JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

AUTOMATIC SMART GPS CAR USING MACHINE LEARNING AND DEEP LEARNING

Prof. Sonal S Bawankule, Riya Chandekar, Rutika Sawarkar, Tisha Welekar, Shubhanshu Wahane

Department of Artificial Intelligence Engineering, Priyadarshini JL College Of Engineering, Nagpur.

ABSTRACT

This study proposes an enhanced model of autonomous vehicle navigation that combines real-time lanes, obstacles, and traffic sign recognition and tracking modules with the Global Positioning System (GPS). With reliable vision and precise navigation, the suggested system seeks to improve the safety and accuracy of autonomous cars. The major navigation tool for the autonomous car is the GPS module, which provides route planning and worldwide positioning. In addition, the model includes vision-based lane-detecting sensors, using sensor fusion techniques, the obstacle identification and tracking component combines information from cameras, radar, and LiDAR to identify and track nearby obstacles in real-time. By improving the car's comprehension of traffic laws and regulations, this feature helps make autonomous driving safer and more law-abiding. By merging data from vision sensors, GPS, and other environmental perception modules, the integrated system creates a comprehensive image of the vehicle's surroundings. This data is processed by a centralized decision-making system, which then prepares and implements the best navigation strategies to ensure a safe and enjoyable driving experience. The proposed approach's efficiency is proved in a variety of driving scenarios using extensive simulations and real-world testing.

Keywords: accurate navigation, route planning, vision-based lane detection sensors, centralized decision making, cameras, and radar.

INTRODUCTION

Autonomous vehicles have revolutionized the automotive industry and brought about a future in which cars can navigate without requiring human aid. At the vanguard of this progress is the GPS model for automobiles, where the incorporation of advanced technology is essential to autonomous navigation. This model's smooth integration of cutting-edge detection and tracking modules with the Global Positioning System (GPS) addresses important challenges in autonomous driving, such as alcohol detection, lane detection, obstacle detection, sign detection, and navigation tracking. Thanks to the integration of GPS technology with state-of-the-art machine learning (ML) and deep learning (DL) algorithms, autonomous vehicles are about to enter a transformative era. Because of this mutually beneficial relationship, GPS model automobiles can make intelligent decisions that allow them to dynamically adjust to ever-changing environments in addition to being able to navigate the physical world. This all-encompassing method improves the accuracy of self-driving navigation while also enhancing the cars' performance in other areas, such as obstacle avoidance, adaptive learning, and route optimization.

The GPS model automobile is built on a strong foundation of GPS technology. Satellite signals are used by the car's GPS receivers to determine the exact location, heading, and speed of the vehicle. Based on this crucial location data, machine learning, and deep learning algorithms are integrated to enable the car to detect and respond to its surroundings with a high degree of precision. The GPS model car relies heavily on machine learning algorithms that use historical navigation data and real-time sensor inputs. These algorithms, which are always learning and adapting to a range of driving conditions, let the car make well-informed decisions by drawing on its experiences. Adaptive navigation entails figuring out the best routes, anticipating traffic patterns, and modifying one's driving style in reaction to changing conditions. Deep learning improves the perception and recognition capabilities of the car, especially about convolutional neural networks (CNNs) and recurrent neural networks (RNNs). Rich data about the environment is captured by cameras, LiDAR, and radar sensors. Deep learning algorithms use this data to recognize and classify objects, lanes, signs, and obstacles. As a result, the car has a thorough awareness of its surroundings and is better equipped to handle challenging situations. The GPS model automobile can now recognize and avoid obstacles in real-time thanks to deep learning models. The car can identify and react to unforeseen obstacles, other vehicles, and people thanks to neural networks that have been trained on enormous datasets. This feature is essential for guaranteeing that autonomous vehicles remain agile and safe, especially in congested areas and hazardous driving situations. The GPS model automobile uses reinforcement learning frameworks to support lifelong learning. Through the utilization of input from its interactions with its surroundings, the car can enhance its ability to make decisions, adjust to changing driving circumstances, and perform better all around. With time, the autonomous system will become more and more skilled at managing a variety of challenging driving situations thanks to this iterative learning technique.

1.1 LANE DETECTION

Precise lane detection is essential for autonomous vehicles to navigate roads safely and efficiently. The model employs high-resolution cameras and computer vision algorithms to identify lane markings and determine the vehicle's position within the designated lanes. By continuously analyzing this data, the system ensures accurate alignment and facilitates smooth navigation, reducing the risk of lane departure incidents.

1.2 OBSTACLE DETECTION

Obstacle detection is critical for avoiding collisions and navigating through dynamic environments. LiDAR, radar, and camera sensors are all integrated into the GPS model to provide real-time obstacle detection and tracking. The system can produce a thorough environmental map thanks to the combination of sensor data, which enables the car to react proactively to barriers and take drastic measures when needed.

1.3 ALCOHOL DETECTION

It is crucial to ensure the safety of autonomous vehicles, and adding alcohol detection technology to the mix increases security. The car's sophisticated sensors constantly check the air in the cabin or the driver's breath for alcohol. The system may identify alcohol impairment and take preventive action to ensure responsible and safe usage. It can notify the driver, notify authorities, or even temporarily disable autonomous mode.

1.4 SIGN DETECTION

To ensure safe and law-abiding autonomous driving, it is essential to recognize and comprehend traffic signs. To effectively recognize and interpret traffic signs, the model makes use of sophisticated computer vision algorithms. This feature improves the car's comprehension of traffic laws, allowing it to obey traffic signals, change its speed, and negotiate intersections based on the signs that are displayed.

1.5 NAVIGATION TRACKING

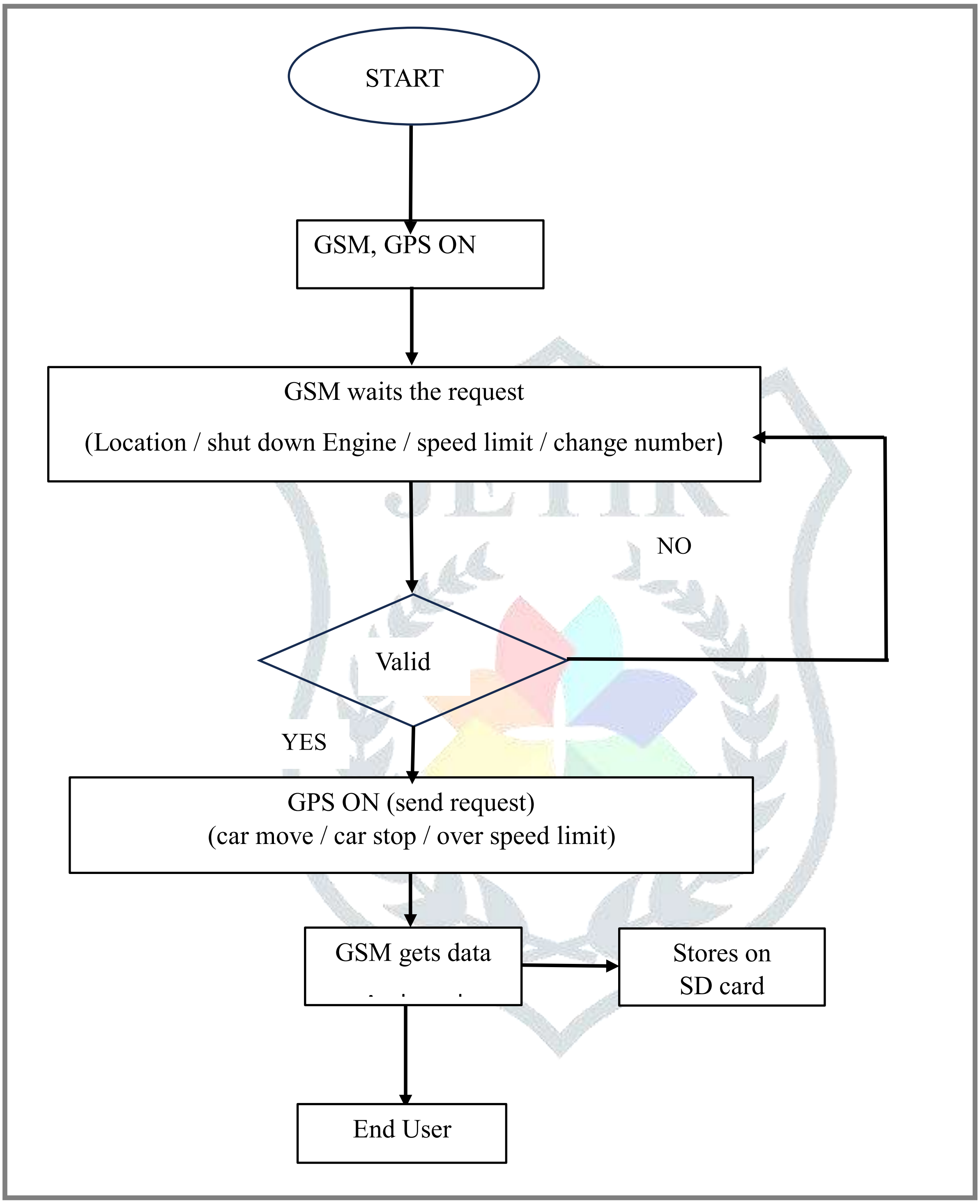
The GPS model's primary function is to deliver accurate navigational data. Accurate positioning, route planning, and real-time tracking of the vehicle's movement are made possible by GPS technology and inertial sensors. This guarantees the autonomous vehicle's ability to travel effectively, adjust to shifting road conditions, and arrive at its destination without incident.

LITERATURE REVIEW

. Real-time GPS vehicle tracking system: This article describes the implementation and design of a real-time GPS tracker system using an Arduino. Tracking salespeople, individual drivers, and vehicle safety were all made easier with this system. The author of the study also made an effort to address the issue of pricey car owners watching and tagging their vehicles to track movement and previous acts. A review of the literature on GPS cars can address a broad range of subjects pertaining to the technology, including as its background, advancement, uses, advantages, and drawbacks. The advantages of employing GPS and GIS technology in fleet management are covered in this paper, including increased productivity, lower costs, less of an influence on the environment, and the use of safety precautions. Road detection has played an essential part in driving assistance systems, providing information such as lane structure and vehicle position relative to the lane. One of the key technologies involved in this is computer vision, which has evolved into a strong tool for perceiving the surroundings and is widely used in a variety of applications by intelligent transportation systems. This work describes a vision-based technique capable of achieving real-time performance in the recognition and tracking of structured road borders (painted or unpainted lane lines) with moderate curvature that is robust in the presence of shadow conditions.In this study, we offer two distinct lane detection and object detection methods that are appropriate for all types of complex traffic conditions, particularly when driving speeds on highways are too high. The photos from the model car are processed, and the resulting data can be used to control the autonomous vehicle. The first method is a minimalist lane detection approach that can only recognize straight lane lines. The second goal is to create a CNN-based model that can learn to drive an automobile using the driver's driving data. This approach can drive a car that has been trained by duplicating the behavior of a human driver.

Alcohol detection linked with GPS-equipped vehicles is a promising solution to combatting drunk driving, which is a major contributor to road accidents and fatalities globally. Several technologies have been investigated for this aim. as these alcohol detection systems are combined with GPS technology, they offer real-time monitoring of alcohol levels as well as accurate location tracking, allowing for prompt intervention or enforcement measures as necessary. Studies evaluating the usefulness and dependability of these systems have yielded promising results, with some examples indicating a reduction in drunk driving episodes and associated accidents.

PROPOSED METHODOLOGY



IMPLEMENTATION AND RESULTS

Developing a GPS-based model automobile capable of recognizing signs, avoiding obstacles, detecting alcohol, lane detection, and GPS tracking is a challenging project that requires the integration of multiple sensors and technology. The GPS automobile's operational module contains lane detection, obstacle detection, alcohol detection, sign detection, and GPS tracking. The camera will take a photograph of the lane, turn it to black and white, blur the background, and highlight the lane in the image. This is known as lane detecting. If the camera and sensor detect an object in front of the vehicle, it will stop. The sign detection system operates by detecting and assisting in the recognition of traffic signs.

First, we will combine all of the hardware components needed for the GPS automobile. Following the combination, components will be tested. The working will be evaluated following testing. Components consist of GPS receiver, Antenna, Processor, Memory, Display, Raspberry Pi, DC buck Converter, Wires, 9V Battery, Sensors, Camera, Motor Driver, Wheels, and Chasis.

Fig 1.1

1 Lane Detection

Lane recognition in GPS-equipped vehicles is a critical component of current navigation systems that improve driver safety and convenience. These systems use onboard cameras or other sensors to continuously evaluate the road ahead to recognize and track lane markers. The system recognizes lane boundaries using image processing techniques such as edge detection and the Hough transform, allowing it to properly calculate the vehicle's position within the allocated lane. This data is then combined with GPS data to provide real-time advice, such as notifying the driver if they wander from their lane or giving lane-specific navigation instructions.

Fig 1.2

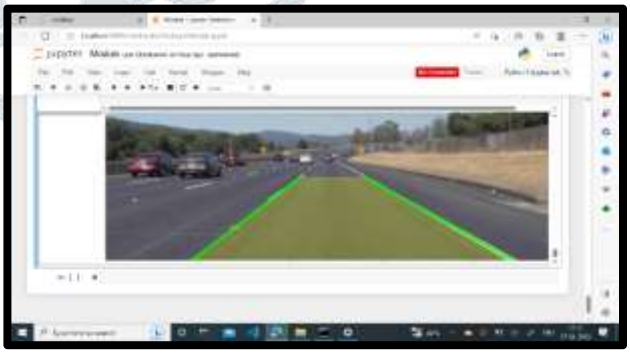
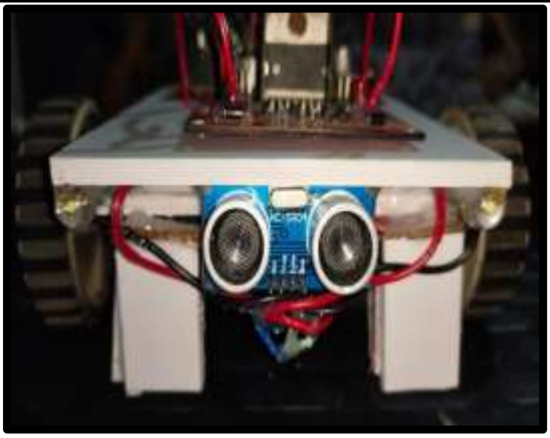


Fig 1.3

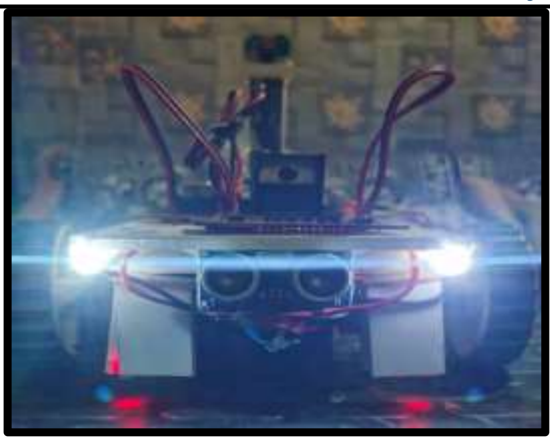
2 Obstacle Detection

Obstacle detection is a crucial function that increases navigational safety and efficiency. These systems constantly scan the vehicle's surroundings for potential road dangers, employing a variety of sensors including LiDAR, radar, cameras, and ultrasonic sensors. Obstacle detection is essential for enabling technologies such as automated emergency braking, adaptive cruise control, and parking assistance, which improve driver safety and convenience. Advanced algorithms predict the future positions of obstacles and assess the risk of a collision, allowing the system to warn the driver or intervene autonomously if needed.



Obstacle detection sensor

Fig 1.4



after detection (working)

Fig 1.5

3 Sign Detection

Sign detection is critical to ensure safe and efficient navigation. These model cars can recognize and understand various signs and symbols encountered along the way because they combine computer vision algorithms with GPS technology. The car's onboard camera takes real-time photos of its surroundings using image processing and machine learning algorithms, scanning for signs such as traffic lights, road signs, and pedestrian crosswalks. Once identified, the signs are evaluated to extract significant characteristics such as forms, colors, and symbols. Machine learning algorithms, typically based on convolutional neural networks (CNNs), are then used to identify the signs and derive their meanings.

Fig 1.6

4 Alcohol Detection

Integrating alcohol detection technology is a key safety strategy for avoiding driving under the influence (DUI) occurrences. This technology provides additional protection against impaired driving by adding sensors capable of detecting alcohol levels within the vehicle's cabin. The alcohol detection system continuously checks the air within the vehicle for traces of alcohol vapor, which could indicate the presence of an intoxicated driver or passenger.

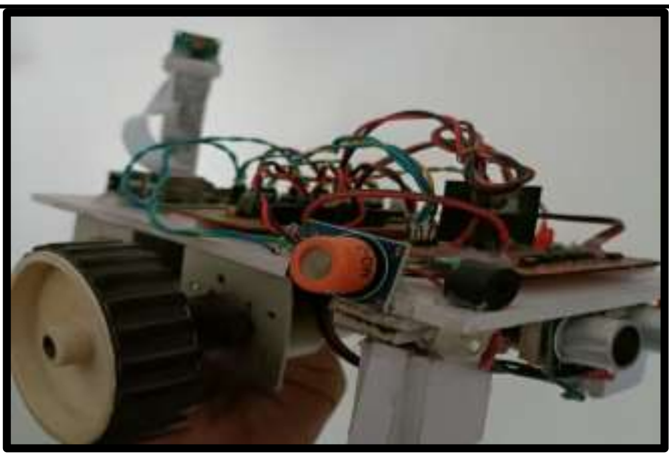


Fig 1.7

5 GPS Tracking

Global Positioning System (GPS) tracking has transformed how we monitor and manage numerous assets, vehicles, and humans. GPS tracking systems can precisely locate a device or object equipped with a GPS receiver through leveraging a network of satellites around the Earth. This technology has several uses, including fleet management, logistics, and personal safety and security. Using GPS tracking in fleet management helps firms to monitor vehicle whereabouts in real-time, optimize routes, improve fuel efficiency, and enhance overall productivity.

Fig 1.8

CONCLUSION

In summary, the combination of GPS technology with sophisticated detecting and tracking modules has allowed self-driving cars to advance significantly in terms of efficiency and safety. The comprehensive strategy creates a strong basis for the successful implementation of a dependable and secure autonomous driving experience. It includes navigation tracking, lane detection, obstacle detection, alcohol detection, and sign detection. The GPS model automobile is an intelligent, flexible, and ever-evolving object thanks to the integration of machine learning and deep learning with GPS technology. This convergence provides accurate navigation as well as the cognitive abilities required for an automobile to drive safely, effectively, and autonomously in a dynamic environment.

REFERENCES

[1] Mahmood, S., Rahman, M., & Sanaullah, "The Role of GPS and GIS in Enhancing Fleet Management and Vehicle Routing Efficiency"(2019);

[2] B.G. Simons-Morton, M. C. Ouimet, Zhang, Z., Klauer, S. G., Lee, S. E., Wang, J., & Dingus, T. A "The Impact of GPS Navigation on Driver Safety" (2016);

[3] Kato, H., & Nishii, K., "Development of GPS-Based Car Navigation System and Its Impact on Travel Behavior" (2017);

[4]Sivaraman, S., and Trivedi, M.M." Looking at Vehicles on the Road: A Survey of Vision-Based Tracking, Behavior Analysis, and Vehicle Detection IEEE Transactions on Intelligence and Systems," 2013-14;

[5] Suet-Peng Yong and P.K. Bhaskar, "Image processing based vehicle detection and tracking method,", International Conference on Computer and Information Sciences (ICCOINS), vol., no., pp.1,5, 3-5In June of 2014;

[6] Steinbeck, J.; Druml, N.; Herndl, T.; Loigge, S.; Marko, N.; Postl, M.; Kail, G.; Hladik, R.; Hechenberger, G.; Fuereder, H. "ACTIVE—Autonomous Carto Infrastructure Communication Mastering Adverse Environments." In Proceedings of the Sensor Data Fusion: Trends, Solutions, Applications (SDF) Conference, Bonn, Germany, 15–17 October 2019;

[7] Mouawad,N.;Mannoni,V.; Denis, B.; da Silva, A.P." Impact of LTE-V2X Connectivity on Global Occupancy Maps in a Cooperative Collision Avoidance (CoCA) System". In Proceedings of the IEEE 93rd Vehicular Technology Conference (VTC2021-Spring), Helsinki, Finland, 25–28 April 2021;

[8] Belaroussi, R.; Foucher, P.; Tarel, J.P.; Soheilian, B.; Charbonnier, P.; Paparoditis, " Road sign detection in images: A case study". In Proceedings of the IEEE 20th International Conference on Pattern Recognition, Istanbul, Turkey, 23–26 August 2010;

[9] Rajendran, S.P.; Shine, L.; Pradeep, R.; Vijayaraghavan, S. "Real-Time Traffic Sign Recognition Using YOLOv3 Based Detector." In Proceedings of the 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Kanpur, India, 6–8 July 2019;

[10] Youssef, A.; Albani, D.; Nardi, D.; Bloisi, D.D. "Fast Traffic Sign Recognition Using Color Segmentation and Deep Convolutional Networks". In Advanced Concepts for Intelligent Vision Systems; Blanc-Talon, J., Distante, C., Philips, W., Popescu, D., Scheunders, P., Eds.; Lecture Notes in Computer Science; Springer International Publishing: Cham, Switzerland , Volume 10016, pp. 205–216. ISBN 978-3-319-48679-6 , 2016;

[11] Gaikwad, V.; Lokhande, " Lane Departure Identification for Advanced Driver Assistance". IEEE Trans. Intell. Transp. 2015;

[12]http://www.themalaysian.blogspot.com/2006/08/fatal-roadaccidents-ranking-malaysia.html,(2008);