StreetCart: An AI-Enabled GPS-Based Real-Time Street Vendor Tracking System Using Location-Based Services

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***Abstract*—Street vendors play a crucial role in the economy, yet many of them lack a virtual presence. Consequently, customers may find it hard to identify street vendors or receive any useful information from them, limiting business opportunities for both sides. Therefore, we decided to create StreetCart, which is an artificial intelligence-based mobile application that allows users to identify nearby vendors with the help of GPS. This application is developed in Kotlin for Android. As a backend, Firebase provides services like authentication, database operations, and push notifications. This system operates with two main parties – vendors who may share their location and some personal data and users who want to find certain vendors within a limited radius. Moreover, the system utilizes the K-Nearest Neighbors algorithm, allowing the app to suggest possible vendors near a person's location based on the preferences of a user. Hence, the application increases the accessibility of street vendors, improves their presence in the network, and gives small vendors access to digital technologies.**

***Index Terms*—Street Vendors, Location-Based Services, Firebase, Vendor Discovery, Artificial Intelligence, Recommendation System, KNN, Digital Inclusion**

I. INTRODUCTION

Street vendors play a crucial role in the Indian economy due to the provision of inexpensive goods and services to customers. In most cases, vendors lack any form of digitalization, which makes it hard for them to reach out to the masses. Despite digitalization efforts by numerous industries, street vendors remain traditional through physical and word-of-mouth promotions.

Smartphones have continued to become common while technologies like geolocation have become advanced. StreetCart was conceptualized to help address the gap that exists in terms of connecting customers to vendors. It is an application that assists the user to identify vendors in their proximity through GPS tracking, listings, and search capability. Kotlin programming language is used to develop StreetCart while Firebase is used in storing the vendor's details.

Vendors can upload their location and vendor details on the platform, making it easy for the users to search for them. Filters can be applied, thereby facilitating better results. StreetCart uses the K-Nearest Neighbors Algorithm to offer recommendations based on the user location and requirements, making the process more convenient and faster.

II. LITERATURE REVIEW

Several pieces of literature have examined the use of digital technology and location-based services for increasing street vendor visibility. An article [1] discusses a mobile application that allows users to locate vendors using GPS. Another study

[2] emphasizes the significance of real-time location-based data for monitoring vendor movement. A literature piece [3] integrates GPS and Google Maps in allowing users to easily search for street vendors in their locations. Similar apps [4] have been identified as useful for locating vendors.

Other studies [5] emphasize the role of location data in making sense of dynamic environments. Digital transformation literature [6] explains the contribution of mobile technology in modernizing street vending.

One study
[7] also focuses on developing vendor management systems through digital solutions. Literature pieces [8] emphasize the significance of integrating street vendors into digital ecosystems. AI-based solutions [9] have been identified as vital for enhancing user experiences. GPS-based literature
[10] supports real-time tracking to enhance performance.
It should be noted that current applications offer limited functionalities such as vendor tracking and simple discovery features. There are no real-time updates, nor are there personalized recommendations. To address this gap, we introduce our novel system that integrates GPS-based vendor tracking with AI-based recommendations.

III. PROBLEM STATEMENT

Street vendors play an important role in city economies; however, their activities are not structured properly, and they do not have any online presence. Despite the existence of mobile phones and geolocation services, there is no adequate system through which vendors can be shown in real-time and their details provided.
As a result, customers find it hard to locate street vendors close to them, and street vendors fail to connect with more people. Besides, the absence of intelligent recommendation mechanisms makes the process tedious.

IV. EXISTING SYSTEMS

1. Pahia Application:
Pahia is a mobile-based platform that connects street vendors with nearby customers using GPS-enabled location services. It allows vendors to create profiles, share their current location, and display the products they offer. Customers can search for vendors in their vicinity and view basic vendor details through the application. While it improves vendor visibility, it provides limited support for advanced features such as real-time updates and comprehensive product management.

2. Google Maps:
Google Maps helps users locate certain street vendors or food stalls through map listings and navigation features. However, it is mainly designed for fixed business locations and does not effectively support the dynamic nature of mobile street vendors who frequently change locations.

3. Street Food Finder Applications:
Applications like Street Food Finder are designed to help users discover nearby food vendors using GPS and map integration. These platforms make it easier to locate and navigate to food stalls. However, they are generally limited to food-related vendors and do not support a broader range of street vendor categories.

Limitations of Existing Systems
- Lack of real-time updates for vendor locations
- Limited features for product listing and price management
- No support for multi-category vendor classification
- Absence of dynamic pricing or time-based offers
- No implementation of AI-based recommendation or personalization
- Limited user interaction and engagement features

Due to these limitations, customers still face challenges in finding nearby vendors offering specific products, while vendors struggle with limited digital visibility. The proposed StreetCart system addresses these issues by providing an integrated platform that combines real-time location tracking, vendor registration, product management, and an AI-based recommendation system within a single application.

V. PROPOSED SYSTEM

StreetCart is a mobile application based on Artificial Intelligence technology. This application will help the street vendors connect with the customers around them using GPS technology. The main aim of the application is to increase the visibility of the vendors and provide the customers with the facility to find the vendors around them.

Technology Used:
The application will be developed using the Kotlin programming language in the Android Studio IDE. Firebase will be used for backend services.

Additionally, the application will use GPS technology to show the customers the location of the vendors on the map.

Features Developed in the Application:

1. Vendor Module:

The Vendor Module will provide the vendors with the facility to add their details. They will be able to add their basic information such as name, category, and contact details. Additionally, the vendors will also be able to share their live location on the map. This will provide them with the facility to reach more customers.

2. Customer Module:

The Customer Module will provide the customers with the facility to find the vendors around them using the GPS technology. They will be able to view the vendors on the map along with the details such as name, category, and distance. The user can search for vendors based on different categories like food, fruits, clothes, etc. Also, the user can add vendors as favorites. Moreover, the system uses the KNN algorithm for recommending vendors based on their location.

3. System Features

- Real-time location tracking of vendors
- Registration of vendors
- Search and filter based on different categories
- Map viewSearch and filter based on different categories
- Map view
- Recommendation of vendors using AI
- Adding vendors as favorites
- Using Firebase for updating data in real-time.

4. Working of the System

- Registration of vendors
- Vendors share their location
- Data is stored in Firebase
- Users open the application
- Users allow location access
- System finds the nearest vendors
- System uses the KNN algorithm
- System shows the location of vendors on the map

Table 1- Comparison of Existing Systems and Proposed System

Feature	Existing Apps	StreetCart
Live Tracking	✗	✓
Multi-Category Vendors	✗	✓
Product & Price Display	✗	✓
AI-Based Features	✗	✓
Vendor-Friendly UI	Limited	✓
Full Digital Inclusion	✗	✓

VI. SYSTEM ARCHITECTURE

The StreetCart system is created in the form of a mobile application that utilizes real time location tracking, cloud storage, and smart processing capabilities to assist users in finding street vendors around them. The system is comprised of four components, the mobile application, backend system, location-based services, and AI recommendation module. information such as their name and category. The customers can search vendors around them using the application.

The backend system is created using the Firebase platform. The system stores the information of the vendors such as their location and category. The vendors can update their information in real time. The changes will be reflected in the application.

The system utilizes GPS location tracking services provided by Google Maps. The application retrieves the location of the user and shows the vendors around them. The system calculates the distance between the customer and the vendors using the Haversine formula.

The application utilizes the Dijkstra algorithm to find the shortest route. The system utilizes the KNN algorithm in the AI recommendation module. The application recommends vendors based on the location of the customer.

In addition, the application provides the following features:

- Category-based search
- Favorite vendors
- Notification system

These features enhance the overall user experience. The application is useful in finding vendors around the customer location.

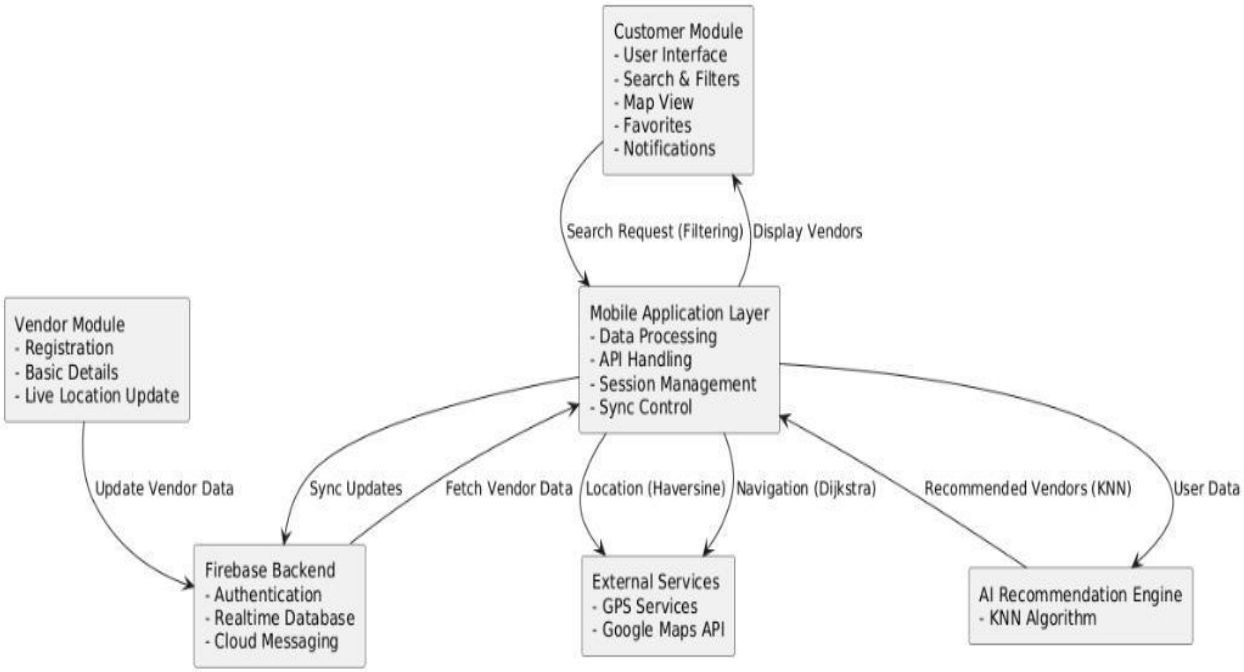

Fig 1: StreetCart System Architecture

The mobile application is created using the Kotlin programming language. The application is used by both vendors and customers. The vendors can create their account and share their real-time location along with their basic

VII. METHODOLOGY

The way in which the StreetCart system works can be described as follows:

Step 1: Vendor Registration and Data Storage

In this step, vendors are registered on the app. This involves adding information such as name and category. This information is then stored on Firebase and can be updated at any time.

Step 2: Location Acquisition

In this step, the location of users and vendors is acquired using GPS technology. This information is then used to locate vendors on the map.

Step 3: Distance Calculation (Haversine Algorithm)

In this step, the distance between users and vendors is calculated using the Haversine algorithm. This information is then used to determine how far a particular vendor is from a user.

Step 4: Nearest Vendor Selection

Vendors are then selected based on their distance from users. The nearest vendors are then displayed to users on the app.

Step 5: Recommendation using KNN

The KNN algorithm is used to make recommendations to users based on their location and preferences.

Step 6: Filtering

Users can filter vendors based on categories such as food, fruits, clothing, and many more. This enables users to find products easily on the app.

Step 7: Real-Time Data Update (Firebase)

Any changes to the data on vendors are updated instantly on the app using Firebase technology.

Step 8: Navigation (Dijkstra Algorithm)

The Dijkstra algorithm is used to calculate the shortest distance between users and vendors.

Step 9: Notifications

Users are notified on their apps when there are vendors nearby or when there are updates on their favorite vendors.

VIII. SYSTEM IMPLEMENTATION

StreetCart application is designed for both vendors and users. Features such as logging in, accessing location, and searching for nearby vendors have been included in the application. From the vendor side, users can register for accounts and login, provide personal information, and send their current location. All the data provided will be saved on Firebase and updated immediately so that vendors can be viewed by users near them.

On the user side, they can log into their accounts or create new ones, access their locations, and search for nearby vendors on a map through GPS. Features including searching for vendors, sorting them based on categories, and favoriting vendors have been integrated into the application. Users can view vendor information and directions to their locations quickly. Firebase will be used as the back-end to store and update data instantly.

The StreetCart application starts with a common entry screen that allows users to choose how they want to use the application. This screen provides two options: Continue as Customer and Login as Vendor.

This feature helps in separating the functionalities of vendors and customers at the beginning itself. Based on the selected option, the user is redirected to the respective module of the application. This improves usability and provides a clear navigation flow for both types of users.

Fig 2: Role Selection Screen

Vendor Module Screens:

The vendor module allows street vendors to register, log in, and manage their business through the application. Vendors can create their account by providing details such as cart name, category, email, and password.

After logging in, vendors are redirected to a dashboard where they can control their availability status (online/offline), view basic statistics such as views and ratings, and manage their inventory.

The system also provides an inventory management feature where vendors can add, update, and manage their products. Vendors can add new items by uploading an image, entering item name, price, and description. They can also control item availability using toggle options. This module helps vendors easily manage their cart and improve their visibility to nearby customers.

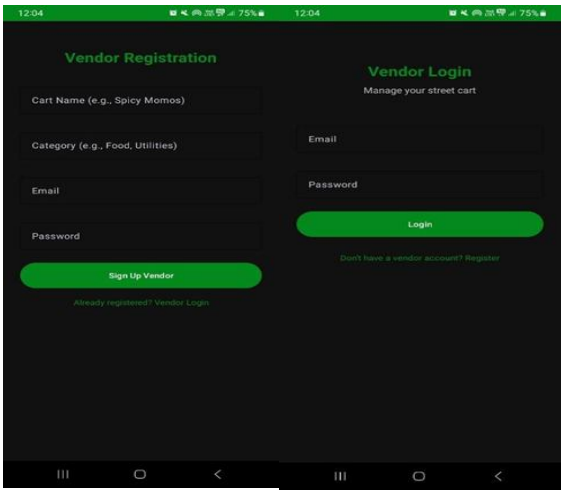

Fig 3: Vendor Registration and Login Screen

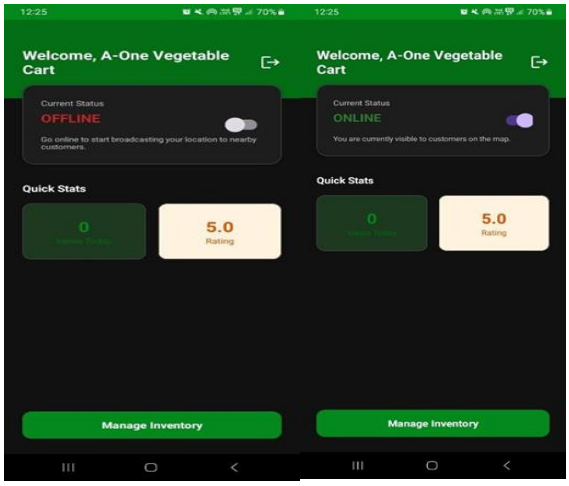

Fig 4: Vendor Dashboard (Offline/Online Status)

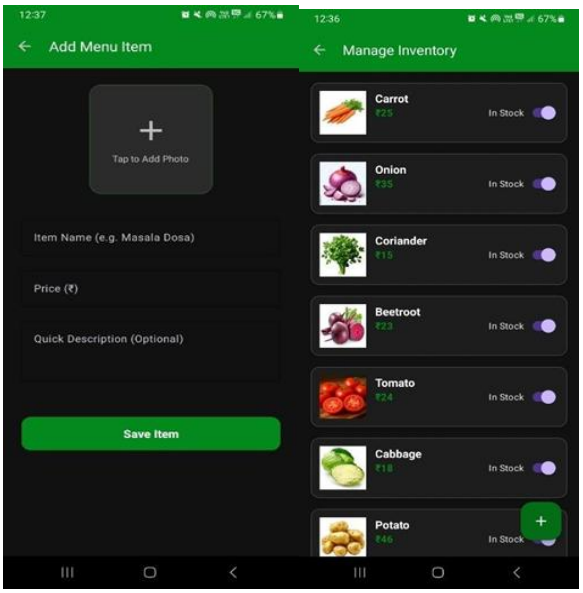

Fig 5: Add Item and Inventory Management Screen

Customer-Side Implementation:
StreetCart application is also implemented on the user side where user interactions and vendor search facilities have been provided.
User can register in the application and login into the application through email and Google. Once logged into the application, request for permission to use GPS to determine the current location.

The system then shows the list of vendors present nearby on the map interface showing information regarding vendors like name, category, distance and rating.
Distance is computed based on the Haversine formula and near vendors get preference.
User can perform searching for vendors, filtering of vendors by categories and see variety of options nearby.
User can save his/her favorite vendor, can see notifications and can see order history.
Furthermore, user can find his/her way to reach the vendor using minimum distance using Dijkstra Algorithm. Application also has help and support feature for users.

Following diagrams present screens of the StreetCart application from user side.

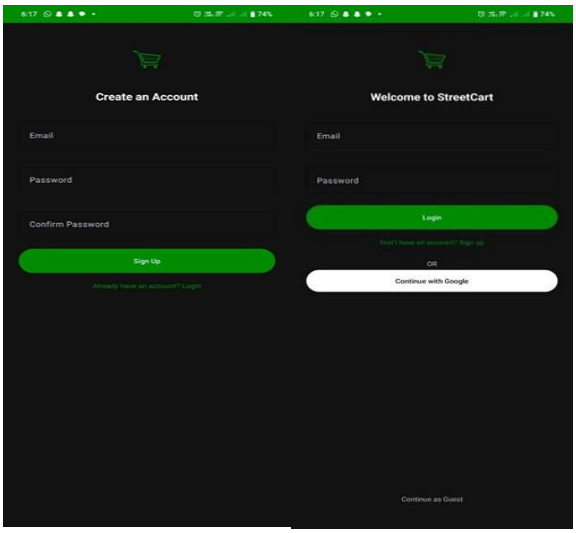

Fig 6: Sign-Up and Login Screen

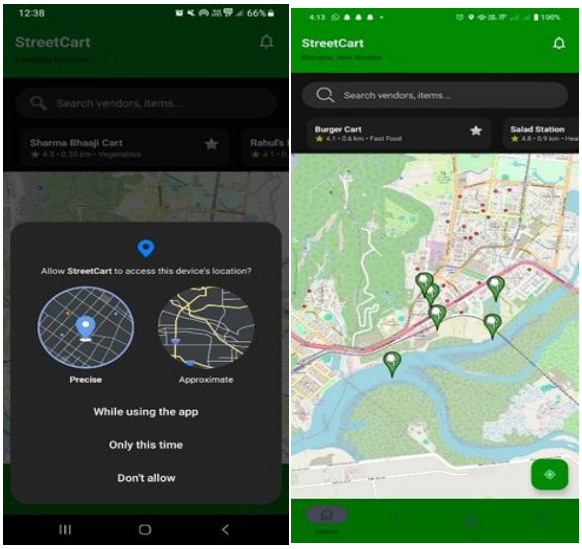

Fig 7: Location Permission Request and Screen Showing Nearby Vendors on Map

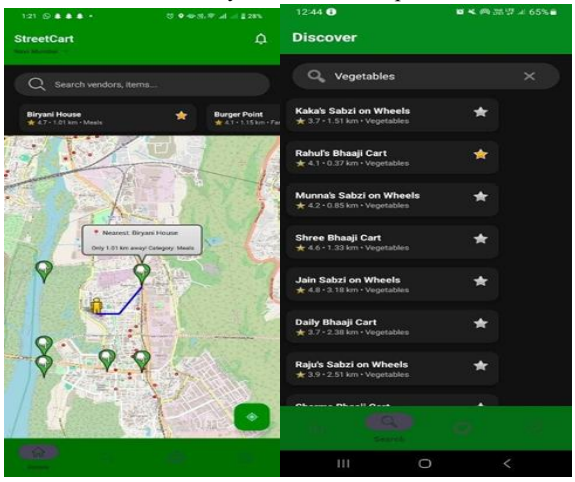

Fig 8: Nearest Vendor Identification and Category-Based Vendor Filtering

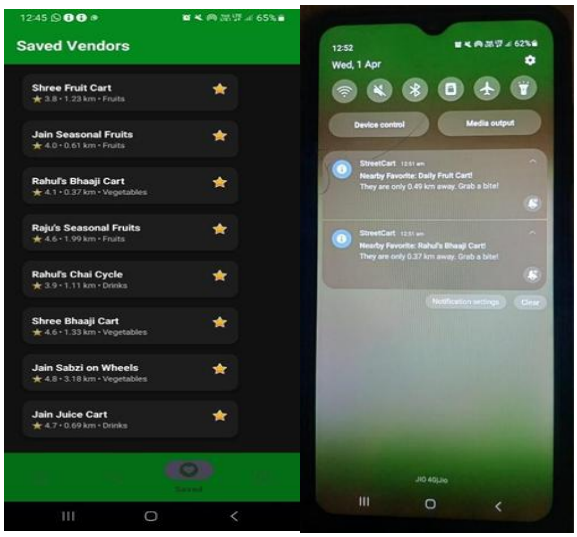

Fig 9: Saved Vendors and Notification System

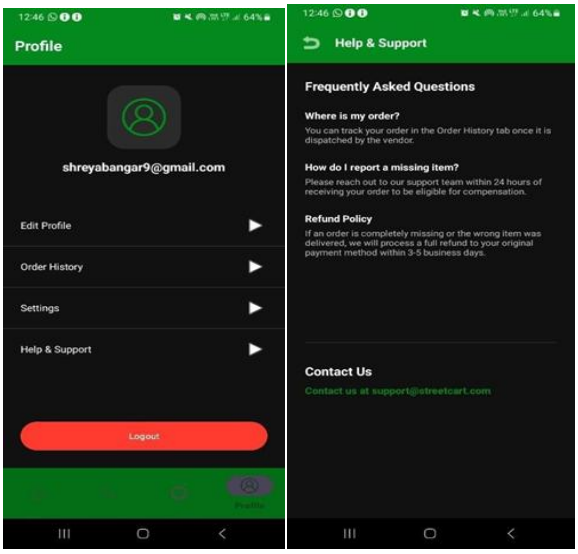

Fig 10: Profile and Help, Support Interface

IX. TECHNOLOGY STACK

The StreetCart system is designed with the use of the current generation of mobile and cloud-based technology. This would guarantee the smooth execution of processes and real-time interactions between vendors and customers in the platform. The application was designed on the Kotlin programming language using Android Studio which provides the perfect platform for building reliable Android applications. Lastly, internet connectivity allows for continuous and effective communication between the mobile application and the various backend services.

As the back-end service, the system uses the Firebase platform, whose services include user authentication, real-time database, cloud storage, and notification services among others. Firebase is responsible for storing data related to vendors such as location and type. Real-time synchronization ensures that any data added by vendors will be instantly visible on the customer end. Moreover, the Google Maps Application Programming Interface allows for visualization of the maps on the app. It also makes the process of locating nearby vendors and obtaining directions much easier. GPS services were used in order to obtain the real-time locations of the users and vendors on the platform.

Additionally, an AI-based recommendation engine was incorporated into the platform using the K-Nearest Neighbors (KNN) algorithm, which would help suggest vendors according to the preferences of customers. The Firebase Cloud Messaging (FCM) service is also integrated into the platform, providing services such as notification messages.

X. PROPOSED OUTCOMES

The StreetCart system will be convenient for finding and communicating with the nearest street vendors due to the possibility of monitoring the location in real time with the help of modern technologies.

A key outcome would be easy access to street vendors near the current position of the user. With the use of GPS and mapping technologies, a user could view the location, distance, category of the vendor, and the rating available in real time. In such a manner, the search process would become less complicated and tedious. Additionally, it would facilitate navigation. With the help of the Haversine algorithm, users could estimate the distance to the street vendors, while the Dijkstra algorithm would calculate the optimal path.

Lastly, internet connectivity allows for continuous and effective communication between the mobile application and As for vendors, the suggested system allows them to get a digital interface and promote themselves. By sharing live information concerning their location and other basic aspects, vendors will be able to establish closer contact with people nearby. Furthermore, there would be a possibility to use the recommendation functionality based on the AI KNN algorithm which would offer users the vendors

depending on their location and personal preferences. Besides, the system will allow users to filter vendors according to different categories such as food, fruits, or clothes. It will be possible to save your favourite vendors and set up notifications on approaching you vendors or updates on them.

Finally, Firebase guarantees real-time synchronization of all information. Whatever changes are introduced by vendors, those would become immediately visible to users via the application.

In general, this platform should be convenient both for customers and street vendors due to ease of use, speed, and accessibility of vendors.

XI. CONCLUSION

StreetCart assists in increasing the visibility and accessibility of street vendors through the development of an online location-based application. This will assist the users to access the available street vendors in their vicinity in an instant manner. In the StreetCart app, users can easily access nearby vendors, see their information, and even locate them. It is faster and less energy-consuming compared to other similar applications that do not use any sophisticated algorithm for finding street vendors. In the current system, the algorithm employed includes the use of Dijkstra's and Haversine algorithms. This ensures that the distance is calculated in a precise way, and also, the nearest path is determined. The KNN algorithm is applied in vendor recommendation to provide convenience in terms of the suggestions given. The vendors also benefit from the system as they are provided with an online avenue where they can provide their contact information as well as their location. In general, the StreetCart application offers a convenient means of connecting customers and vendors.

ACKNOWLEDGEMENT

I would like to express my sincere thanks to Dr Gayatri Hegde Madam for guiding us throughout the project.

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