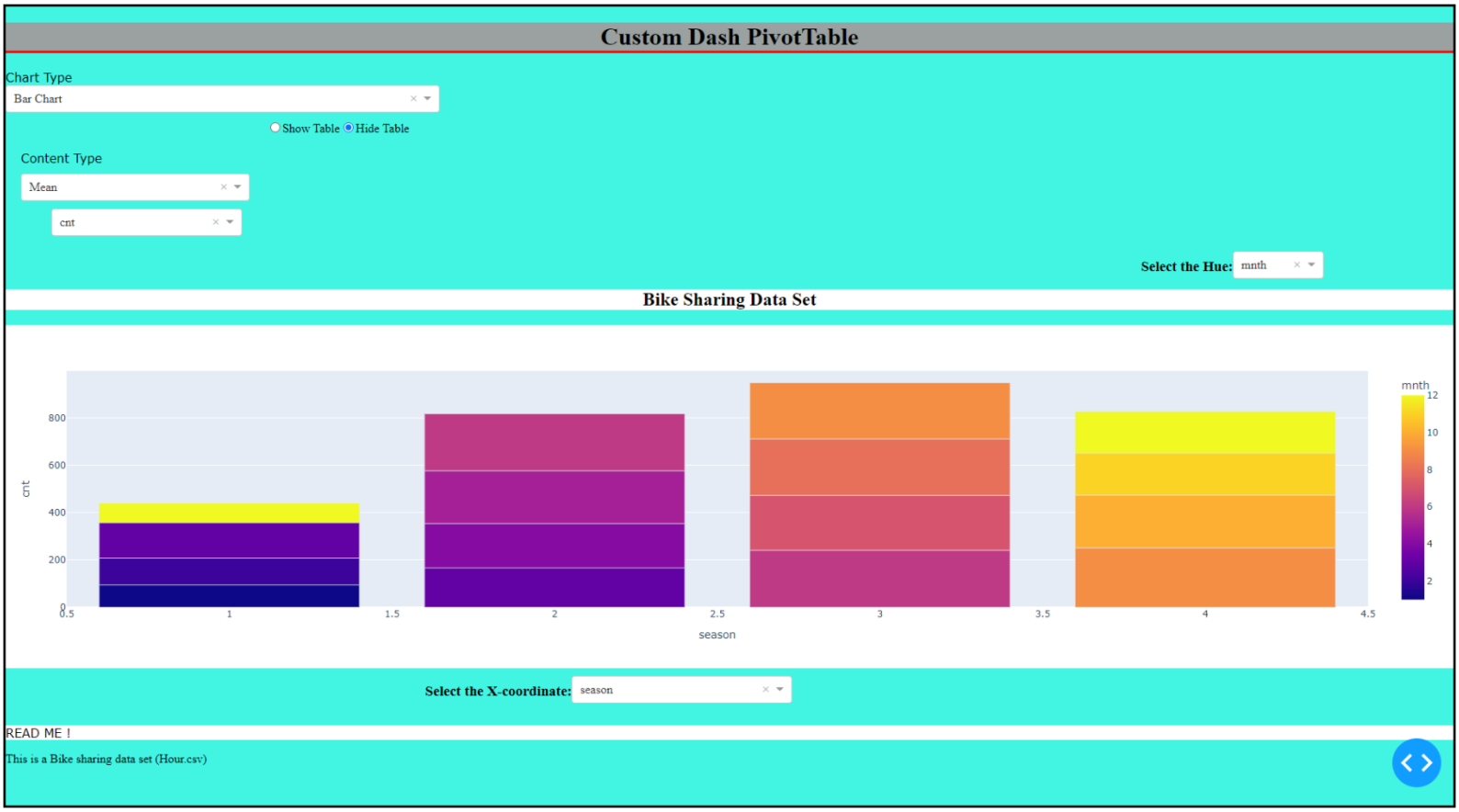

Figure 1: Dashboard

3. Tools/ Resources Used

Python is the core programming language used to build this system and for the better demonstration of the system on how it is now some of the few listed tools or resources were used in the overall development of the dashboard.

- **Pandas**: It is a data powerful open-source data analysis and manipulation tool, built on top of Python Programming Language. Here, in the development it is used to read and manipulate the data source as required for maximum efficiency and convenience.

- **Dash**: Dash is the original low-code framework for rapidly building data apps in various programming language. It is writing on top of Plotly.js and React.js making it ideal for building and deploying data apps with customized user interfaces (Plotly, 2021). Within, this system development Dash is the core framework used and implemented.

- **Plotly express**: It is a module which contains functions that can create entire figures at once (plotly, 2022). Simply stating it is a data visualization module for Python. It uses graph objects internally for plotting figures. The Graph plotted in the dashboard developed is also by using Plotly express module in the code.

- **NumPy**: NumPy is another one of the Python based library used to work on numeric codes in common. The function being used to present the data table in the dashboard is where the NumPy is being used in the backend of the system.

- **Visual Studio Code**: It is an IDE or simply can be understood as a text editor where all the development codes were carried on and it cumulates all the building blocks of the programs and concept being used behind the scene to develop the dashboard as a whole and operated seamlessly with proper convenience and efficiency.

The above-mentioned tools and resources are by far not all the tools used for the development but only the major role player during the development of this dashboard which made it successful for the system to reach where it is now as a complete program.

4. System Overview and Explanation

The system overview and explanation are done on the basis of major dash core components being used in the dashboard which is presented below:

3.1. Dropdown Menus

A drop-down menu is a collection of items that appear when you click on a piece of text or a button. This is a graphical approach presented to users in which they can select a value from a list (techopedia, 2022).

- Chart Type

Figure 2: Dropdown Menu: Chart Type

It is the first dropdown menu in the dashboard which controls the type of chart in which format the data is to be displayed. The content contains ‘Bar chart’ by default which is then shown in the graph of the data to be displayed. The other options or types of chart incudes Line Chart, Scatter Chart and Area Chart in the dashboard which could be used as desired.

- Content Type

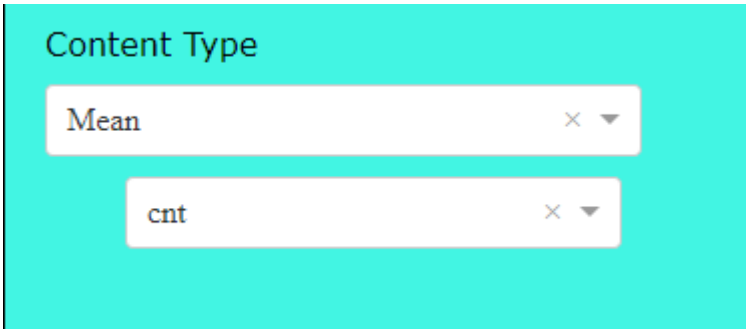

Figure 3: Dropdown Menu: Content Type

The content Type drop down menu actually act on two different dropdown menus; The first one controls the operation to be performed on the column selected on the second drop down menu. Here, in general it specifies the column whose data is to be plotted along the Y-coordinate in the plot and the operation to be performed based on the column chosen. The different type of operation that can be performed are Mean, Count (no. of occurrence of data), Median, Sum and so on. Now, for the second menu it contains all the list of columns in the dataset being currently used since the user might require to plot any column along the Y-axis.

- Select the Hue

Figure 4: Dropdown Menu: Hue

As clear as the day from its name about the description; this dropdown menu allows user to choose the column name that is not selected on the “Select the X-coordinate” drop down menu and plot it against others by varying the hue of the plot or simply put it is the variable for color differentiate during the data visualization of the graph in the dashboard.

- Select the X-coordinate

Figure 5: Dropdown Menu: X-Coordinate

This dropdown menu in the dashboard is responsible to determine the column of the dataset to plotted along the X-coordinate in the graph. It only allows the selection of column name that is not selected in the “Select the Hue” drop down menu as plotting same column against each other is not what normal data visualization requires. It is a convenience feature for the user to work around the dashboard.

3.2. Radio Button

Radio button are special kind of button where among the group of buttons only one can be selected at a time and it specifies only one task at a time in a quick glance.

- Show/ Hide Table

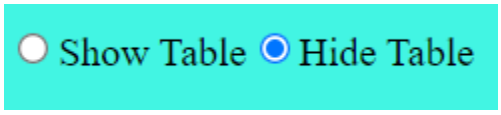

Figure 6: Radio Button: Show/ Hide Table

This radio button is simple as stated and is responsible to either show or hide the tabular form of the data being currently plotted in the graph as required by the user. It just presents a user with a data table that shows values being plotted against each other in tabular form. The data table can be viewed by selecting ‘Show Table’ or be kept hidden by selecting ‘Hide Table’ Button respectively in the dashboard.

3.3. Data Table

1	2	3	4	5	6	7	8	9	10	11	12	season
94.4247725…	112.865026…	149.699683…									82.21414913957935	1
		165.753816…	187.260960…	222.907258…	240.577083…							2
					240.391666…	231.819892…	238.097627…	237.036087…				3
								251.020833…	222.15851137146797	177.33542101600557	175.03958333333333	4

Figure 7: Data Table

Data Table is a component within the Dash which is used to present the data in the tabular form for the better understanding of the data in a glance. It is somehow similar to data visualization but just in different form factor which is Tabular form.

The data being displayed here on this data table is by selecting the ‘Show Table’ button at the beginning of the dashboard and the data in the cell are based on the dropdown menu which also affect the variable of the plot being displayed. Currently, the default options of dropdown menus are responsible for producing the data presented.

3.4. Graph/ Plot

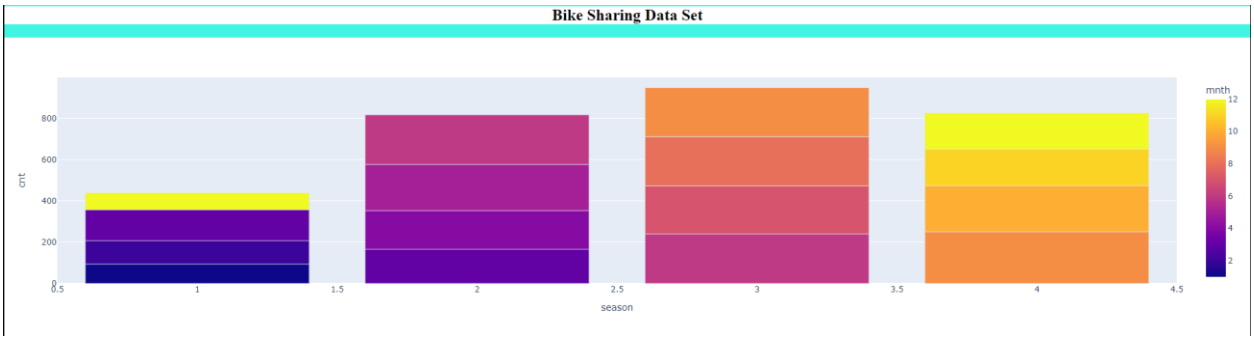

Figure 8: Graph/ Plot

Graph is the main component of the dashboard where the actual data visualization could be perceived by the user based on the requirements, they selected in the dropdown menu throughout the dashboard. The visualization currently being shown is based on the default selection of dropdown menus which can be altered anytime and anyhow as desired by the user. Furthermore, the default behavior provided by Plotly.express library like zooming in or out, resetting indexes and selecting a particular portion of graph could be done from upper right corner of the graph which is shown on hover.

5. Conclusion

As with every development comes a bundle of knowledge and experience throughout the course of actually building the system. Similar with this statement, a lot of research and findings were made during the process. The core objective of the project was to get familiar with dashboard development using different libraries and modules in Python which will later prove to be more helpful for data analysis and other works for working with data. The proper research through web surfing and guidance from supervisor were proved to be enough for the development done which is far from perfect and can always be improved further based on the change of time and requirements from the clients or user.

Similarly, the dashboard was the cumulation of various learning, following certain guidelines and being sincere and discipline throughout the development. It was developed for the utmost convenience for the user. Further, this is also built like a module in itself where by only changing the data set used and few tweaks under the default value of drop-down menu; it can perform well with any other dataset similar to the dataset originally used for the development. Hence, it is not limited to visualization of only one dataset.

All in all, the project built a sense of achievement and confidence by the end of it along with a lot of knowledge on hand to be dispatched to similar work related to working with data visualization, analysis or playing and modifying the data in general as required.

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6. References

Plotly, 2021. *Introduction to Dash.* [Online] Available at: https://dash.plotly.com/introduction [Accessed 10 April 2022].

plotly, 2022. *Plotly Express in Python.* [Online] Available at: https://plotly.com/python/plotly-express/ [Accessed 10 April 2022].

sisense, 2022. *What is data visualization?.* [Online] Available at: https://www.sisense.com/glossary/data-visualization/ [Accessed 08 April 2022].

techopedia, 2022. *Drop-Down Menu.* [Online] Available at: https://www.techopedia.com/definition/5429/drop-down-menu [Accessed 10 April 2022].

7. Appendix

7.1. Dataset Details

The details of the dataset used in the development is presented below:

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Bike Sharing Dataset
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Background
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Bike sharing systems are new generation of traditional bike rentals where whole process from
membership, rental and return
back has become automatic. Through these systems, user is able to easily rent a bike from a
particular position and return
back at another position. Currently, there are about over 500 bike-sharing programs around the world
which is composed of
over 500 thousands bicycles. Today, there exists great interest in these systems due to their
important role in traffic,
environmental and health issues.

Apart from interesting real world applications of bike sharing systems, the characteristics of data
being generated by
these systems make them attractive for the research. Opposed to other transport services such as bus
or subway, the duration
of travel, departure and arrival position is explicitly recorded in these systems. This feature
turns bike sharing system into
a virtual sensor network that can be used for sensing mobility in the city. Hence, it is expected
that most of important
events in the city could be detected via monitoring these data.

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Data Set
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Bike-sharing rental process is highly correlated to the environmental and seasonal settings. For
instance, weather conditions,
precipitation, day of week, season, hour of the day, etc. can affect the rental behaviors. The core
data set is related to
the two-year historical log corresponding to years 2011 and 2012 from Capital Bikeshare system,
Washington D.C., USA which is
publicly available in http://capitalbikeshare.com/system-data. We aggregated the data on two hourly
and daily basis and then
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extracted and added the corresponding weather and seasonal information. Weather information are
extracted from http://www.freemeteo.com.

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Associated tasks
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          - Regression:
                    Predication of bike rental count hourly or daily based on the environmental and
seasonal settings.

          - Event and Anomaly Detection:
                    Count of rented bikes are also correlated to some events in the town which
easily are traceable via search engines.
                    For instance, query like "2012-10-30 washington d.c." in Google returns related
results to Hurricane Sandy. Some of the important events are
                    identified in [1]. Therefore the data can be used for validation of anomaly or
event detection algorithms as well.


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Files
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          - hour.csv : bike sharing counts aggregated on hourly basis. Records: 17379 hours


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Dataset characteristics
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          - instant: record index
          - dteday : date
          - season : season (1:springer, 2:summer, 3:fall, 4:winter)
          - yr : year (0: 2011, 1:2012)
          - mnth : month ( 1 to 12)
          - hr : hour (0 to 23)
          - holiday : weather day is holiday or not (extracted from http://dchr.dc.gov/page/holiday-
schedule)
          - weekday : day of the week
          - workingday : if day is neither weekend nor holiday is 1, otherwise is 0.
          + weathersit :
                    - 1: Clear, Few clouds, Partly cloudy, Partly cloudy
                    - 2: Mist + Cloudy, Mist + Broken clouds, Mist + Few clouds, Mist
                    - 3: Light Snow, Light Rain + Thunderstorm + Scattered clouds, Light Rain +
Scattered clouds
                    - 4: Heavy Rain + Ice Pallets + Thunderstorm + Mist, Snow + Fog
          - temp : Normalized temperature in Celsius. The values are divided to 41 (max)
          - atemp: Normalized feeling temperature in Celsius. The values are divided to 50 (max)
          - hum: Normalized humidity. The values are divided to 100 (max)
          - windspeed: Normalized wind speed. The values are divided to 67 (max)
          - casual: count of casual users
          - registered: count of registered users
          - cnt: count of total rental bikes including both casual and registered

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License
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Use of this dataset in publications must be cited to the following publication:

[1] Fanaee-T, Hadi, and Gama, Joao, "Event labeling combining ensemble detectors and background
knowledge", Progress in Artificial Intelligence (2013): pp. 1-15, Springer Berlin Heidelberg,
doi:10.1007/s13748-013-0040-3.
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```
@article{
          year={2013},
          issn={2192-6352},
          journal={Progress in Artificial Intelligence},
          doi={10.1007/s13748-013-0040-3},
          title={Event labeling combining ensemble detectors and background knowledge},
          url={http://dx.doi.org/10.1007/s13748-013-0040-3},
          publisher={Springer Berlin Heidelberg},
          keywords={Event labeling; Event detection; Ensemble learning; Background knowledge},
          author={Fanaee-T, Hadi and Gama, Joao},
          pages={1-15}
}

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Contact
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For further information about this dataset please contact Hadi Fanaee-T (hadi.fanaee@fe.up.pt)
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