OPTIMUM TRAVEL ROUTE

Video

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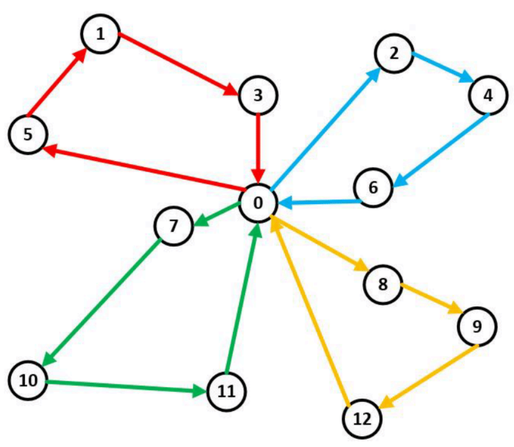
The project focuses on developing an **automated visit plan** for tourists in **Puebla, Mexico**. The goal is to provide personalized and efficient itineraries that **maximize traveler satisfaction**, considering **factors** such as available time, budget, and attraction preferences. Using a mathematical and computational **model** based on **Greedy algorithms** and the **Traveling Salesman Problem (TSP)**, optimal tourist routes are generated to **minimize travel times**. The project utilizes data from Google Maps and TripAdvisor to calculate distances, times, and satisfaction levels. The implementation is done in Python, using libraries such as numpy and pandas. The result is an **intelligent system** that enhances the tourist experience and contributes to the **economic**, **social**, **and sustainable development** of Puebla by promoting more effective and attractive tourism. This approach has the potential to be replicated in other cities and regions, expanding its positive impact on the tourism sector.

Introduction

The need to improve tourist visit planning in Puebla, a destination known for its natural and cultural attractions, motivates this project. The main objective is to develop an intelligent tool that maximizes traveler satisfaction through personalized itineraries and certain factors, optimizing time as well. This tool will not only enhance the tourist experience but also boost local economic, social, and sustainable development.

Methodology

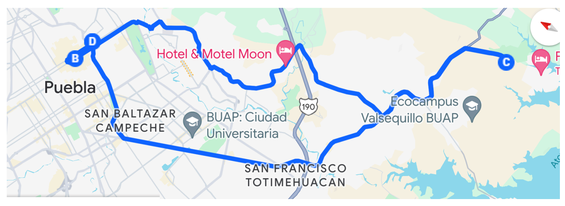
A **mathematical and computational model** based on Greedy algorithms and the TSP is employed. Data were collected from sources such as **Google Maps** and **TripAdvisor** to calculate travel times, distances, costs, and tourist satisfaction levels. The **Greedy** algorithm selects the most satisfying tourist spots, while the **TSP** optimizes the visit order to minimize travel times. The implementation was carried out in **Python**, using libraries such as numpy and pandas.



Results

The developed algorithm produces optimal daily itineraries for tourists, considering specific time and budget constraints. For example, in a test with a three-day itinerary, the system generated routes that maximized user satisfaction with a total travel time of **19.73 hours** and a total cost of **1289.5 pesos**, staying within the assigned budget. These results demonstrate the model's effectiveness in optimizing the tourist experience in Puebla.

DAY 1



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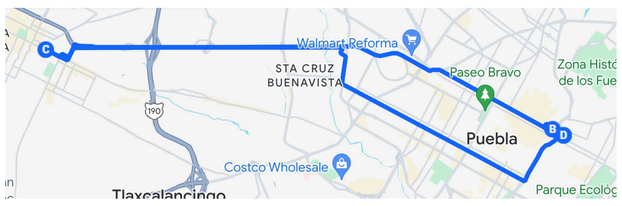

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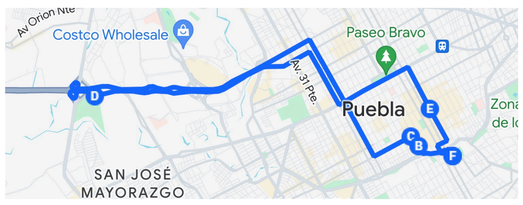

Conclusions

An algorithm adaptable to user needs was developed, considering specific factors and achieving a positive impact on Sustainable Development Goals (SDGs) 8, 9, and 13. This project promotes sustainable tourism, drives technological innovation in travel planning, and reduces carbon emissions by optimizing travel times. The tool is adaptable to other regions, allowing the inclusion of cultural, gastronomic, and historical elements, maximizing the user experience. It offers personalized itineraries that enrich the visit and have the potential for replication in other cities.

8 DECENT WORK AND ECONOMIC GROWTH

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE

13 CLIMATE ACTION

Acknowledgments

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References

Turismo en México: tendencias que marcan al sector en este 2023. (November 30, 2022). Wortev Capital. https://wortev.capital/consumo-5-0/turis mo-en-mexico-tendencias/

Secretaría de Turismo. (September 17, 2023.). *Capta Puebla casi 9 millones de visitantes en siete meses gracias a estrategia estatal. Gobierno de Puebla*. https://sectur.puebla.gob.mx/noticias/capta-puebla-casi-9-millones-de-visitantes-en-siete-meses-gracias-a-estrategia-estatal

Kuo, M. (April 18, 2024). *Algorithms for the Travelling Salesman Problem*. (November 8, 2023). Rou- tific. https://www.routific.com/blog/travelling-salesman-problem

Las 10 mejores cosas que ver en Puebla 2024. (2024). Tripadvisor. https://www.tripadvisor.com.mx/Attractions-g152773-Activities-Puebla_Central_Mexico_and_Gulf_Coast.html

Néstor, G. (June 6, 2023). *Las matemáticas y el turismo*. LinkedIn. https://www.linkedin.com/pulse/las-matem%C3%A1ticas-y-el-turismo-gustavo-n%C3%A9stor-fern%C3%A1ndez?originalSubdomain=es

Codex, A. (October 12, 2023). *Python and Greedy Algorithms*. Reintech. https://reintech.io/blog/python-and-greedy-algorithms-tutorial

Turismo en México: tendencias que marcan al sector en este 2023. (November 30, 2022). Wortev Capital. https://wortev.capital/consumo-5-0/turismo-en-mexico-tendencias/