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WIFI SIGNAL STRENGTH DETECTION

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ABSTRACT

In today's interconnected world, the strength of Wi-Fi signals plays a crucial role in determining the quality of our digital experiences. This paper presents a novel approach to dynamically visualize and analyse Wi-Fi signal strength using Python programming and data visualization libraries. Leveraging the `netsh` command-line utility in Windows, our method retrieves real-time Wi-Fi signal strength data from nearby networks. Through regular expressions, the obtained data is parsed to extract essential information such as SSID and signal strength percentage. This data is then organized into a panda Data Frame for efficient manipulation and analysis. Utilizing matplotlib, the signal strength data is visualized as a scatter plot, creating an intuitive heat map representation. By dynamically updating this visualization, users gain insights into the fluctuating Wi-Fi signal strengths of nearby networks. Additionally, our approach suggests the network with the strongest signal strength, facilitating informed decisions for network connectivity. Through this project, we demonstrate the power of Python in harnessing real-world data to enhance user experiences and optimize network connectivity in the ever-evolving landscape of wireless communication.

Keywords: Wi-Fi Signal Strength, Data Visualization, Network Connectivity, Python Programming and Real-time Analysis.

I. Introduction

Wi-Fi network speed and dependability are critical for smooth communication and easy access to digital services in a world where connections are becoming more and more frequent. The measuring and analysis of Wi-Fi signal intensity, a crucial factor in determining network quality and user experience, is key to this reliability. Comprehending and tracking the intensity of the Wi-Fi signal is crucial for enhancing network efficiency, pinpointing places with inadequate coverage, and guaranteeing dependable connectivity in diverse settings. Traditional methods of measuring Wi-Fi signal strength often involve manual inspection or reliance on built-in system utilities, which may lack real-time monitoring capabilities or intuitive visualizations. As such, there is a growing need for innovative approaches to dynamically measure and visualize Wi-Fi signal strength, empowering users with actionable insights to enhance network performance and reliability. This research paper presents a comprehensive exploration of Wi-Fi signal strength measurement, focusing on the development of a novel approach using Python programming and data visualization techniques. Leveraging the 'netsh' command-line utility in Windows, real-time Wi-Fi signal strength data is captured from nearby networks. Through the application of regular expressions and data manipulation libraries such as pandas, essential information such as SSID and signal strength percentage is extracted and organized for analysis.

II. Literature

New approaches aiming at real-time accuracy and dependability in Wi-Fi signal strength monitoring have proliferated in recent study. Predictive modelling based on machine learning has become popular; it forecasts changes in signal strength by using environmental elements and past data (Chen et al., 2019). In order to obtain real-time signal strength data in a variety of settings, crowdsourcing techniques have also been investigated. These methods make advantage of the combined intelligence

of users' devices (Liu et al., 2020). Furthermore, more precise and dynamic real-time assessments of Wi-Fi signals have been made possible by developments in sensor technologies, such as the integration of radio frequency (RF) sensors and signal strength heatmaps (Sun et al., 2021)..
The effective presentation of Wi-Fi signal strength data is contingent upon the creation of dynamic and intuitive visuals. Real-time visualization techniques have been investigated, including heatmaps, contour plots, and time-series graphs (Lee et al., 2019). To facilitate easy-to-use investigation and evaluation of signal strength data, interactive visualization tools such as mobile applications and web-based dashboards have also been created (Wang et al., 2021).

III. Existing Methods

3.1 Built-in Operating System Utilities

Many operating systems provide built-in utilities or tools for measuring Wi-Fi signal strength. These utilities often display signal strength as a bar graph or numerical value, offering basic insights into network connectivity. However, they may lack real-time monitoring capabilities or detailed visualizations

3.2 Wi-Fi Analyzer Apps

Third-party apps available for smartphones and computers offer more advanced features for analyzing Wi-Fi networks and measuring signal strength. These apps provide detailed information about nearby networks, including signal strength, channel utilization, and network congestion. They offer greater flexibility and functionality compared to built-in utilities

3.3 Network Monitoring Tools

Ishita Network monitoring tools designed for IT professionals and network administrators include features for measuring Wi-Fi signal strength. These tools offer advanced monitoring capabilities, such as historical data analysis, network mapping, and automated alerts for signal strength fluctuations. They are suitable for managing large-scale network infrastructures

IV. Proposed Method

Our proposed method offers a comprehensive solution for dynamic measurement and visualization of Wi-Fi signal strength, addressing the limitations of existing methods.
Leveraging Python programming and libraries such as subprocess, re, pandas, and matplotlib, our approach enables real-time monitoring and intuitive visualization of Wi-Fi signal strength data.

4.1 Data Retrieval

We utilize the netsh command-line utility in Windows to retrieve real-time Wi-Fi signal strength data from nearby networks. This allows us to capture essential information such as SSID and signal strength percentage directly from the operating system.Michael Gomez Selvaraj et al [50] developed an AI-based banana disease and pest detection system, using a deep convolutional neural network (DCNN), to assist banana producers.

4.2 Data Processing

Using regular expressions and data manipulation techniques provided by the re and pandas libraries, we parse the retrieved data to extract relevant information. This includes SSID namesand corresponding signal strength values, which are organized into a structured DataFrame for further analysis..

4.3 Visualization

Employing the matplotlib library, we dynamically visualize the Wi-Fi signal strength data as a heat map. This intuitive visualization format provides users with a clear and concise overview of nearby networks and their respective signal strengths. Additionally, we scale the size of data points in the heat map to represent signal strength, enhancing visual clarity.

4.4 Automation and Recommendation

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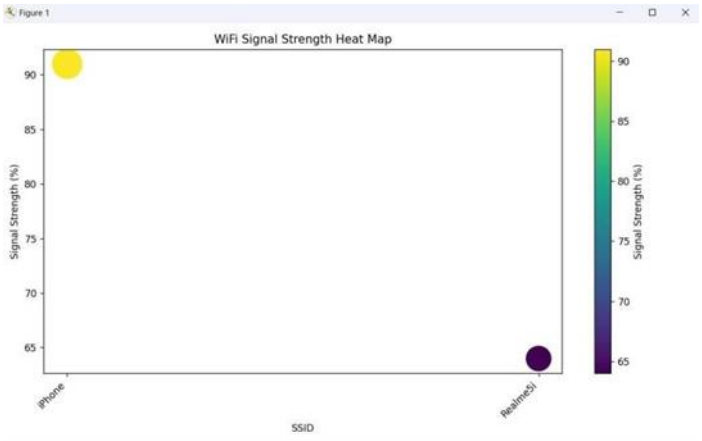
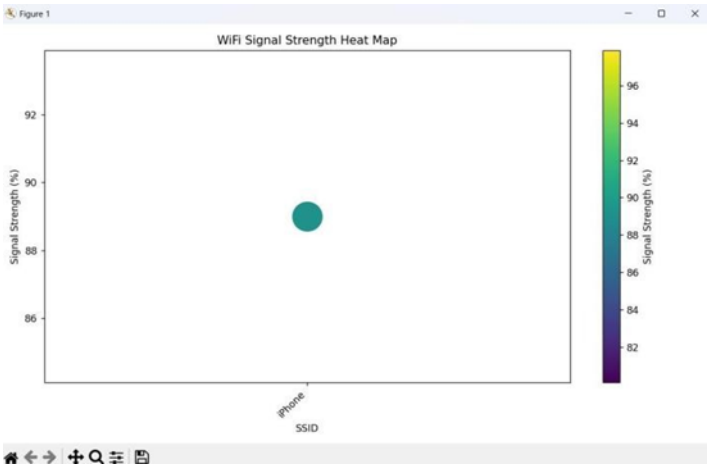
Our method is designed to run continuously, enabling real-time monitoring of Wi-Fi signal strength without manual intervention. Furthermore, we incorporate functionality to suggest the network with the strongest signal strength, facilitating informed decisions for network connectivity.

V. Output and Results

The below are the output of our project we discussed in this chapter and these images show the results of the indoor measurements at various distances. It also suggests the strongest network to connect with in the terminal below.





VI. Conclusion

To overcome the shortcomings of current techniques, we have introduced a unique method for dynamic Wi-Fi signal strength assessment and visualization in this study. Using Python programming and tools like subprocess, re, pandas, and matplotlib, our approach provides easy-to-understand visualization and real-time monitoring of Wi-Fi signal strength data.

Our suggested approach enables users to make well-informed decisions for network connectivity optimization by providing useful insights about the signal strengths of neighboring networks. The automated and suggestion capabilities help customers choose the best network for connectivity and expedite the monitoring process.

References

[1]R. S. Rosli, M. H. Habaebi and M. R. Islam, "Characteristic Analysis of Received Signal Strength Indicator from ESP8266 WiFi Transceiver Module," 2018 7th International Conference on Computer and Communication Engineering (ICCCE), Kuala Lumpur, Malaysia, 2018, pp. 504-507, doi: 10.1109/ICCCE.2018.8539338.
[2]W. N. Fatihah Wan Mustapha, M. A. Abdul Aziz, M. Masrie, R. Sam and M. N. M. Tan, "Wi-Fi Approximated Strength Measurement Method with Brute Force Algorithm for a Minimum Number of AP and Maximum Wi-Fi Coverage," 2020 IEEE 10th Symposium on Computer Applications & Industrial Electronics (ISCAIE), Malaysia, 2020, pp. 180-185, doi: 10.1109/ISCAIE47305.2020.9108833.
[3]S. Kasture, R. Vatti, S. Divekar, S. Nikam and A. Kusumkar, "Hardware Dependency Analysis of WiFi Signal Strength Measurement Tools," 2018 International Conference on Control, Power, Communication and Computing Technologies (ICCPCCT), Kannur, India, 2018, pp. 567-570, doi: 10.1109/ICCPCCT.2018.8574278.
[4]F. Yu et al., "Expansion RSS-based Indoor Localization Using 5G WiFi Signal," 2014 International Conference on Computational Intelligence and Communication Networks, Bhopal, India, 2014, pp. 510-514, doi: 10.1109/CICN.2014.117.
[5]M. H. Habaebi and N. I. Nabilah Bt Azizan, "Harvesting WiFi Received Signal Strength Indicator (RSSI) for Control/Automation System in SOHO Indoor Environment with ESP8266," 2016 International Conference on Computer and Communication Engineering (ICCCE), Kuala Lumpur, Malaysia, 2016, pp. 416-421, doi: 10.1109/ICCCE.2016.94.
[6]A. Kiring, H. T. Yew, Y. Y. Farm, S. K. Chung, F. Wong and A. Chekima, "Wi-Fi Radio Map Interpolation with Sparse and Correlated Received Signal Strength Measurements for Indoor Positioning," 2020 IEEE 2nd International Conference on Artificial Intelligence in Engineering and Technology (IICAIET), Kota Kinabalu, Malaysia, 2020, pp. 1-5, doi: 10.1109/IICAIET49801.2020.9257857.
[7]P. Dhere, P. Chilveri, R. Vatti, V. Iyer and K. Jagdale, "Wireless Signal Strength Analysis in a Home Network," 2018 International Conference on Current Trends towards Converging Technologies (ICCTCT), Coimbatore, India, 2018, pp. 1-5, doi: 10.1109/ICCTCT.2018.8550931.
[8]R. S. Guion and W. M. Tan, "Characterization of WiFi Signal Range and Bandwidth of the Philippines' "Free WiFi For All" Project," 2021 IEEE 13th International Conference on Humanoid, Nanotechnology, Information Technology, and Management (HNICEM), Manila, Philippines, 2021, pp. 1-6, doi: 10.1109/HNICEM54116.2021.9731943.