



DELHI METRO NETWORK ANALYSIS

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Abstract—

The progressive hub of Delhi, surrounded by diverse states, necessitates effective communication avenues. With road, rail, and the efficient metro network, connectivity thrives, facilitating swift transit like Delhi to Meerut within hours. Our project delves into analyzing Delhi's metro system, scrutinizing its structure, efficiency, and operational efficacy, including connectivity, traffic, stations, and routes.

Keywords—

“Introduction”, “Reason of Delhi Metro”, “Language and model use”, “Analysis”, “Application”, “Conclusion”, “Reference”

I. INTRODUCTION

Established in 1995 under the Companies Act, the Delhi Metro Rail Corporation (DMRC) symbolizes a collaborative effort between the Government of India and the Government of the National Capital Territory of Delhi. Operating from its headquarters at Metro Bhawan, New Delhi, DMRC boasts a board comprising 17 Directors, reflecting both governments' involvement. With a sprawling network spanning 392.44 Kms and 288 stations, including extensions to NOIDA, Gurugram, and beyond, DMRC has redefined urban transit in India. Its innovative services, punctuality, and eco-friendly initiatives, such as regenerative braking and solar power integration, underscore its commitment to sustainable urban development and efficient mass transit.

II. REASON OF DELHI METRO

The city boasts a population exceeding one million and surpasses Mumbai, Kolkata, and Chennai combined in registered vehicles. Automobiles, constituting over two-thirds of atmospheric pollution, exacerbate environmental concerns. Moreover, the region witnesses a high frequency of road accidents. Over 35 studies advocate for the implementation of a mass rapid transit system to address these challenges effectively.

III. LANGUAGE AND MODEL USE

The Software Requirement Specification outlines the key software components utilized in the project:

Python: The primary programming language employed for development, known for its versatility and extensive library support.

Pandas: A Python library facilitating data manipulation and analysis, particularly adept at handling structured data like spreadsheets or databases, pivotal for data exploration and cleaning in our project.

NumPy: Essential for numerical computing, providing support for large multi-dimensional arrays and a suite of mathematical functions, pivotal for efficient numerical operations and scientific computing.

Matplotlib: A comprehensive Python library for data visualization, enabling the creation of a wide array of plots and charts, crucial for presenting insights visually.

Seaborn: Built on top of Matplotlib, Seaborn offers enhanced aesthetics and additional plot types, enhancing the visual appeal and interpretability of our visualizations.

GeoPandas: Integrating pandas with geospatial data capabilities, GeoPandas facilitates effortless manipulation and analysis of geographic data, essential for geographical insights in our project.

Folium: Facilitating the creation of interactive maps within Python, Folium empowers dynamic spatial visualizations, crucial for representing geographical data effectively.

Plotly: Offering web-based interactive visualizations with extensive customization options, Plotly enriches our project with dynamic and shareable plots, seamlessly integrating with other Python libraries and external tools.

ANALYSIS

In a metropolis like Delhi, metro network analysis contributes to the development of urban transportation infrastructure, which in turn improves commuter experiences and city planning. The procedure we can use to complete the Delhi Metro Network Analysis task is listed below:

- a. Geographical Analysis
- b. Time-Series Analysis
- c. Metro-Line Analysis
- d. Station Layout Analysis

Geographical Analysis

The metro stations' positions on a map. It will help us understand how the stations are distributed geographically around Delhi. Each station will be plotted using the latitude and longitude information.

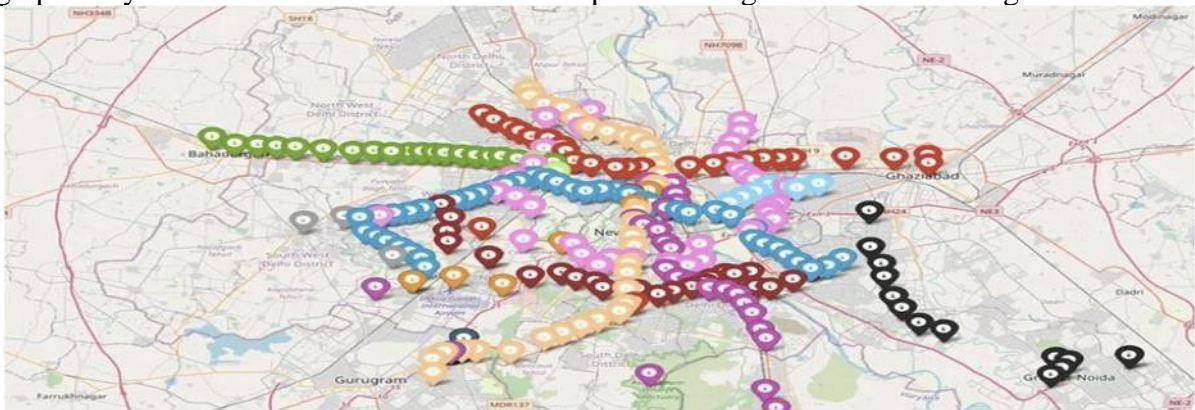


Fig [geographical map of Delhi metro network]

Time-Series Analysis

I will analyze the growth of the Delhi Metro network over time. I'll look at how many stations were opened each year and visualize this growth. It can provide insights into the pace of metro network expansion and its development phases.

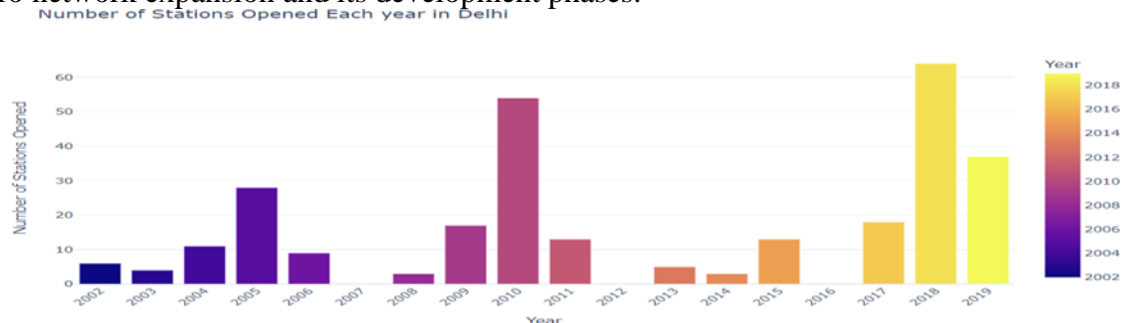


Fig [Time_series bar of Delhi metro network]

Metro-Line Analysis

I'll analyze the various metro lines in terms of the number of stations they have and the average distance between stations.

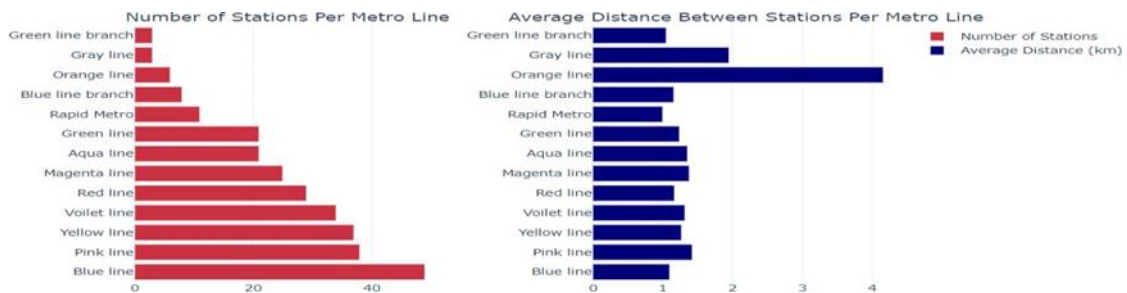


Fig [Metro_line histogram of Delhi metro network]

Station Layout Analysis

I'll explore the station layouts (Elevated, Ground Level, Underground).

I'll analyze the distribution of these layouts across the network and see if there are any patterns or trends, such as certain lines favouring a particular layout.

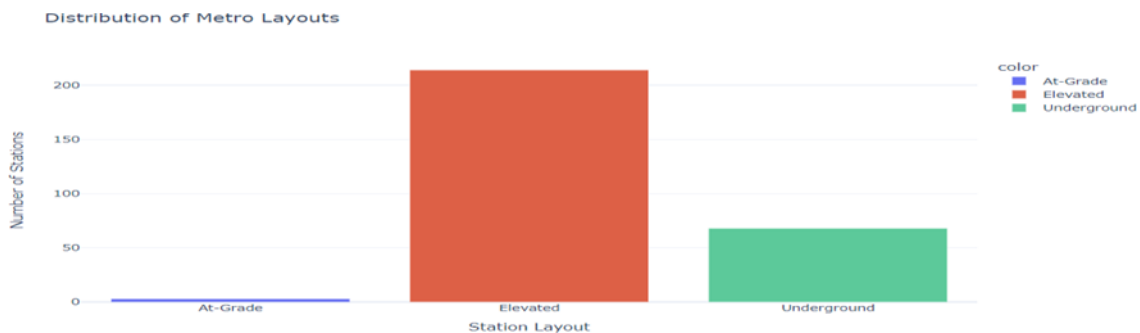


Fig [Station layout bar of Delhi metro network]

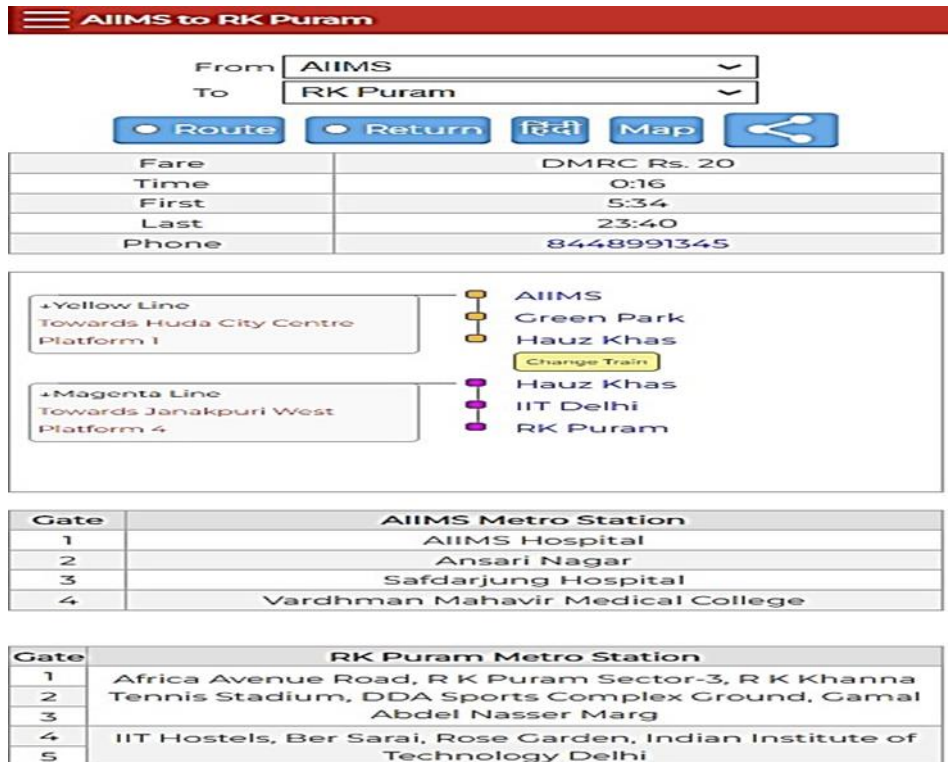
V. APPLICATION

The Delhi Metro Path Finder stands as a user-friendly interface designed to streamline navigation within the intricate Delhi Metro system. With its clear designation as "DELHI METRO" and the section header "DELHI METRO ROUTE," the interface prioritizes its function of aiding in route discovery. Users engage with the system by inputting their starting and ending stations via designated fields labeled "SOURCE" and "DESTINATION," respectively. These inputs are facilitated through dropdown menus labeled "Select Station," offering users a convenient selection process from a comprehensive list of available stations. Upon submission, the system swiftly computes the optimal route, factoring in variables such as distance and travel time, with the aid of the "Find Route" button. To provide users with visual context, an option to "Click Here To View Map" presents a graphical representation of the metro network, potentially with the calculated route highlighted for enhanced clarity. Lastly, an "Exit" button offers a straightforward means to close the application, ensuring user convenience throughout the navigation process.

The Delhi Metro network spans a vast expanse, encompassing a multitude of lines tailored to serve the diverse regions of Delhi and its surrounding areas. Among these lines are the well-known Red, Yellow, and Blue lines, along with the Airport Express, Green, Rapid, Violet, Magenta, Pink, Blue, Green, Aqua, and Gray Lines. Each line extends its reach into various neighborhoods and districts, catering to the transportation needs of millions of commuters on a daily basis. This extensive network not only facilitates efficient travel within Delhi but also fosters connectivity between different parts of the National Capital Region, contributing significantly to the region's mobility infrastructure and urban development.



Fig[Delhi Metro Path Finder Application]



Fig[Plan of Delhi Metro Path Finder]

CONCLUSIONS

In this project, we fused Delhi Metro Network Analysis with the Delhi Metro Path Finder, creating a holistic solution for commuters navigating the extensive metro network. Through data analysis, we gained insights into the metro's historical expansion, facilitating a deeper understanding of its evolution. The implementation of the Path Finder enables commuters to plan journeys efficiently, offering optimal routes, fare information, and essential details for a seamless experience. By integrating all components and incorporating conditional logic, the project ensures user-friendly operation, serving as a valuable resource for commuters, both regular and new, facilitating hassle-free travel within the metro network.



REFERENCES

- [1] •www.delhimetrorail.com. Retrieved 16 April 2022.
- [2] "Economic Survey of Delhi 2023–24" (PDF). p. 240. Archived from the original (PDF) on 11 March 2024. Retrieved 5 April 2024.
- [3] Gandhiok, Jasjeev (18 January 2024). "Delhi Metro logs 2 billion passenger trips for 2023 — highest ever". Hindustan Times. New Delhi. Retrieved 19 January 2024.
- [4] "Board of Directors of DMRC". www.delhimetrorail.com. Retrieved 2 April 2022.
- [5] "Delhi Metro adding 120 more coaches to upgrade remaining fleet of 6-coach trains". Hindustan Times. 4 April 2021. Retrieved 10 April 2022.
- [6] "Introduction | DMRC". www.delhimetrorail.com. Retrieved 16 April 2022.
- [7] "VROOM! Delhi metro top speed increased! Now, IGI Airport to New Delhi Railway Station in just". 22 March 2023.
- [8] "Delhi airport metro line, now running at 100 KMPH". 23 March 2023.
- [9] "Delhi Metro increases speed to 120kmph on Airport Line. Know how long will it take to reach Delhi airport". 16 September 2023.
- [10] Dua, Tanya (24 November 2018). "After 5 years of riding the New York City subway, I tried the Delhi Metro at the busiest time of the year – and it showed me exactly what I'm missing". Business Insider. Retrieved 24 February 2019.
- [11] "Route map". www.delhimetrorail.com. Retrieved 16 April 2022.
- [12] "DMRC Services Update". delhimetrorail.com. Delhi Metro Rail Corporation (DMRC). 24 October 2023. Retrieved 14 November 2023.
- [13] Roy, Sidharatha (25 December 2017). "Delhi Metro: It all started 15 Xmas days ago". The Times of India. New Delhi. Archived from the original on 7 January 2018. Retrieved 16 January 2018.