Exploratory Research – Problem Formulation and Data Collection Planning

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1 Problem Statement

Urban Commuting Issues in Bengaluru: Carpooling and Pollution Reduction

Bengaluru faces severe urban commuting challenges due to rapid population growth, high private vehicle usage, traffic congestion, and limited last-mile connectivity. A large number of commuters travel daily in single-occupancy vehicles, contributing to traffic delays, fuel wastage, and increased air pollution.

The objective of this research is to explore whether structured carpooling strategies can reduce traffic congestion and vehicular pollution in Bengaluru. The study focuses on understanding commuting patterns, willingness to carpool, and identifying areas where carpooling can be effectively encouraged. This work emphasizes analysis and data-driven insights rather than implementing a specific carpooling algorithm.

2 Research Design

Two major research design strategies are considered for this study:

Primary Research

Due to limited availability of detailed public datasets on individual commuting patterns and carpooling behavior, primary data collection is required. This includes data from commuter surveys, interviews, and ride-sharing usage patterns to understand travel distances, vehicle occupancy, and willingness to share rides.

Secondary Research

Secondary data sources include publicly available traffic congestion reports, pollution data from government agencies, existing carpooling app statistics, and road network information. Traffic density maps and peak-hour congestion data can be used to identify high-impact zones where carpooling could significantly reduce vehicle load.

3 Sampling and Data Collection

Human-centric data collection is essential to capture behavioral and preference-based information that cannot be obtained through sensors or traffic cameras alone. The following questions guide the data collection process:

1. What is the average daily commute distance and duration for Bengaluru residents?
2. How many commuters travel alone in private vehicles during peak hours?
3. How many people travel along similar routes and time windows?
4. Would commuters be willing to carpool if matched with:
   (a) Colleagues from the same workplace

(b) People from nearby residential areas

(c) Verified users through an app

5. What factors discourage people from carpooling (privacy, flexibility, trust)?
6. How much fuel cost and time do commuters estimate they could save through carpooling?
7. Are commuters aware of the pollution impact of single-occupancy vehicle usage?
8. Would incentives such as priority parking or reduced tolls increase carpool adoption?

4 Analysis

By analyzing commute distances, time overlaps, and route similarities, it is possible to identify clusters of commuters suitable for carpooling. Estimating reduced vehicle count directly correlates with lower fuel consumption and emissions. These insights can help design effective policies and systems that promote shared mobility and sustainable urban transport.

5 Report

The final report and presentation will justify the feasibility of carpooling as a solution to Bengaluru's commuting and pollution challenges. It will include data visualizations, scenario-based simulations, and analysis of potential reductions in traffic density and air pollution under different carpool adoption levels.