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IntelliTrack - Smart Vehicle Tracking System

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Contents

Literature Survey

Sr No.	Publication Title with Authors [mention whether Journal or Conference paper]	Publication Year	Positive Points Of The Publication	Research Gaps in Publication Work
1.	Testing Intelligence: Accelerating the Verification and Validation of Intelligent Vehicles, IEEE Transactions on Intelligent Vehicles, vol. 8, no. 2, pp. 1003, February 2023.	2023	1. Proposal of a control-oriented task planning system that improves energy-saving and computational efficiency in intelligent vehicles [T1]. 2. Introduction of a love-of-variety-based method for low-latency high-definition map transmission [T2]. 3. Development of a stop-line-aided cooperative positioning framework for connected vehicles in intersection scenarios [T2]. 4. Design of a robust performance-prescribed attitude control scheme for a foldable wave-energy powered autonomous underwater vehicle [T3]. 5. Presentation of a unified graphical representation method for dynamic traffic scenarios to improve trajectory prediction of surrounding vehicles [T6].	1. Lack of real spatial relevance in the fixed graph for trajectory prediction [T3]. 2. Scarcity of datasets for testing intelligent vehicles and the challenge of balancing simulation efficiency and fidelity [T5]. 3. Need for new methodologies to cover multiple metrics of testing intelligence in existing testing methodologies [T5].

2.	Data Forwarding Scheme for Vehicle Tracking in Named Data Networking by Rui Hou, Shuo Zhou, Mengtian Cui, Lingyun Zhou, Deze Zeng, Jiangtao Luo, and Maode Ma (Journal Paper)	2021	1. Introduces a data forwarding scheme tailored for vehicle tracking in Named Data Networking (NDN) environments. 2. Addresses a specific challenge in vehicular communication systems, enhancing the relevance of NDN in modern transportation. 3. Authors' affiliations with IEEE indicate expertise in the field. 4. Contributes to the advancement of networking technologies for intelligent transportation systems.	1. Lack of empirical validation and real-world experimentation to assess the effectiveness of the proposed scheme. 2. Limited comparison with existing data forwarding schemes used in vehicular networks. 3. Scalability and performance considerations under various traffic conditions need further discussion. 4. Practical implementation challenges and integration with existing vehicular communication infrastructure may require exploration.
3.	Smart Vehicle Tracking System using GPS and GSM Technologies	2020	1. Clear and concise explanation of the methodology used in developing the Smart Vehicle Tracking System, highlighting the roles of the GPS module, GSM module, and Microcontroller board-Arduino. 2. Effective utilization of Arduino Uno and GPS receiver-neo 6m components for accurate location tracking and real-time monitoring of vehicles. 3. Integration of GSM technology for seamless communication and data transmission, enabling remote access to vehicle location information. 4. Emphasis on the importance of vehicle security and safety, showcasing the practical application of GPS and GSM technologies in ensuring the protection of vehicles. 5. Future scope outlined for potential enhancements and extensions of the system, such as incorporating E2PROM for data storage and memory expansion, demonstrating a forward-looking approach to technology development.	1. Lack of detailed discussion on the specific challenges faced during the implementation of the Smart Vehicle Tracking System using GPS and GSM Technologies. 2. Limited exploration of potential security vulnerabilities or risks associated with the system, such as data breaches or unauthorized access. 3. Absence of comparative analysis with similar existing systems to highlight the unique features or advantages of the proposed system. 4. Insufficient information on the scalability of the system for large-scale deployment or integration with other IoT devices. 5. Limited discussion on the energy efficiency and power consumption aspects of the system, especially in prolonged usage scenarios.

4.	Online Multiple Maneuvering Vehicle Tracking System Based on Multi-Model Smooth Variable Structure Filter by Zhongzhen Luo, Mina Attari, Saeid Habibi, and Martin Von Mohrenschildt (Journal Paper)	2020	1. Introduces an online tracking system for multiple maneuvering vehicles. 2. Utilizes Multi-Model Smooth Variable Structure Filter for enhanced tracking accuracy. 3. Addresses real-world challenges in vehicle tracking, including maneuvers. 4. Potential for improving traffic management and safety.	1. Lack of detailed discussion on system implementation and deployment. 2. Empirical validation and real-world testing not reported. 3. Comparison with existing tracking systems/methods is not provided. 4. Scalability and robustness in various traffic conditions not discussed. 5. Limited insight into the system's practical applicability and integration.
5.	A vehicle tracking algorithm combining detector and tracker by Bo Yang, Mingyue Tang, Shaohui Chen, Gang Wang, Yan Tan, and Bijun Li (Journal Paper	2020	1. Introduces a vehicle tracking algorithm that combines detector and tracker methods. 2. Integration of detector and tracker enhances accuracy and robustness of tracking. 3. Addresses real-world challenges in vehicle tracking scenarios. 4. Potential for improving surveillance and traffic management systems.	1. Lack of detailed technical description of the algorithm. 2. Empirical validation and performance comparison with existing methods not provided. 3. Scalability and robustness in various environmental conditions not discussed. 4. Limited insight into the algorithm's practical implementation and integration.

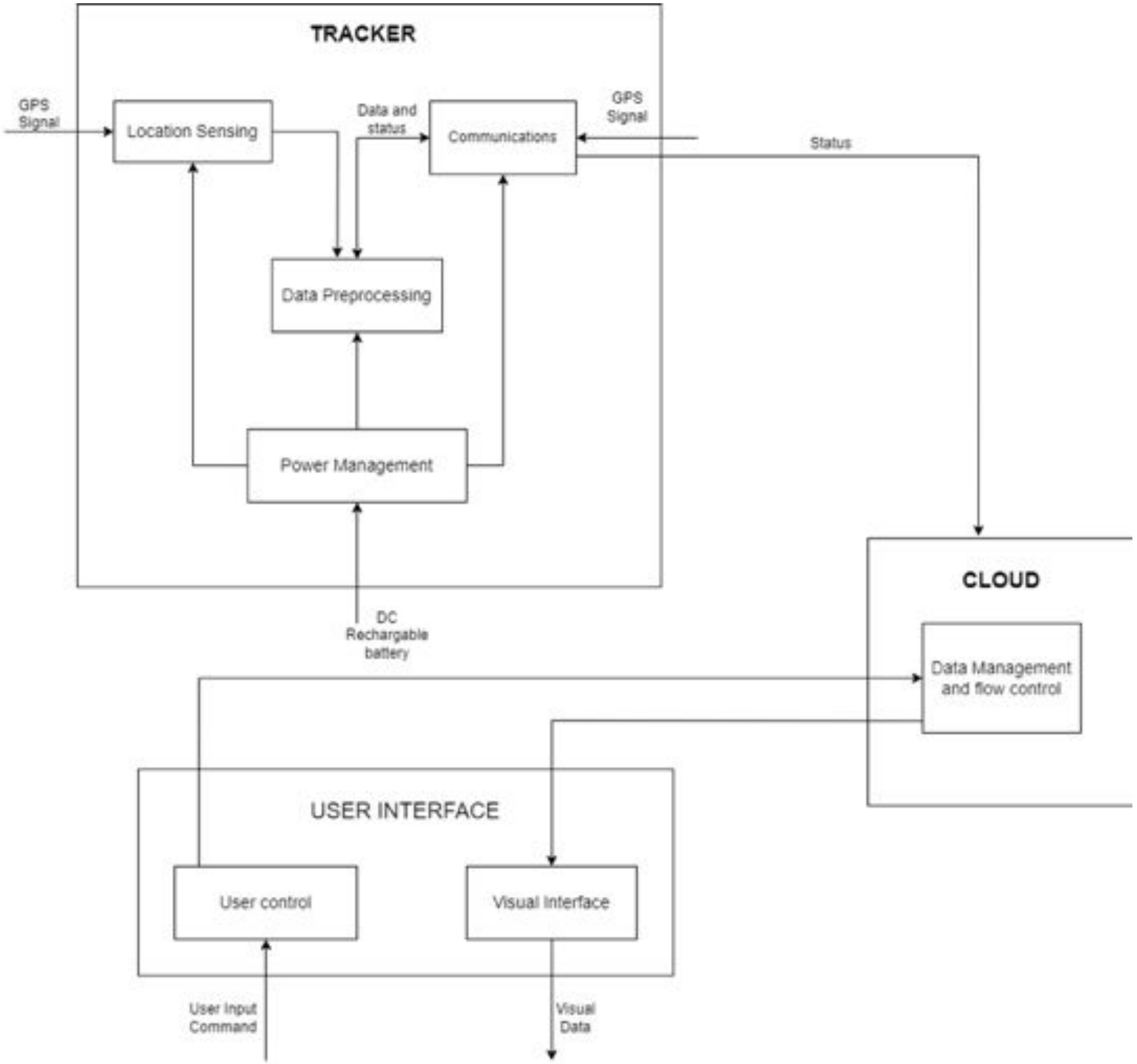
6.	Real-Time State-of-Charge Tracking Embedded in the Advanced Driver Assistance System of Electric Vehicles by Kaveh Sarrafan, Kashem M. Muttaqi, and Danny Sutanto (Journal Paper)	2020	1. Integration of state-of-charge tracking in Advanced Driver Assistance System (ADAS) of Electric Vehicles. 2. Real-time tracking enhances efficiency and reliability of EVs. 3. Authors' affiliations with IEEE indicate expertise in the field and potential rigor in research. 4. Addresses a significant aspect of EV technology advancement. 5. Potential for improving EV performance and user experience. 6. Contributes to the advancement of intelligent vehicle technology.	1. Lack of empirical validation and performance comparison with existing systems/methods. 2. Scalability and robustness considerations in various driving conditions need discussion. 3. Practical applicability and integration challenges may need to be addressed.
7.	Smartphone-Based Real-Time Vehicle Tracking in Indoor Parking Structures by Ruipeng Gao, Mingmin Zhao, Tao Ye, Fan Ye, Yizhou Wang, and Guojie Luo (Journal Paper)	2017	1. Innovative smartphone-based tracking system. 2. Real-time monitoring for indoor parking efficiency. 3. Potential practical implementation for improved management.	1. Lack of detailed methodology. 2. Absence of empirical validation. 3. Limited comparison with existing approaches. 4. Scalability and robustness considerations not addressed. 5. Currency of research may be affected by publication year.

8.	M. Driusso, C. Marshall, M. Sabathy, F. Knutti, H. Mathis, and F. Babich, Vehicular position tracking using LTE signals, IEEE Transactions on Vehicular Technology,2016.	2016	1. Feasibility of LTE-Based Position Tracking: The research demonstrates the feasibility of a position tracking system based on LTE downlink signals, showcasing the potential for utilizing existing commercial LTE networks for accurate positioning [T1]. 2. Innovative Positioning Algorithm: The study introduces the ESPRIT and Kalman filter for Time of Arrival Tracking (EKAT) algorithm, which leverages signal combining in various domains to estimate pseudoranges for positioning [T1]. Highlighting the use of advanced algorithms can emphasize the sophistication and effectiveness of the proposed approach. 3. Practical Application in Vehicular Tracking: By conducting data collection during a car drive in Rapperswil, Switzerland, the study provides a practical demonstration of the proposed positioning system in a real-world scenario [T1]. This real-data gathering approach adds credibility to the research findings and showcases the system's potential for vehicular position tracking applications.	1. Limited Real-World Validation: The authors highlight a lack of experimental real-world validation in the literature regarding the use of LTE downlink signals for positioning measurements [T5]. This gap underscores the need for more field studies to confirm the feasibility and effectiveness of this approach in practical scenarios. 2. Clock Properties of Base Stations: The study assumes that base station (BS) positions are known to the receiver and that each BS makes its clock properties available to the positioning engine [T5]. Further research could explore methods to address potential challenges related to obtaining accurate BS clock properties and ensuring their availability for positioning calculations.

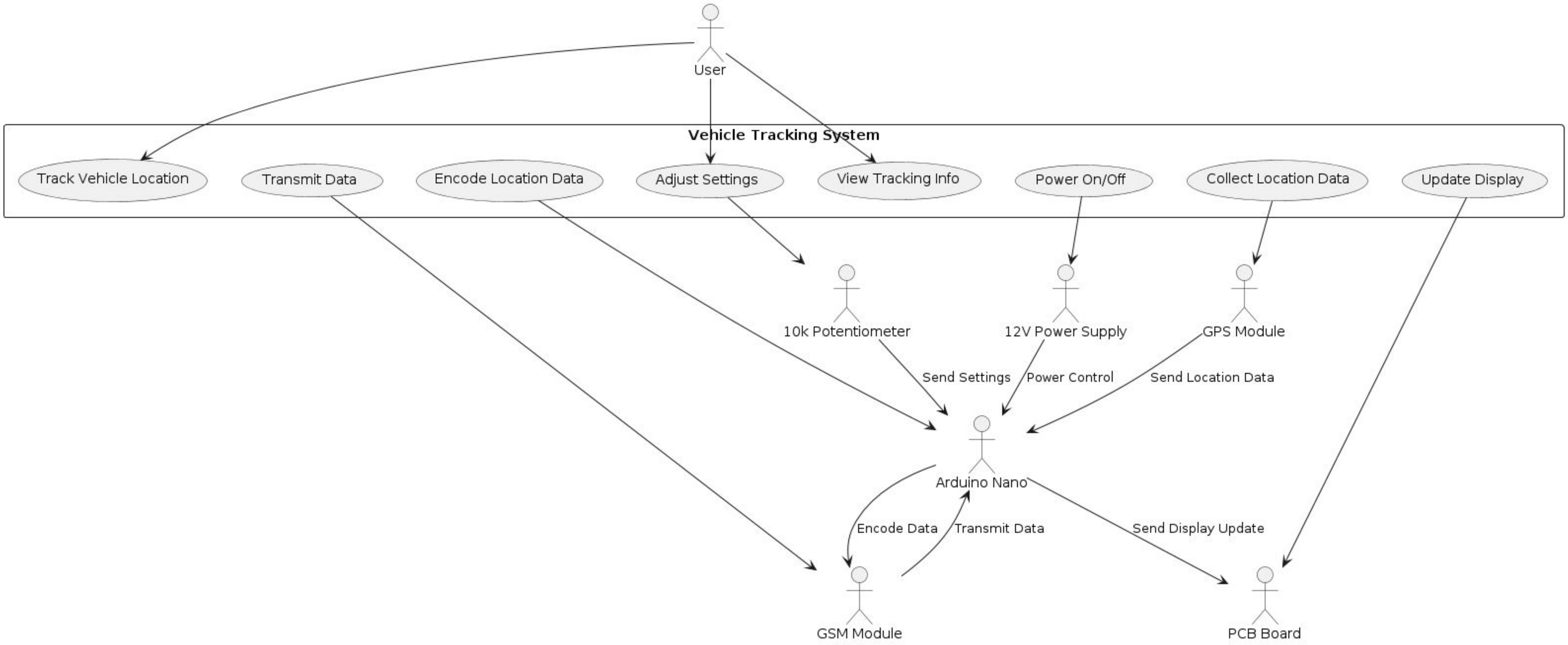
9.	M. Driusso, C. Marshall, M. Sabathy, F. Knutti, H. Mathis, Member, IEEE, and F. Babich, Senior Member, IEEE, Vehicular Position Tracking Using LTE Signals, IEEE Transactions on Vehicular Technology, 2016.	2016	1. Field Validation: The study stands out for its real-world validation of a positioning approach using LTE signals, providing practical insights into the feasibility and performance of the proposed system. 2. Multipath Mitigation: The utilization of the EKAT algorithm for mitigating multipath effects on LTE-based range estimations showcases an advanced signal processing technique to enhance positioning accuracy. 3. Comprehensive Methodology: The paper presents a comprehensive methodology covering signal processing, TOA estimation, pseudorange correction, and positioning algorithms, demonstrating a systematic approach to vehicular position tracking using LTE signals.	1. Limited Comparison: The paper lacks a detailed comparison with existing positioning systems or techniques, making it challenging to assess the novelty and superiority of the proposed LTE-based system. 2. Scalability Concerns: The scalability of the proposed system for larger networks or urban environments with dense LTE coverage is not thoroughly discussed, leaving a gap in understanding its applicability in various scenarios. 3. Real-time Performance: The real-time performance of the system in dynamic vehicular environments, considering factors like high-speed movement and rapid signal variations, is not extensively evaluated.

10.	T. P. Yunck, S. Wu, J. Wu, and C. L. Thornton, Precise Tracking of Remote Sensing Satellites With the Global Positioning System, IEEE Transactions on Geoscience and Remote Sensing, vol. 28, no. 1, January 1990.	1990	1. The research presents four approaches to GPS-based tracking of low-earth satellites, offering different strategies to achieve high tracking accuracy [T1]. 2. The techniques discussed in the document show promise in providing sub decimeter tracking accuracy for dynamically unpredictable satellites down to the lowest orbital altitudes [T3]. 3. The integration of GPS ground receivers with a receiver aboard the user satellite to estimate user orbit, GPS orbits, and selected ground locations simultaneously is highlighted as a key aspect of the tracking techniques [T3]. 4. The document discusses the potential for achieving decimeter accuracy in tracking satellites through a combination of dynamic and kinematic solutions, showcasing advancements in satellite tracking technology [T3].	1. The document mentions the need for continued improvement in gravity models to achieve decimeter accuracy in tracking satellites, especially at lower altitudes [T1]. 2. There is a mention of vulnerability to system degradation in the kinematic strategy due to its direct dependence on observing geometry [T1]. 3. The gravity adjustment strategy is highlighted as beneficial for missions like Topex with suitable orbits and processing schedules, indicating a potential limitation for missions with different characteristics [T1]. 4. The importance of accurate dynamic models is emphasized, suggesting that further refinement is necessary to achieve the desired tracking accuracy [T4].

System Architecture Diagram



UML Diagrams (Use Case Diagram)



Implementation

Components List of Vehicle Tracking System:-

S.No.	Components	Quantity
1	Arduino Nano	1
2	GPS Neo-6M Module	1
3	GSM SIM800L Module	1
4	Zero PCB (Printed Circuit Board)	1
5	12V DC Power Supply	1

1. **Arduino Nano**:
   - The Arduino Nano serves as the central processing unit of the tracking system. It's a compact microcontroller board based on the ATmega328P chip, offering similar functionality to the larger Arduino Uno but in a smaller form factor.
   - The Arduino Nano runs the tracking system's firmware code, which controls the operation of other hardware components, interfaces with sensors and modules, and manages data processing and transmission.

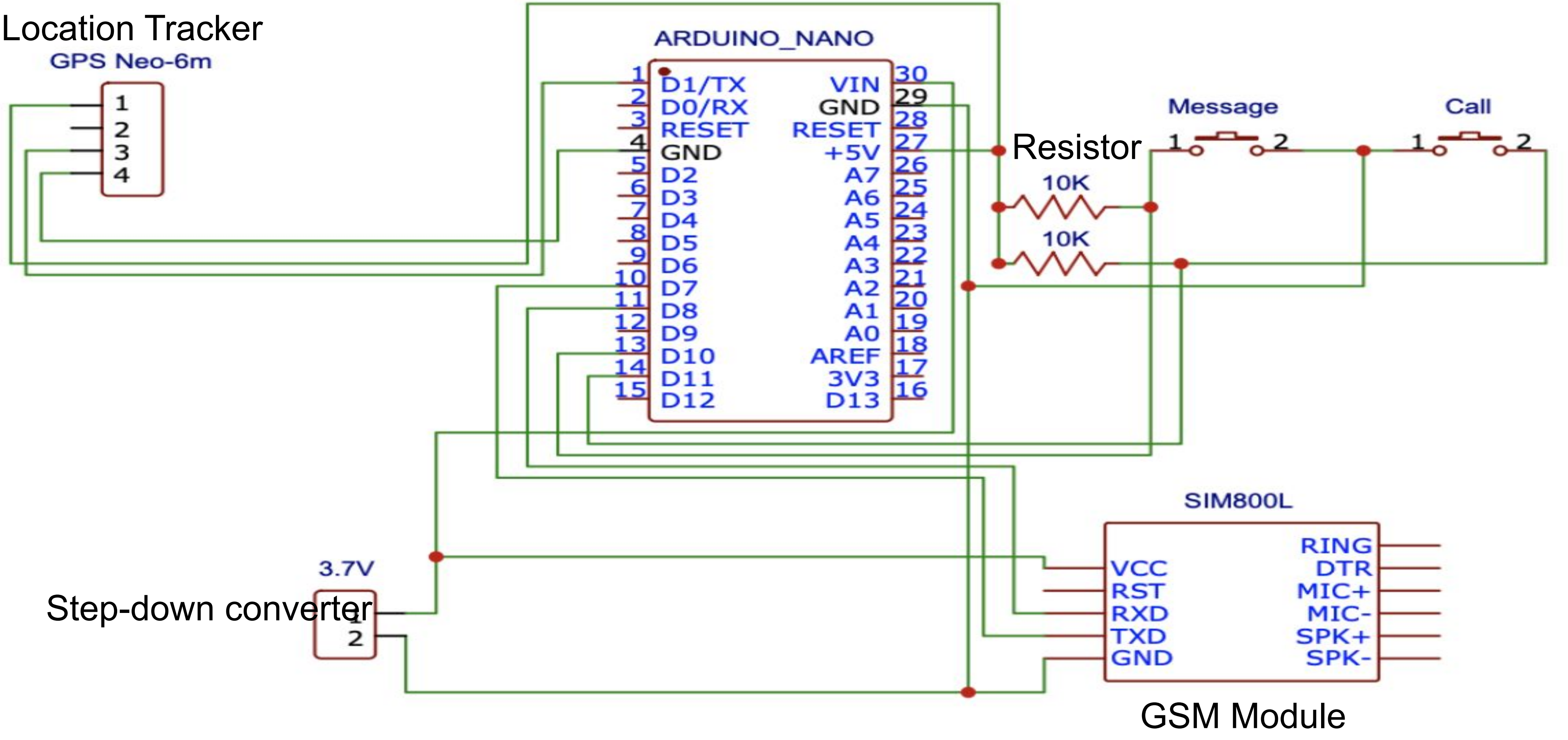
2. **GPS Neo-6M Module**:
   - The GPS Neo-6M Module is a GPS receiver that communicates with GPS satellites to determine the vehicle's precise geographic location in terms of latitude, longitude, and altitude.
   - The Neo-6M Module sends GPS data to the Arduino Nano via serial communication protocols (e.g., UART), allowing the Arduino to process the location information and incorporate it into the tracking system's data stream.

3. **GSM SIM800L Module**:
   - The GSM SIM800L Module enables the tracking system to establish a cellular connection with the internet, facilitating real-time communication with a remote server or cloud platform.
   - The SIM800L Module communicates with the Arduino Nano via serial communication, allowing the Arduino to send location data, status updates, and other information to the server over the cellular network.

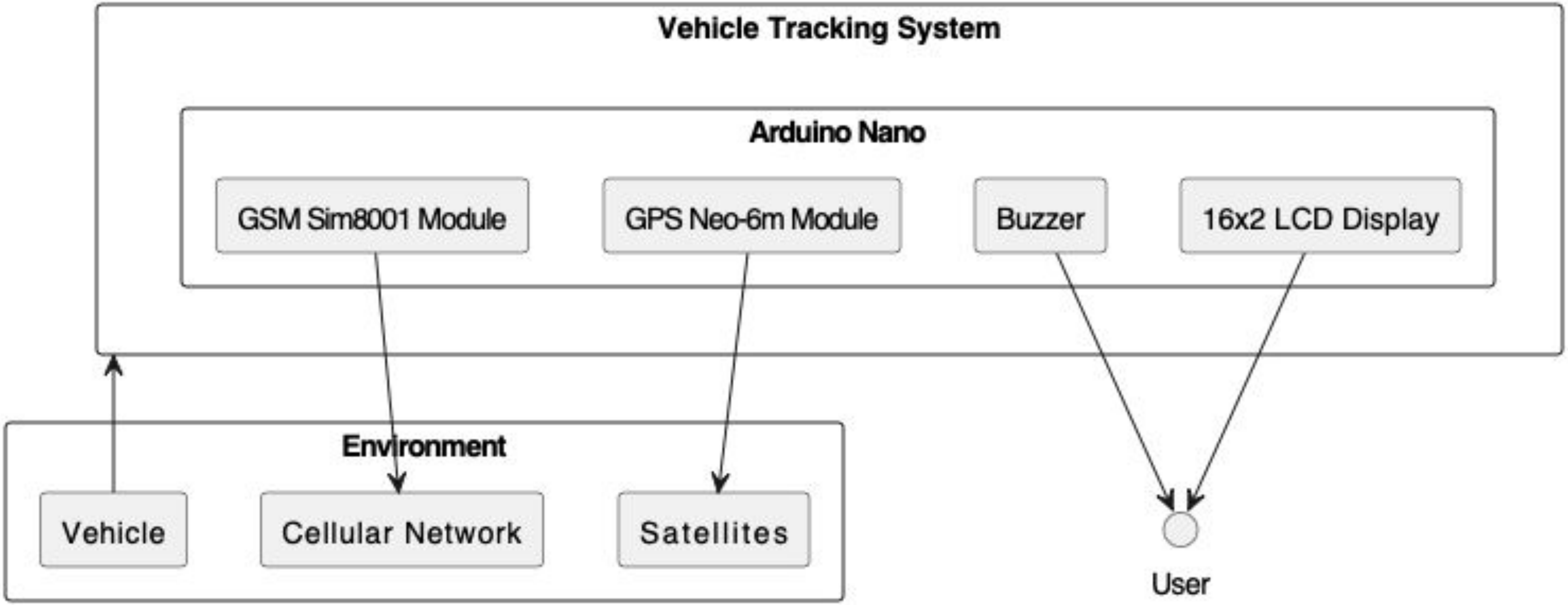
4. **Zero PCB (Printed Circuit Board)**:
   - The Zero PCB provides a platform for mounting and interconnecting the various electronic components of the tracking system, including the Arduino Nano, GPS module, GSM module, and other peripheral devices.
   - It helps organize the components in a compact and structured manner, reducing the risk of loose connections or interference between components.

5. **12V DC Power Supply**:
   - The 12V DC Power Supply provides the necessary electrical power to operate the tracking system. It may be sourced from the vehicle's battery or an external power source.
   - The power supply ensures that all components of the tracking system receive a stable and sufficient supply of electricity for continuous operation.

Pin Diagram of Vehicle Tracking System



Block Diagram of Vehicle Tracking System



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