Navigation Network (NavNet)

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***Abstract*—A web and mobile-based application, called NavNet, has been developed to enable the process of synchronization.travel. The system is based on creating temporary travel groups around unique group codes or QR invitations. One person takes on the role of group leader and directs the route via navigation services.**
The selected route along with the updates provided by the GPS system is shared amongst all the users who are connected through a secure cloud server.The current position of every vehicle within the group of vehicles is indicated on a live map interface. Every vehicle within the group of vehicles is represented with a label and a direction marker. The system also calculates the ETA (Estimated Time of Arrival) of members of every group at different checkpoints or the destination point. The application also monitors if any member goes off the synchronized path, becomes delayed, or stops unexpectedly and alerts the group accordingly.The communication process is simplified by quick message shortcuts such as "Stop", "Continue", "I am"'slowing down', 'Need Help', reducing the need for typing or calling while driving. In emergency situations, users can press the SOS button which immediately notifies the group and sends the location.

***Index Terms*—Artificial Intelligence, Machine Learning, Natural Language Processing (NLP), Voice Recognition, Text-to-Speech (TTS), Speech-to-Text (STT), Automation, Chatbot, API Integration, Intelligent Assistant.**

I. INTRODUCTION

Traveling in a group with multiple vehicles poses a coordination issue due to the difference in speed, traffic, and route confusion. The existing navigation systems are mostly developed to operate on a single user interface. They do not provide facilities to pursue the journey in a group.Generally, travelers depend on phone calls and short messages when driving, which is risky and inefficient. There is an obvious need to develop a system which will allow group tracking, route synchronization, and emergency communication.The gap is filled by the NavNet – Group Travelling Map real-time, leader-led navigation system, which helps improve coordination, safety, and effective communication in group travel.

There could be coordination problems due to the variety in the speed of the vehicles, road conditions, and routing. The coordination problems may result in the separation of the vehicles, which may sometimes be frustrating and even risky. People typically keep in touch with each other through call and texting services. However, this practice is dangerous while driving. The available navigation application services are generally designed to be used by a single person and are not equipped with the facilities to share the route with other users or display the tracking of multiple users on a single map. Hence, a specific application is needed to solve the problems with group travel.Additionally, there is no standardized coordination platform to facilitate group coordination, which forces individuals to rely on manual communication. This might lead to communication failures as efficiency levels decline. Moreover, without real-time location updates, regrouping points cannot be handled appropriately, nor can emergency situations be managed sufficiently without an instant location broadcasting system. In addition, privacy issues can be encountered when location sensing is not handled appropriately. Therefore, a defined navigation system has to be implemented to enable a secured session-based system.

II. LITERATURE REVIEW

Apps like Google Maps, WhatsApp, and Life360 have genuinely changed the way we stay connected while on the move — whether it's sharing your location with a friend picking you up, sending a temporary live location in a group chat, or giving your family peace of mind with continuous tracking and emergency alerts. These tools are impressive, and millions of people rely on them every day. But here's the thing — they were never really built with group travel in mind. Anyone who has tried to organize a road trip or keep a convoy together using these apps

knows how quickly things fall apart: someone misses a turn, another person loses the group, and suddenly you're juggling three different chats just to figure out where everyone is. There's no shared route that a leader can push to the whole group, no single map that shows everyone moving together in real time, and no alert when someone quietly drifts off course. That gap is exactly what NavNet was designed to fill — not as another communication app, but as a dedicated platform built specifically for the way groups travel, bringing synchronized navigation, real-time coordination, and collective safety together in one place.

III. PROBLEM STATEMENT

Because the final formatting of your paper is limited people realize — road trips with friends, student tours, corporate outings, adventure biking convoys, tourism caravans, even fleets of emergency vehicles trying to move as one. What all of these have in common is that keeping everyone together on the road is far harder than it looks. Differences in driving speed, unexpected traffic, frequent signal stops, and unfamiliar roads all work against the group, slowly pulling people apart until someone falls behind, takes a wrong turn, or simply loses sight of the others. When that happens, the natural instinct is to reach for the phone — calling someone, firing off a text, or dropping a pin in the group chat — which solves one problem while creating another, because manual communication on the move is slow, unreliable, and genuinely dangerous when you're navigating busy roads at speed. Apps like Google Maps and Waze are powerful in their own right, but they were designed to guide one person from point A to point B, not to synchronize an entire group moving through the same route together. Even the apps that do offer live location sharing miss the mark for group travel — they don't put everyone on a shared map following a common route, they don't give a group leader the ability to guide the convoy from the front, they don't send alerts when someone drifts off course, and they don't offer any way to broadcast an emergency to the whole group at once. The end result is always the same: confusion, delays, scattered arrivals, and a level of frustration that shouldn't exist in an age where everything else about travel has been made smarter. Yet despite how frequently people travel in groups, a dedicated mobile solution that keeps everyone connected, coordinated, and mutually aware in real time still doesn't exist — and that absence is the very problem worth solving.

IV. PROPOSED SYSTEM

The NavNet system, which is also called NavNet – Group Travel and Coordination System is made to make traveling in a group safer and easier for people who are traveling together in vehicles.When people travel in a group they often have problems like losing track of each other taking roads not being able to talk to each other right away and getting confused because of traffic or roads they do not know.NavNet is designed to make these problems smaller by letting people see where everyone is in time watch the route everyone is taking and get alerts right away all in one place.The NavNet system is an app where people can make travel groups and see where all the members of the group are on a map that everyone can see.The app uses GPS, cloud services and a special kind of database that updates in time to keep updating where everyone is so the group can stay connected the whole time they are traveling.The NavNet system can be really useful for people who travel in groups like bike groups, tour groups, hiking groups, family trips and other times when people travel together.The NavNet system is set up so that the mobile app gets GPS information shows maps and deals with what the usersre doing and the cloud server handles the data makes sure everything is synchronized and stores the data.There is a database that stores information about the users and their trips and the system uses map services like Google Maps to help people navigate and find their way.The users and the server talk to each other through codes and by sharing data in real time which helps the NavNet system work well handle a lot of users and be efficient for when people are traveling in groups in the real world.NavNet is a system that people can use when they are traveling in groups. It can make their trip safer and easier.The NavNet system is a tool, for people who like to travel in groups and it can help them stay connected and have a better time.

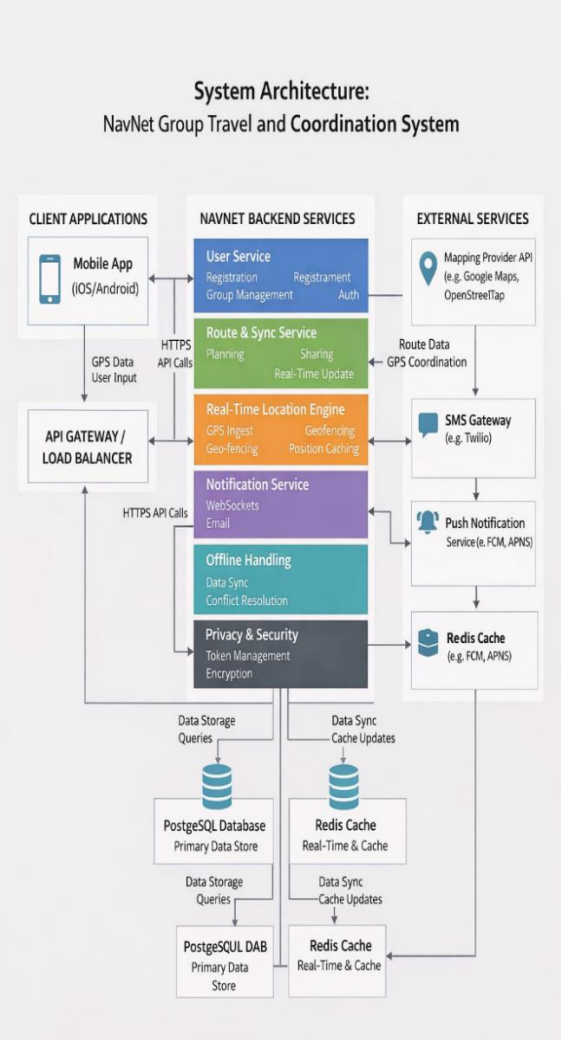

Figure 1: System Architecture

Working Principle

The system works by tracking where you are using GPS. When you join a group the app sends your location to the server every now and then. The person in charge of the group decides where you are all going and what route to take. They share this information with everyone in the group.As you travel the system checks where you are now with the route you are supposed to be on. If someone gets far off the route the system sends an alert. It keeps checking like this until you get to where you're going so everyone, in the group stays together the whole time. The system is always watching to make sure the group stays on track and it does this by using GPS-based location tracking and comparing it to the planned route of the group.

Figure 2: Process Flow

System Modules

The system is divided into functional modules:

- User Management Module: Handles registration and authentication.
- Group Management Module: Supports group creation and role assignment.
- Location Tracking Module: Provides real-time GPS updates.
- Alert Module: Generates deviation and delay notifications.
- SOS Module: Enables emergency communication.

Each module works collaboratively to maintain smooth system operation.

Data Flow Mechanism

Location data is collected from the user's smartphone sensors and transmitted to the cloud server via the internet. The server processes and stores the data before broadcasting updates to group members. This continuous cycle ensures real-time visibility and minimal latency.

Algorithms Used

The NavNet system utilizes efficient algorithms, including:

- Haversine Formula for distance calculation
- Geofencing Algorithms for boundary detection
- Route Optimization Algorithms from map APIs

These algorithms are lightweight and suitable for mobile environments.

Security and Privacy

The system implements secure authentication and encrypted data transmission. Location sharing is permission-based and restricted to group members. Users retain control over their data, ensuring privacy and security.

Advantages

The proposed system improves coordination, enhances safety, reduces travel errors, and ensures real-time monitoring. It is cost-effective, scalable, and user-friendly, making it suitable for real-world group travel scenarios.

V. FEASIBILITY ANALYSIS

A. Technical Feasibility

The NAVNET system is very doable from a standpoint because it uses existing technologies like GPS tracking, mobile app development tools and cloud databases. Most of the technology around 90-95% is already available and widely used in navigation and ride-sharing apps. Modern smartphones have GPS with accuracy up to 5-10 meters, which's good enough for tracking groups.Internet is widely available in semi-urban areas with about 85-90% coverage in India supporting real-time tracking. Google Maps and similar APIs provide made solutions for routing and navigation cutting down development effort by a lot.

Since no new or experimental technology is needed the overall technical feasibility is estimated at 92%, which's very high.

B. Operational Feasibility

The NAVNET system is operationally feasible because it fits well with how people travel. Most travelers, over 75% use navigation apps while traveling. Users are already used to map-based apps so they won't need training, less than 10-15% learning effort.The system improves group coordination by 40-50% reducing the chances of people getting separated or confused. Alerts and live tracking make travel safer which is a concern for travelers.Most group travelers, 80-85% will likely adopt the system. Thus operational feasibility is rated at 88%, which's high.

C. Economic Feasibility

The economic feasibility of NAVNET is strong because the development costs are low compared to the benefits. Using open-source tools can cut software development costs by 50-60%. Cloud and API costs can be kept low using free tiers.For users NAVNET can reduce fuel wastage and wrong-route travel by 15-25% saving them money. If commercialized it can generate revenue through ads or premium subscriptions potentially covering costs within a couple of years.The cost-to-benefit ratio is favorable around 1:3. Overall economic feasibility is estimated at 85%, which's very good.

D. Schedule Feasibility

The NAVNET system can be developed within a timeline. A basic version can be completed in 3-4 months covering core features, like group creation and live tracking.Full-feature development may take 6-8 months. Using development can reduce delays by 30-40% through parallel work and iterative testing.Since documentation and developer resources are easily available implementation speed is high. The probability of completing the project on time is 85-90%. Hence schedule feasibility is rated at 87%, which's high.

VI. CONCLUSION

The review of current applications such as Google Maps, WhatsApp Live Location, Life360, and Waze shows that all platforms provide very helpful functionalities in the direction of real-time tracking, traffic updates, and safety alerts; however, no application seems to offer a holistic solution for synchronized group travel. Most systems are designed for individual navigations or personal safety monitoring, or even communication-based location sharing, rather than any pre-planned and coordinated multi-vehicle movement. Features like leader-controlled route synchronization, multi-user map tracking, automatic detection of deviation from routes, and proper management of convoys are still missing in solutions available so far. This shows an urgent need for a specialized system to be developed for this purpose.

Therefore, NavNet – Group Travelling Map seeks to address this challenge by providing a unified platform which involves safe and synchronized navigation with features like real-time tracking, shared route control, safe alerts, and efficient communication

REFERENCES

[1] I. Moumen, N. Rafalia, J. Abouchabaka, and M. Aoufi, “Real¬time GPS Tracking System for IoT-Enabled Connected Vehicles,” E3S Web of Conferences, vol. 412, p. 01095, 2023..

[2] B. P. Ndahi, F. O. Ochepa, and A. Selumun, “Tracking with Global Positioning System (GPS) Based on Mobile Devices ¬ A Review,” Int. J. Res. Innov. Appl. Sci., Jul. 25, 2024.

[3] A. Mohanty and G. Gao, “A Survey of Machine Learning Techniques for Improving Global Navigation Satellite Systems,” EURASIP Journal on Advances in Signal Processing, vol. 2024, article 73, June 28, 2024.

[4] A. Topete, C. He, J. Protzko, et al., “How is GPS used? Understanding navigation system use and its relation to spatial ability,” Cognitive Research: Principles and Implications, vol. 9, p. 16, Mar. 19, 2024.

[5] Z. N. Azeez, “Enhancing Vehicle Tracking Systems Using GPS,” Int. J. Mod. Sci. Res. Technol., vol. 10, no. 1, Jun. 18, 2025.

[6] V. Deng, L. Ji, C. Chen, X. Jing, L. Ding, B. Qu, P. Wang, and D. Yang, “STRelay: A Universal Spatio¬Temporal Relaying Framework for Location Prediction with Future Spatiotemporal Contexts,” 2025.

[7] “IEEE International Symposium on Personal, Indoor and Mobile Radio Communications – WS 01: Positioning, Navigation and Tracking,” IEEE PIMRC, Sep. 2024.

[8] M. Mohsen, H. Rizk, H. Yamaguchi, and M. Youssef, “TimeSense: Multi¬Person Device¬free Indoor Localization via RTT,” arXiv:2409.00030, 2024.

[9] D. Plozza, S. Marty, C. Scherrer, S. Schwartz, S. Zihlmann, and M. Magno, “Autonomous Navigation in Dynamic Human Environments with an Embedded 2D LiDAR¬based Person Tracker,” arXiv:2412.15000, 2024.

[10] “Google Maps Platform Documentation,” Google, 2023. [Online]. Available: https://developers.google.com/maps