WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

VOGUE: Where Technology Meets Motion

Lect. D. C. Pardeshi [1], Mr. Himanshu Ahirrao [2], Mr. Atharv Chatur [3], Mr. Anuj Kothawale [4]

[1] Professor, Department of Artificial Intelligence and Machine Learning, AISSMS Polytechnic, Pune, Maharashtra, India
[2, 3, 4] Student, Department of Artificial Intelligence and Machine Learning, AISSMS Polytechnic, Pune, Maharashtra, India

ABSTRACT :

VOGUE (Vocal Oriented Gesture Usability Engine) seizes a gesture and voice-controlled vehicle system of its type. It incorporates hand motion recognition and voice system management to function the car with a higher degree of intuition. By the use of a MEMS sensor, a Bluetooth module, and an Android-based voice command system, VOGUE assures a hands-free, distraction-free driving interface. The invention's primary mission is to make it easier to deal with the car, plus increase driving safety, and as the beginning, the development of the smart car technology is provided.

Keywords: Gesture Control, Voice Recognition, MEMS Sensor, Arduino, Bluetooth HC-05, Vehicle Automation.

INTRODUCTION:

Advanced technology is being employed in most of the present-day mechanized vehicles, among other things, to minimize the risks of events like project activity, power consumption, and storage system status and to maximize the protection provided. An intense situation emerges where older vehicles provided with manual controlling functions take a significant portion of the driver's notice that can involve unsafe issues through distraction. In particular, if a driver needs to adjust climate settings or turn on an entertainment radio or such things, the driver will have to concentrate on doing the actions and hence lose focus on the road, which may cause accidents. All of these underline the need for a well-performing system that automates essential car functions without turning the car into a spaceship control panel.

Solving the problems with gestures, as well as voice recognition, the VOGUE car automation system integrates them in the system. The MEMS (Micro-Electro-Mechanical Systems) based gesture recognition technology acquires natural hand movements from which the car is controlled, and voice commands processed through Android applications are natural, hands-free control. This dual-interface technology besides eliminating the distractions that drivers have to undergo it also offers the driver a better chance for safe and convenient driving. By taking innovative technology and user-centered design, VOGUE redefines the way people communicate with cars and also portrays the future car intelligence.

Motivation of the Project:

One of the key factors in road accidents all over the world is distracted driving. It is usually the result of the necessity to operate automobile systems manually. Traditional techniques of managing vehicles, such as steering, braking, and controlling other essential devices, are performed at the expense of the driver's involvement and thus, the driver's attention is diverted from the road. This gap in attention has led to the urgent need for new solutions that focus on safety as their first priority without complicating matters. The request for a hands-free, easy-to-use interface was the main driving force behind the formation of VOGUE, a hybrid system whose purpose is to solve these problems.

VOGUE has hands-free technology and voice recognition features that make the driving experience very intuitive and smooth. Engineering the vehicle in such a way that it allows its drivers to manipulate the vehicle functions through simple hand gestures or oral commands greatly reduces the passenger's likelihood of developing attention-deficit disorders and makes the roads a safer place. Moreover, the fusion of high-end technology has a twofold benefit of augmenting road safety and also making the vehicles convenient to handle for both, drivers and passengers. VOGUE is a significant pain in the back of the cars industry as a result of its contribution to the innovation of the sector by creating a more secure and efficient vehicle interface.

VOGUE's most significant strength is the many areas it may be used in, which include not only automotive systems but also healthcare and the entertainment sector as well as smart environments. Its no-touch technology capacities gesture recognition which can be used in the medical sector and on top of that voice commands give an opportunity to disable the hands or enhance the features of the smart homes or industry automation. Those working in the field of digital design can benefit from the use of the system for hands-free digital design, and its built-in AI functionalities that function in real-time and promise a new kind of interaction with the user across platforms. In the same way that vehicles become more user-friendly thanks to safety and convenience, they also become the launchpad for the solutions that will solve various issues in different domains, thus VOGUE is the truly transformative technology.

Brief description

VOGUE stands for a Vocal Oriented Gesture Usability Engine and is an innovative prototype that allows vehicle use through gesture and voice recognition. Created with the idea of minimizing driver distractions while enhancing usability, VOGUE offers a hands-free, natural way to control everything the driver needs in the car. This approach leads to a reliable, real-time system that takes care of the interaction in a safe way via MEMS gesture detection and Android-processed voice commands.

System Overview

Hardware Components

- **Arduino Uno:** The brain of our system which processes all the input.
- **MEMS Sensor:** Device that senses and translates hand movements to commands.
- **Bluetooth Module (HC-05):** Allows the Android device to communicate with hardware.
- **Ultrasonic Sensor:** Used to detect obstacle and stop vehicle for safety.
- **Motor Driver:** Controls motor movements from the processed input.
- **Android Device:** The AMR voice application that receives voice commands

Software Components

- **Voice application (AMR):** Convert sound commands to string array and send them via bluetooth.
- **Arduino IDE:** Maps gesture and voice commands to specific vehicle functions.

For VOGUE, advanced gesture and voice control could fundamentally change how we interact with information in vehicles, enabling safer and more intuitive control at our fingertips.

LITERATURE SURVEY:

Deep Learning Algorithm Using Virtual Environment Data for Self-Driving Car (2019)
This paper discusses an autonomous driving technique developed by NVidia using car games. The research uses datasets like "Learning data with an end-to-end method" and achieves a performance of 80%. The Precision and Recall rates of this study are 81% and 85%, respectively.

[2] A Cognitive Agent-Based Approach to Varying Behaviors in Computer-Generated Forces System to Model Scenarios like Coalitions (2006)
This paper focuses on the dynamic variation in behavior of entities in military-based computer-generated forces (CGF) system scenarios. It employs a methodology using autonomous cooperative building blocks to handle CGF. The performance, Precision, and Recall rates are 77%, 74%, and 73%, respectively.

[3] Military-Based Vehicle-to-Grid and Vehicle-to-Vehicle Microgrid System Architecture and Implementation (2017)
The paper presents the use of Vehicle-to-Grid (V2G) and Vehicle-to-Vehicle (V2V) systems in military settings to form a quick, aggregated, and effective power solution. This system can be set up in under 20 minutes to provide up to 240kW of power. The performance, Precision, and Recall rates of this system are 70%, 75%, and 65%, respectively.

[4] Probabilistic Risk-Based Security Assessment of Power Systems Considering Incumbent Threats and Uncertainties (2016)
This paper explores the security of power systems considering natural and human-related threats. The risk assessment includes vulnerabilities to dependent contingencies, and the results are affected by uncertainty. The performance, Precision, and Recall rates of this paper are 69.5%, 80%, and 75%, respectively.

[5] Design and Implementation of Hand Movement Controlled Robotic Vehicle with Wireless Live Streaming Feature (2019)
This paper discusses the design and implementation of a gesture-controlled robotic vehicle that offers wireless live streaming. The system allows movement in all directions using hand gestures, with onboard cameras for remote monitoring. The performance, Precision, and Recall rates are 84%, 86%, and 91%, respectively.

[6] Smart Glove and Hand Gesture-Based Control Interface for Multipolar Aerial Vehicles (2019)
This study compares real-time image processing and object recognition techniques for controlling multipolar aerial vehicles. It uses AI techniques such as MobileNet SSD and DNN for obstacle detection and object recognition. The performance, Precision, and Recall rates are 89.79%, 60%, and 85%, respectively.

[7] Study of Evaluation Method of In-Vehicle Gesture Control (2017)
This paper examines the usability of in-vehicle gesture control through a simulated driving cockpit. The study utilizes a fuzzy comprehensive evaluation system to determine the most suitable gesture solution for different tasks. The performance, Precision, and Recall rates are 75%, 34%, and 70%, respectively.

PROBLEM STATEMENT :

As the automotive industry evolves towards greater automation and connectivity, the integration of artificial intelligence (AI) into vehicles presents both opportunities and challenges.
To design and implement an AI-enabled vehicle that effectively utilizes voice and hard gesture controls to enhance user interaction, improve safety, and ensure reliability while addressing the challenges of accuracy, user diversity, and system integration.

Proposed Machine Learning Algorithm

Block Diagram
The speech and gesture-controlled car system's workflow is depicted in the diagram. First, the Android software records hand motions or vocal commands. The Arduino Uno receives these commands from the Bluetooth Module, interprets them, and regulates the motor driver. The MEMS Sensor monitors hand motions, and to improve the accuracy of gesture interpretation, machine learning techniques such as K-Nearest Neighbors (KNN) for dynamic gesture identification and Support Vector Machines (SVMs) for gesture categorization can be used. The car stops when the ultrasonic sensor detects obstructions in the way. Lastly, the system controls the movement of the vehicle by carrying out the relevant operations in response to the input.

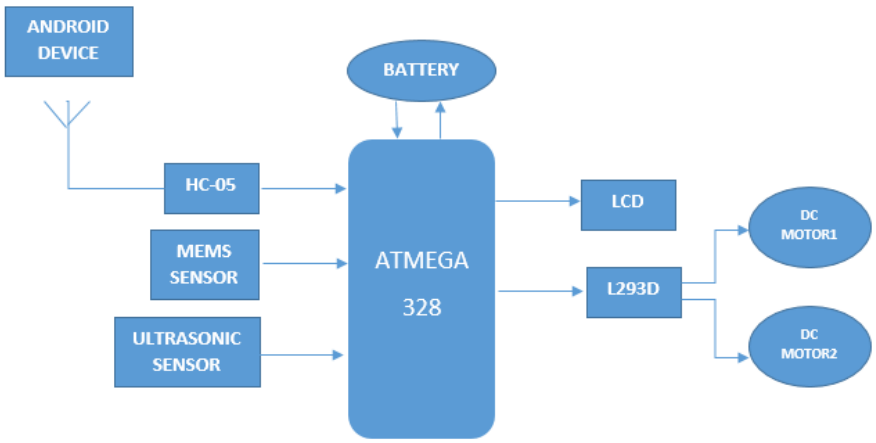

Fig. Block Diagram

1. System Components: Includes Arduino Uno, Bluetooth Module, MEMS Sensor, Ultrasonic Sensor, Motor Driver, and Android app (BT Voice Control for Arduino).
2. Communication: Bluetooth Module (HC-05) enables connection between Android phone and the system.
3. Voice Command Processing: The app converts voice commands into strings, which are sent to the Arduino Uno.
4. Gesture Control: MEMS Sensor detects hand gestures, converts them into strings, and sends them to the Arduino Uno.
5. Arduino Control: Arduino Uno processes commands and controls motors via the Motor Driver.
6. Obstacle Detection: Ultrasonic Sensor detects obstacles, stopping the vehicle when one is found.

Proposed Deep Learning Algorithms

The 'VOGUE: Vocal Oriented Gesture Usability Engine' starts by using an Android app to record hand gestures or voice commands. The Arduino Uno receives these commands from the Bluetooth Module, interprets them, and regulates the motor driver. Deep learning algorithms such as Convolutional Neural Networks (CNNs) for gesture recognition and Recurrent Neural Networks (RNNs), specifically Long Short-Term Memory (LSTM) networks, are used to enhance gesture accuracy and dynamic tracking while the MEMS Sensor records hand movements. The car stops when the ultrasonic sensor detects obstructions in the way. Lastly, the system controls the movement of the vehicle by carrying out the relevant operations in response to the input.

Applications

1. Autonomous Ride-Sharing Services
2. Autonomous Delivery Vehicles
3. Assisted Driving for Elderly and Disabled
4. Personalized In-Car Experience
5. Smart Home Integration
6. Safety and Emergency Response
7. Interactive In-Car Entertainment
8. Fleet Management for Logistics
9. Vehicle Customization and Maintenance

Challenges

1. Accuracy of Gesture Recognition
2. Voice Command Limitations
3. User Adaptability
4. System Integration

Future Scope

1. Enhanced Multimodal Interaction
2. Personalized User Profiles
3. Integration with IoT
4. Improved AI and Machine Learning

CONCLUSION:

With the possibility to use satellite technology in the future to improve their range, the demand for military vehicles powered by artificial intelligence has grown dramatically in recent years. Gesture-controlled systems offer a different way to operate robots, and as artificial intelligence (AI) advances, different functions can be added to gesture-controlled vehicles for a range of uses in industries, healthcare, defense, and surveillance. The car can go forward, backward, left, right, and stop, among other directions. To accomplish these goals, the Arduino programming language and development environment are used to program the controller. The goal of this project is to help older and disabled people become more self-reliant by designing and building a Smart Electronic Vehicle with a Bluetooth module and MEMS sensor.

Acknowledgments

We would like to express our sincere gratitude to our academic mentors for their invaluable guidance, patience, and constructive feedback throughout the course of this research. We extend our deepest appreciation to the Head of the Department for their continuous support and advice, which have been instrumental in keeping our work on track. We are also profoundly grateful to the project coordinator for their unwavering guidance and assistance during the project.

Our thanks also go to the technical staff of the Artificial Intelligence and Machine Learning Department for their support and for providing the necessary resources to complete this project. Lastly, we express our heartfelt appreciation to our families for their constant encouragement and support throughout this academic journey.

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