POLYTECHNIC UNIVERSITY OF THE PHILIPPINES
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Proposed Title:	"Developing a Model to Optimize Public Transportation Routes and Reduce Carbon Emission"
Improved Title:	
Research Themes:	Transportation and Environmental Sustainability
Keywords / Concepts:	Public transportation; carbon emission; air quality; sustainability; environmental impacts
Purpose of the Study:	The aim of this proposed study is to develop a data-driven model that can help optimize public transportation routes, leading to improved efficiency and reduced carbon emissions. This study seeks to address the challenges that public transportation systems face such as traffic congestion and inefficient routing, which can result in increased emissions and reduced experience for the commuters. By optimizing routes based on data and machine learning algorithms, the study aims to reduce carbon emissions and improve the sustainability of public transportation systems while maintaining or improving the quality of service for the passengers. The results of the study could be used by public transportation authorities to inform decisions about route planning and system design. Ultimately, the purpose of the study is to contribute to the development of more sustainable, efficient, and user-friendly public transportation systems.

STATEMENT OF THE PROBLEM (Question Form) / STATEMENT OF PURPOSE (Declarative Form)	
PROPOSED	REVISED
1. What is the current state of public transportation routes and carbon emissions in the study area?	
2. What are the challenges in implementing the optimized public transportation routes and how can they be addressed?	
3. What are the key factors that influence the efficiency of public transportation routes and the amount of carbon emissions generated?	
4. How can data science and machine learning techniques be used to identify opportunities for route optimization in public transportation systems?	
5. What data sources and machine learning algorithms can be used to develop a model for optimizing public transportation routes and reducing carbon emissions?	
6. What are the most effective strategies for implementing optimized routes in public transportation systems, and how can they be evaluated?	
7. How can the model be validated and tested to ensure that it produces reliable and accurate results?	

Significance of the Study	Institutional:	At the institutional level, the study's data-driven model can benefit public transportation agencies and authorities by creating an efficient and sustainable system, leading to increased revenue. It also offers academic institutions an opportunity for interdisciplinary and applied research, which could result in publications, presentations, and grants, elevating their profile and attracting funding and partnerships.
Who and how will they benefit from the study?	Local:	At the local level, the proposed study can benefit residents and businesses by improving public transportation quality, reducing carbon emissions, and creating a more sustainable and eco-friendly community. Additionally, the study's model can be used as a reference for other regions to optimize their public transportation, providing widespread benefits to society and the environment.
	National:	At the national level, the study can inform national policy and decision-making on transportation and environmental issues, resulting in more sustainable and efficient public transportation systems throughout the country. This creates a more eco-friendly transportation sector, leading to national-level benefits such as reduced carbon emissions and improved access to transportation options.

METHODOLOGY	
Research Design:	The study will use a mixed-methods approach, starting with a literature review on transportation, carbon emissions, and optimization models. Then, primary data will be collected through surveys and interviews with key stakeholders, and used to develop a quantitative optimization model that incorporates traffic flow, passenger demand, and carbon emissions. The model will be tested through simulation and compared to current public transportation systems in Metro Manila. The study aims to reduce carbon emissions and improve public transportation efficiency in the region.
Research Locale:	The proposed study will be conducted in Metro Manila, Philippines. Metro Manila is known for having a highly congested road network, which often leads to increased carbon emissions and decreased efficiency in public transportation. As such, optimizing public transportation routes to reduce carbon emissions and improve efficiency can have significant impacts on the environment and the daily lives of commuters in the city.
Target Participants:	The target participants of the study will include various stakeholders in the city's public transportation system, such as transportation agencies, planners, policymakers, commuters, drivers, and operators. Their insights and perspectives will be gathered to address current challenges and integrate potential solutions into the model.
Sampling Technique:	The proposed study will utilize both purposive and stratified sampling techniques. Purposive sampling will target participants with relevant knowledge and expertise, while stratified sampling will ensure representation of the entire population, including commuters of different demographics in Metro Manila.
Research Instrument:	Surveys will be distributed to public transportation passengers to gather information about their travel patterns, preferences, and satisfaction with the current transportation system. Meanwhile, data collection forms will be used to gather data on current public transportation routes, schedules, and other relevant data to help develop the model. Furthermore, existing data sources, such as transportation schedules, traffic reports, and environmental impact assessments, can be used as a research instrument for the development of the model. These can include data on current public transportation routes and schedules. Environmental organizations and research institutions may also have data on air pollution levels and greenhouse gas emissions in the study area.
Expected Output:	The proposed study aims to produce a data-driven model for public transportation agencies in Metro Manila. The model will optimize routes, reduce travel times, and decrease carbon emissions, accounting for factors such as demand, traffic, and emissions. Additionally, the study will provide recommendations to implement the model for improved efficiency, reduced emissions, and better commuter experience.

INITIAL REFERENCES

1. "Green Transportation for Sustainability: Review of Current Barriers, Strategies, and Innovative Technologies" by Shah et al. (2021)

2. "Optimal Public Transport Operational Strategies to Reduce Cost and Vehicle's Emission" by Tang et al. (2018)

3. "An Integrated Multi-Objective Model for Optimizing Public Transit Routing and Scheduling" by L. Li et al. (2018)

4. "Simulation, Optimization, and Machine Learning in Sustainable Transportation Systems: Models and Applications" by de la Torre et al. (2021)

5. "A Multi-Objective Evolutionary Algorithm for Optimizing Urban Public Transportation Networks" by Zhang et al. (2019)

RESEARCH MILESTONES

DATE	ACTIVITY	PERSON/S INVOLVED

Target Date of Completion:

RECOMMENDATIONS:

FINAL APPROVAL:

Dr. Juancho D. Espineli