Nearest Parking Locator

MASTER THESIS PROJECT REPORT

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DECLARATION

I certify that

a. The work contained in this report has been done by me under the guidance of my supervisor.

b. The work has not been submitted to any other Institute for any degree or diploma.

c. I have conformed to the norms and guidelines given in the Ethical Code of Conduct of the Institute.

d. Whenever I have used materials (data, theoretical analysis, figures, and text) from other sources, I have given due credit to them by citing them in the text of the thesis and giving their details in the references.

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This is to certify that the project report entitled "**Nearest Parking Locator**" submitted by **Aryan Kumar(20IM30033)**to Indian Institute of Technology, Kharagpur towards partial fulfillment of requirements for the award of degree of Master of Technology in Industrial and Systems Engineering is a record of bona fide work carried out by her under my supervision and guidance during Autumn Semester 2023-24.

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ABSTRACT

Urban parking shortages have become a growing issue due to rapid city expansion and increasing vehicle ownership. This project aims to develop a web-based application that assists users in locating nearby parking spots based on their current location. By utilizing the Geolocation API, Leaflet.js, and Leaflet Routing Machine, the system calculates the real-time distance between the user and available parking locations. The project showcases a dynamic, interactive map that updates the user's location and parking spot proximity. The system's flexibility allows for future integration with real-time parking availability data. This project provides a scalable solution to urban parking challenges, improving user convenience and helping reduce time spent searching for parking.

KEYWORDS

Urban parking, Geolocation API, Leaflet.js, Leaflet Routing Machine, real-time distance calculation, web-based parking locator, dynamic map, real-time parking data, parking availability, smart parking system.

1. INTRODUCTION

The rapid urbanization of cities has led to an increasing demand for parking spaces, creating a need for intelligent systems that help users find available parking spots with ease. The aim of this project is to design a web-based application that helps users locate the nearest available parking spots based on their current location. The system dynamically calculates the distance between the user's location and nearby parking spots and provides real-time updates on availability.

This project aims to optimize user convenience by offering alternate parking locations if the nearest one is full. The long-term objective of this project is to integrate real-time parking data and make it accessible to end users.

2. LITERATURE REVIEW

Recent studies have focused on solving urban parking problems using smart technologies such as geolocation services and real-time parking data. Several approaches to parking space management have been proposed, including predictive algorithms to determine the availability of spaces based on historical data and current trends.

Relevant literature includes the use of geospatial tools like **Leaflet.js** to display location-based services on maps and **Leaflet Routing Machine** for distance calculations. These tools have been widely used in various location-based applications, providing reliable methods for calculating real-time distances and routes between points on a map.

The integration of real-time parking data is a growing trend. Existing solutions such as smart parking systems leverage IoT devices and cloud infrastructure to provide users with up-to-date information on parking availability. However, few solutions focus on creating user-friendly interfaces that guide users to alternative parking spots in real-time, which is the main focus of this project.

3. PRELIMINARIES

The following tools and technologies were selected for developing the prototype:

a) **HTML & CSS**: To structure and style the web page.
b) **JavaScrip**t: For dynamic behaviour and handling the logic behind location tracking and distance calculation.
c) **Leaflet.js**: A leading open-source library for interactive maps, used for rendering the user's current location and parking spots on an OpenStreetMap base layer.
d) **Leaflet Routing Machine:** An extension of Leaflet.js that helps calculate routes and distances between points.
e) **Geolocation API**: Provided by modern web browsers to access the current geographic location of the user.

Routing Mechanism

1. **Leaflet Routing Machine**: This library uses actual road data to calculate the shortest paths. When you create a routing control in your code using L.Routing.control(), it considers the following:

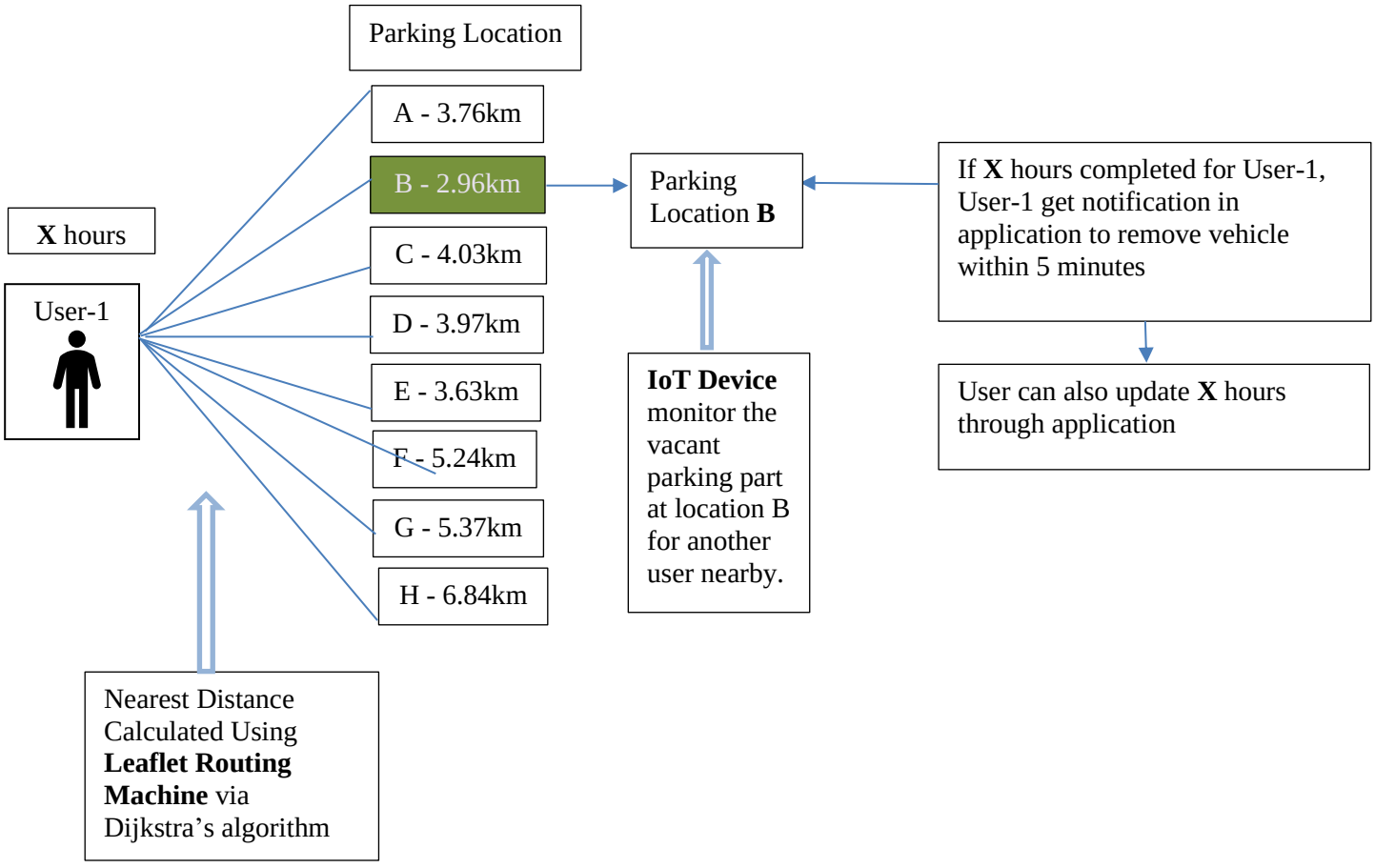
- **Road Network**: It utilizes maps that contain road information, typically sourced from OpenStreetMap (OSM) or other mapping services. This means it calculates distances based on the available routes on the map, including the complexities of the road network, such as intersections, turns, and road types.
- **Route Calculation**: The library sends a request to a routing engine (like GraphHopper, OSRM, or others) that processes the route based on real-world conditions rather than direct point-to-point distance.

4. METHODOLOGY

The development of this system follows the following steps:

User:
Latitude: 22.3205748 **Longitude**: 87.302024

Parking Name	Latitude	Longitude	Distance from User Location (in KM)
A	22.325	87.305	3.76
B	22.329	87.309	2.96
C	22.333	87.312	4.03
D	22.327	87.299	3.97
E	22.331	87.315	3.63
F	22.338	87.321	5.24
G	22.340	87.325	5.37
H	22.344	87.330	6.84



5. FUTURE WORK

a) **Parking Slot Availability**: A real-time system will be implemented to display the number of available parking slots at each location. This will provide users with more accurate information about parking availability, allowing them to make informed decisions.

b) **Booking Time Management**: Users will be able to book parking spots in advance, with the system keeping track of booking durations. If a user exceeds the booked time, additional charges will be applied automatically. This feature will encourage timely usage and efficient turnover of parking spots.

c) **Dynamic Pricing Based on Time**: To optimize parking space utilization, the system will incorporate dynamic pricing based on demand and time. For instance, parking charges may increase during peak hours or decrease during off-peak periods.

d) **Simulation and Performance Testing:** The application will be simulated under various conditions to evaluate performance, such as varying parking demand levels, booking durations, and user traffic. These simulations will help identify potential system bottlenecks and optimize the app's efficiency.

6. REFERENCES

a) Leaflet.js Documentation: https://leafletjs.com/
b) Leaflet Routing Machine Documentation: https://www.liedman.net/leaflet-routing-machine/
c) Geolocation API MDN Web Docs: https://developer.mozilla.org/en-US/docs/Web/API/Geolocation_API
d) OpenStreetMap: https://www.openstreetmap.org/