**Related Work**

The integration of mobility data and environmental factors, particularly air quality, plays a crucial role in understanding urban dynamics and their impact on climate change. As cities continue to grow, analyzing how mobility patterns influence environmental conditions such as air pollution becomes increasingly important. Our project builds upon this idea by comparing mobility patterns across multiple cities and assessing their effects on air quality. Several key studies provide the foundation for our work, offering methodologies and insights that are directly relevant to our objectives.

Al Jawarneh et al. [1] proposed a scalable approach to integrate heterogeneous mobility and pollution data, ensuring quality of service (QoS) guarantees. Their framework effectively handles large-scale geospatial big data, enabling joint analytics across diverse urban datasets. This work directly informs our approach to integrating mobility and environmental data in a way that ensures the reliability of our analysis, particularly as we compare air quality across different cities.

In addition, Al Jawarneh et al. [2] focused on approximate query processing for smart cities, where spatial data streams are used to analyze mobility and environmental factors in real-time. Their work emphasizes the need for efficient processing techniques that can handle the continuous flow of data generated by urban systems. This aligns well with our project, as real-time analysis of mobility patterns and air quality will be essential in deriving actionable insights for policy interventions.

Another relevant contribution by Al Jawarneh et al. [3] explores the integration of mobility and environmental data for climate change analytics. This paper examines how urban mobility can be analyzed in conjunction with environmental factors to provide a more holistic understanding of climate change impacts on cities. Their approach highlights the importance of combining multiple data sources to study the complex relationship between urban mobility and environmental conditions—an approach we will adopt in our project.

Al Jawarneh et al. [4] also contributed by focusing on the simplification of complex geospatial data for more efficient analytics. Their research on polygon simplification for georeferenced big data will be valuable for handling large-scale datasets, such as those containing mobility and air quality data across cities. By reducing the complexity of spatial data, their methodology will help us improve the scalability and efficiency of our own analysis.

Furthermore, the work of Ghaffarpasand et al. [5] investigates the impact of urban mobility on air pollution in Kampala, a sub-Saharan African city. The authors used a combination of mobility data from GPS and air quality measurements to model the relationship between transportation patterns and pollution levels. Their study applies statistical modeling techniques to quantify how urban mobility influences pollutant concentrations. This study is highly relevant to our project, as it provides valuable insights into how mobility patterns affect air quality, particularly in cities with diverse urban dynamics.

Bandeira et al. [6] studied the impact of land use on urban mobility patterns and emissions in a medium-sized Portuguese city. Their research combined traffic data collection, land use classification, and air pollution monitoring to understand how different land use categories affect mobility and emissions. This methodology is directly applicable to our work, as understanding how land use influences mobility patterns will help us compare urban environments across cities and assess their impact on air quality.

Together, these studies provide essential methodologies and frameworks for integrating and analyzing geospatial big data in urban mobility and environmental contexts. They highlight the challenges and techniques for managing large-scale data, ensuring real-time processing, and deriving actionable insights from complex urban datasets. These contributions form the basis of our approach to comparing mobility patterns across cities and assessing their impact on air quality, ultimately informing policy recommendations for improving urban sustainability.

**References**

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