

CSD416 Project Phase II Project Evaluation

TOUR ROUTE OPTIMISER USING TSP HEURISTIC ALGORITHMIC APPROACH

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Abstract

- Tourism significantly impacts the global economy. Efficient itinerary planning is crucial for travel experiences.
- This project focuses on using the Traveling Salesman Problem (TSP) in tourism which aims to find the best route for tourists and minimizing time.
- Objective: Develop software to optimize tourist itineraries by solving the TSP.
- Data collection includes tourist attractions and distances.

Domain of Project & Topic

Domain:

Travel And Tourism Trip Planning Application Using TSP

Project Topic:

Tour Route Optimizer Using TSP Heuristic Algorithmic Approach

Relevance of the Topic

- **Convenience:** Users can plan their entire trip in one place, from finding attractions to booking accommodation.
- **Information access:** The system provides a central hub for all tourism related information, making it easy for users to find what they need.
- **Business promotion:** Entrepreneurs can reach a wider audience of potential customers through the system.

Introduction

- Tourism Planner is an innovative and user-friendly platform designed to simplify and enhance the travel planning experience.
- Seamlessly integrating cutting-edge technology, it offers a dual-sided interface catering to both administrators and users.
- Administrators play a pivotal role by providing and updating essential travel data, while users leverage the system to access, customize, and visualize information through an interactive map.
- This dynamic platform empowers users to plan their journeys efficiently.



Proposed Project

- The project redefines travel planning by addressing challenges through the Traveling Salesman Problem (TSP).
- TSP is an NP-hard problem that finds the shortest route among given points.
- The software integrates data on attractions and distances using the TSP algorithm.
- Users can customize adventures, prioritize attractions and manage time constraints.
- The innovation transforms travel by offering optimized itineraries to explore the world efficiently.

The Project

Problem Statement:

To develop a software using the Traveling Salesman Problem (TSP) to assist tourists in creating optimal travel routes. This software aims to improve the efficiency of exploring tourist attractions.

The Project

Proposed Solution:

- TSP Application
- Project Focus
- Combinatorial Optimization
- Data Collection and Curation
- User Flexibility
- Software Benefits

Literature Review

IntechOpen, Travelling Salesman Problem:

- The Traveling Salesman Problem (TSP) applies mathematical techniques to solve real-world scenarios involving optimal routes for visiting multiple cities, reflecting everyday situations where ordering affects total cost.
- Its practical applications in diverse fields emphasize the significance of TSP research, demonstrating its relevance and impact on optimizing costs in various everyday situations.

Literature Review

On solving TSP by genetic algorithms:

- Introduced a genetic algorithm for the Traveling Salesman Problem, initially generating strong but not optimal solutions for problems with a specific city count, later enhanced for improved performance.
- Through experimentation, showcased the algorithm's capability to solve medium-sized problems efficiently, achieving optimal solutions within acceptable time limits for smaller city counts while providing an approximate solution for larger problems.

Literature Review

An expert system for tourists using Google Maps API:

- **eTourism Significance and Software Development:** The passage emphasizes the importance of highlighting tourist destinations in eTourism and the growing need for swift software development to meet customer demands in this field.
- **Google Maps API and Expert Tourist System:** It introduces the utilization of Google Maps API, driven by AJAX, for map-based services.

Project Design

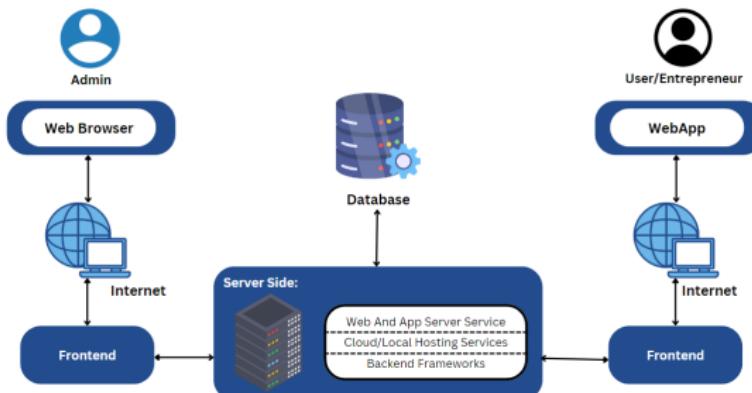


Figure: Web Application Architecture: General

Project Design

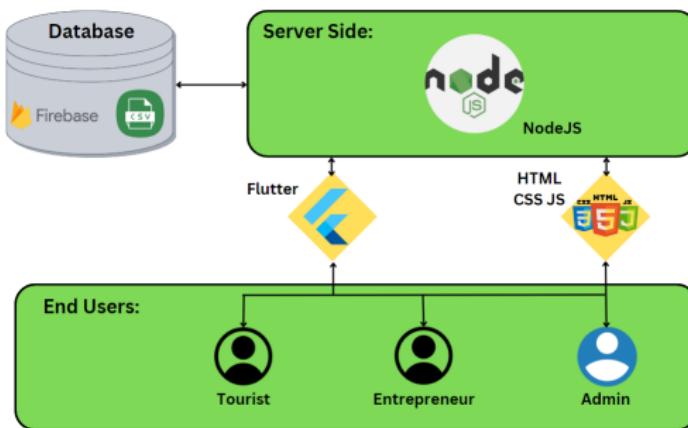
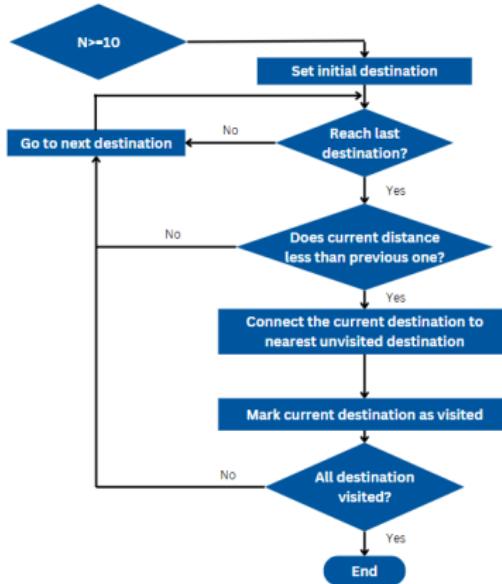
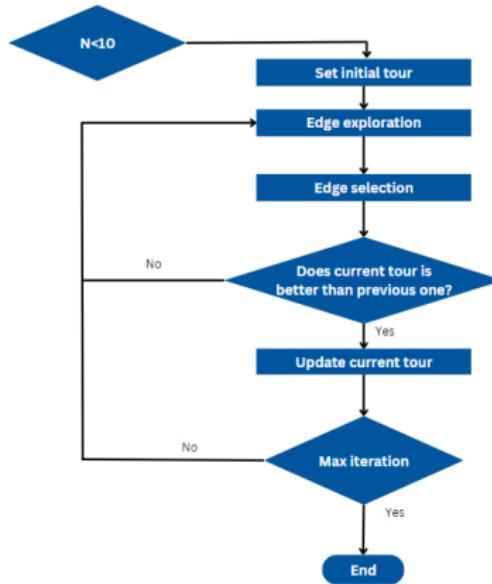


Figure: Web Application Architecture: Precise to project

Algorithm Flow



Algorithm Flow



Nearest Neighbor - Approximation

Main Algorithm (nearestneighbor):

Start with an initial city (can be chosen randomly).

Create an empty path.

Mark the initial city as visited.

While there are unvisited cities:

Find the nearest unvisited city from the current city.

Add this city to the path.

Mark this city as visited.

Update the current city to the newly visited city.

Add the starting city to the end of the path to complete the cycle.

Return the generated path.

Main Function (main):

Initialize coordinates and paths.

Print the given coordinates.

Apply Nearest Neighbor algorithm to find the path.

Nearest Neighbor - Approximation

Calculate the total distance of the generated path.

Print the generated path and its total distance.

Plot the generated path.

Execute the Main Function:

Run the main() function to start the process.

Lin-Kernighan Heuristic - Optimization

Main Algorithm (linkernighan):

Start with an initial path, which can be generated randomly or by any other means.

Begin the loop for optimization:

Initialize a flag improved as True.

While improved is True:

Set improved to False.

Iterate through the path:

Consider all possible swaps of subsequences in the path and check if the resulting path is better than the current path.

If an improvement is found, update the path and set improved to True.

Repeat until no more improvements can be made.

Return the optimized shortest path.

Lin-Kernighan Heuristic - Optimization

Main Function (main):

Initialize coordinates and paths.

Print the given coordinates.

Generate an initial random path.

Calculate the initial total distance of the path.

Apply Lin-Kernighan algorithm to find the shortest path.

Calculate the shortest total distance of the optimized path.

Print the shortest path and its total distance.

Plot the optimized shortest path.

Execute the Main Function:

Run the main() function to start the process.

Data Flow Diagram

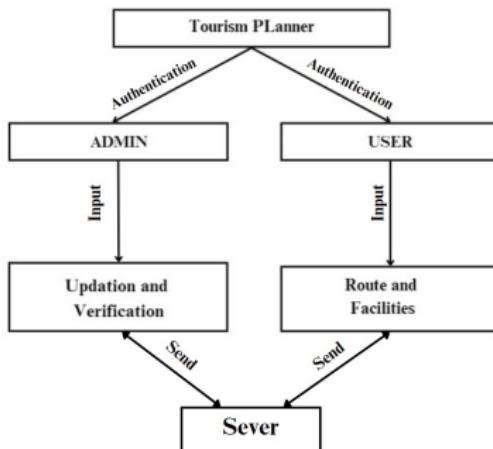


Figure: Data Flow Diagram Level 0

Data Flow Diagram

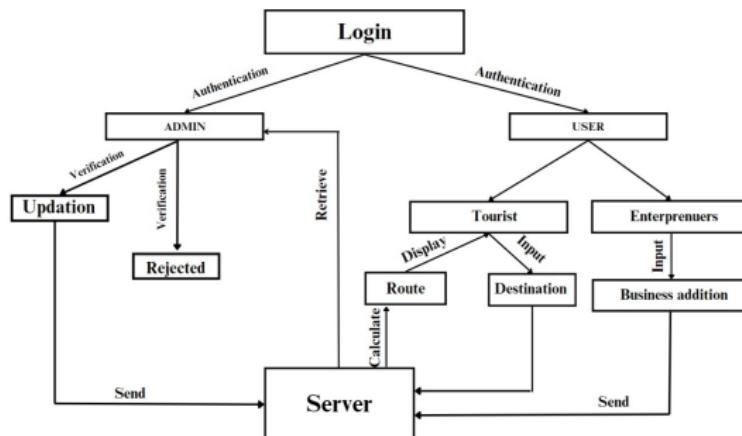


Figure: Data Flow Diagram Level 1

Data Flow Diagram

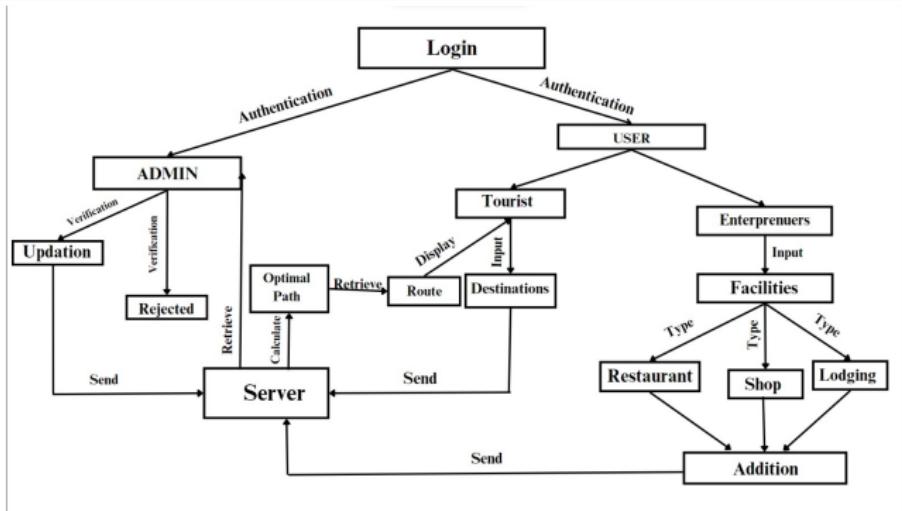


Figure: Data Flow Diagram Level 2

ER Diagram

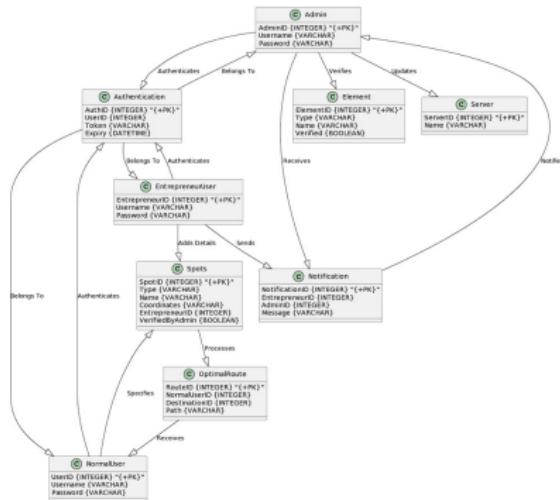


Figure: ER Diagram

Hardware Specifications

- Smartphone(with android 8 or more)
- Laptop(processor i5 or greater)
- RAM 8gb or more
- Hard-disk 160gb or above

Software Specifications

- Development tools such as Visual Studio Code (VSCode) for coding and project management.
- Fronted framework - Flutter, HTML, CSS, JavaScript
- Backend development framework used for web and application development - NodeJS and Hive
- Database Management System used for data storing and retrieval Firebase and CSV
- Web hosting platform provided through the GitHub Student Pack or from College server.

Work Schedule

- **October to December (2023):** Get Familiarized with Google Maps API features. Analyzing various approximation and optimization algorithms related to tsp. Review and understand the best algorithm for implementation. Begin designing the project, including conceptualization and initial UI/UX planning.

Work Schedule

- **January to April (2024):** Get Familiarized with HTML, CSS, JavaScript, Flutter and NodeJs. In-depth learning of Python. Commence the project development phase. Work on user interface development and Implementation of data structure and algorithm visualization. Address any technical challenges that arise during development. Then we enter the debugging and testing phase.

Development Progress

- Installation of Node Modules
- Front-End Development
- Back-End Development
- Apis
- Testing
- Hosting on Cloud Server
- App Development

Login page

✉ Email

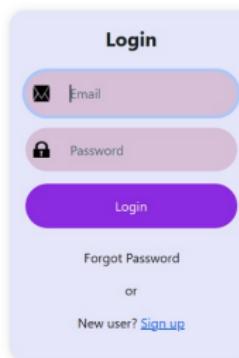
🔒 Password

Login

Forgot Password

or

New user? [Sign up](#)



Homepage

The screenshot shows the homepage of a travel website called TREKZEN. The top navigation bar includes links for HOME, SERVICES, NEWPLANS, OLDPLANS, CONTACT, and LOGIN. The main banner features a photograph of three people in a natural setting, with one person taking a photo. The text in the banner reads: "GET YOUR DESIRED VACATION IN SOUTH INDIA" and "Adventure awaits beyond every horizon; armchair the journey, for in it lies the magic of discovery and the essence of life." Below the banner, a section titled "Services" is displayed, containing three boxes: "Quick Planner" (with a clock icon), "Long Trip Planner" (with a map pin icon), and "Business" (with a building icon). The bottom right corner of the page includes standard browser navigation icons.

TREKZEN

HOME SERVICES NEWPLANS OLDPLANS CONTACT LOGIN

GET YOUR DESIRED VACATION IN SOUTH INDIA

Adventure awaits beyond every horizon; armchair the journey, for in it lies the magic of discovery and the essence of life.

Services

Quick Planner
Enhance your travel experience with our quick trip planning service.

Long Trip Planner
Indulge in the ultimate travel experience with our detailed trip planning service.

Business
Adding business is a simple yet powerful feature that allows you to include your business details on our platform.

Profile Page

The screenshot displays the Trekzen Profile Page. On the left, a dark sidebar menu lists "Pages" (Home, Profile), "Services" (Quick Plan, Vacation Planner, Message Business, Add Place), and "Profile". The main content area has a header "Trekzen P" with a "Delete Account" button. The "Activities" section shows a timeline of trips:

- Year 1: MG Nagar → Chennayandam → Athiyar → MG Nagar
- Year 2: Aaloor → Chengalpet(E) → Aaloor
- Year 3: Aaloor → Malakunnu → Aaloor
- Year 4: Adchanalur → Chengai → Adchanalur
- Year 5: Aaloor → Panthodu → Kannatrady → Aaloor
- Year 6: Kanchi → Patel → Chempando → Kanchi
- Year 7: Adchanalur → Adchanalur → Admalathura → Admalathura → Adchanalur

The "Long Trip Tour" section shows a tour plan:

- Tour Day 1
 - Adchanalur
 - Chengalpet(E)
- Day 2
 - Achoorasanam
 - Chenvalley

Figure: Profile Page

Quick Plan Page

The screenshot shows the 'Quick Plan' feature of the Trekzen application. On the left, a sidebar menu includes 'Pages' (Home, Profile), 'Services' (Quick Plan, Vacation Planner, Manage Business, Add Place), and 'Quick Plan'. The main area is titled 'Quick Plan' and contains fields for 'Place to visit', 'Starting location' (set to 'Adityapuram Surya Temple'), 'Select Districts' (All Districts), 'Geopoint' (Place), 'Select Destination' (Kavlem), and a 'Add to Route' button. Below these fields is a map showing a route from 'Starting Location: Adityapuram Surya Temple' to 'Kavlem'. The map highlights several locations with green circles and provides step-by-step driving instructions. At the bottom of the map, it says 'Get your free GPS device now!' and 'Author: Map data © OpenStreetMap contributors, CC-BY-SA, Imagery by Mapbox'. To the right of the map, there are four buttons labeled 'Narayani', 'Vaktharam', 'Kavlem', and 'Start New Tour'.

Figure: Quick Plan Page

Vacation Planner page

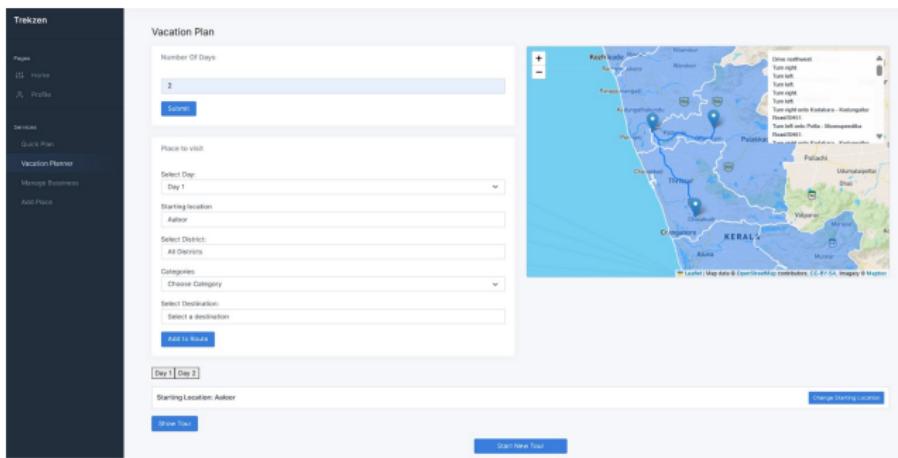


Figure: Vacation Planner page

Add Business page

The screenshot shows the Trekzen application interface. On the left is a dark sidebar with the Trekzen logo at the top. Below it are sections for 'Pages' (Home, Profile) and 'Services' (Quick Plan, Vacation Planner, Manage Business, Add Place). The 'Add Place' option is currently selected. The main content area has a header 'Add Places' with a blue 'Add Places' button. Below it is a section titled 'Your Added Place' containing a table with two rows of data.

Places	Type	Location	Approval
abin de veedu	Place	85,32	Not Approved Yet
ddfs	Place	56,24	Not Approved Yet

Figure: Add Business Page

Manage Business page

The screenshot shows the 'Manage Business' page within the Trekzen application. On the left, there is a dark sidebar menu with 'Pages' and 'Services' sections. Under 'Services', 'Manage Business' is highlighted. The main content area has a header 'Business' with a 'Add Business' button. Below it is a table titled 'Your Business' with columns: Name, Type, Location, and Approval. The table contains six rows of data.

Name	Type	Location	Approval
hff	Restaurant	fghfgh	Contact us
sads	Restaurant	adds	Not Approved Yet
tata elksi	Shop	89,56	Not Approved Yet
dwaqd	Restaurant	awd	Not Approved Yet
sads	Shop	adds	Not Approved Yet
sads	Lodging	adds	Not Approved Yet

Figure: Manage Business Page

Admin Login page

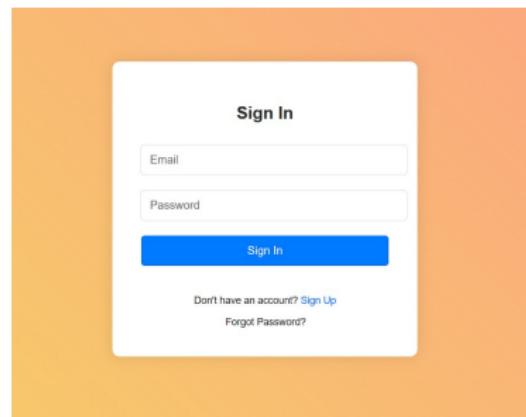


Figure: Admin Login page

Admin Main page

Business Requests

Business Name	Location	Type	Approval	Action
Express Way	78,28	Shop	Not Approved Yet	Edit
Darko	98,67	Restaurant	Not Approved Yet	Edit
Qwality	28,63	Shop	Not Approved Yet	Edit

New Places Requests

Place Name	Location	Type	Approval
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Figure: Admin Main page

Conclusion

The completion of the Tour Route Optimizer project marks a significant advancement in travel planning, harnessing TSP heuristic algorithms to provide users with an intuitive platform for vacation, business trip, and weekend getaway planning. Seamlessly integrating across both app and website interfaces, the system offers robust functionality. This successful implementation underscores the transformative potential of heuristic algorithms in enhancing tourism and travel route planning experiences.

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-  Heinrich Braun "On solving travelling salesman problems by genetic algorithms" 01 January 2005 Institut fiir Logik, Komplexitdt und Deduktionssysteme, Universi t Karlsruhe Posffach 6980, D 7500 Karlsruhe, Deutschland, e-maih braun@ira.uka.de
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