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Automatic Vehicle Speed Control System

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Abstract

An inventive way to overcome the drawbacks of human-driven speed control is the Automatic Vehicle Speed Control System (AVSCS), which makes use of cutting-edge technologies. This technology maintains ideal driving conditions for a safe and effective driving experience by using GPS, radar, and video sensors to detect and react to speed limits, road conditions, and nearby traffic. Fuzzy logic and PID control are two components of a complex control system that dynamically modifies vehicle speed in real-time, lowering driver workload, decreasing human error, and improving overall road safety. The AVSCS is a perfect option for contemporary transportation since it provides a number of advantages, including as higher road safety, increased efficiency, and a better driving experience. It is also compatible with current vehicle technologies and can be adjusted to different driving circumstances.

Introduction

The number of road accidents has skyrocketed, taking many lives and destroying families. Despite strict government laws and sophisticated safety measures, speeding is still the biggest offender. Despite their effectiveness, current laser-based speed control solutions are expensive and have limitations when it comes to detecting human movement.

We suggest creating an Automatic Area-Based Speed Control System to address this problem. This innovative system makes use of radio frequency (RF) technology to guarantee that cars stay under specified speed limits in particular areas. RF transmitters are placed in these locations so that cars with receivers can pick up the signals and automatically change their speed to meet the required limits.

This cutting-edge system provides a dependable, affordable, and automated way to enforce speed restrictions, lessening the strain on drivers and lowering the possibility of collisions. We can greatly reduce the likelihood of traffic accidents, improve general road safety, and avoid needless fatalities by putting this technology into practice.

Literature Survey

1. H. Gupta and A. Pundir proposed an “RF Module Based Speed Check and Seat Belt Detection System” to enhance vehicular safety by integrating RF technology for real-time speed monitoring and seat belt compliance verification. The system utilizes RF transmitters and receivers to track vehicle speed and enforce speed limits while employing sensors to detect seat belt usage. Experimental results demonstrate its effectiveness in reducing violations and improving road safety. This research, presented at the *Second International Conference on Computational Intelligence & Communication Technology*, IEEE 2016, highlights the potential of RF-based enforcement systems in intelligent transportation frameworks [1].

2. A. S. Jahan and I. Hoq developed a “GPS Enabled Speed Control Embedded System Speed Limiting Device with Display and Engine Control Interface” to regulate vehicle speed based on geographical locations. The system integrates GPS technology to dynamically adjust speed limits in predefined zones, ensuring compliance with traffic regulations. Additionally, it features a display interface for real-time driver alerts and an engine control mechanism to enforce speed restrictions automatically. This research, published in 2013, emphasizes the role of GPS-based speed management in enhancing traffic safety and accident prevention [2].

3. A. Mishra and J. Solanki designed an “RF Based Speed Control System for Vehicles,” which utilizes RF communication to regulate vehicle speed based on predefined speed zones. The system employs RF transmitters at strategic locations that communicate with in-vehicle receivers, prompting speed adjustments to ensure adherence to traffic norms. Their study, published in the *International Journal of Advanced Research in Computer and Communication Engineering*, Vol. 1, No. 8, 2012, demonstrates the feasibility of RF-based interventions in mitigating over-speeding and improving traffic regulation compliance [3].

Components

Arduino

Arduino is an open-source platform designed for the development of electronic projects. It comprises a physical programmable circuit board, commonly known as a microcontroller, along with software known as an Integrated Development Environment (IDE) that operates on a computer. This software is utilized to write and upload code to the physical board. The Arduino board features 20 digital input/output pins, of which 6 can function as PWM outputs and another 6 as analog inputs. Additionally, it includes a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button. The platform encompasses all necessary components to support the microcontroller; users can easily connect it to a computer via a USB cable or power it using an AC-to-DC adapter or battery to begin their projects. Arduino streamlines the creation of control systems by offering a standard board that can be programmed and integrated into various systems without the requirement for complex PCB design and implementation. As an open-source hardware initiative, the design details are accessible to anyone, allowing for modifications and enhancements.

MotorDrive

An Automatic Vehicle Speed Control System (AVSCS) utilizing a motor drive represents a sophisticated advancement in vehicle technology, significantly improving efficiency, safety, and automation. The motor drive is essential for managing the speed and torque of an electric motor, ensuring accurate speed regulation through real-time data obtained from sensors and algorithms. Contemporary electric vehicles (EVs) and autonomous vehicles depend on various motor drive types, such as DC drives, AC drives, and Brushless DC (BLDC) drives, to deliver seamless and effective operation. These drives process inputs from speed sensors, GPS, radar, LiDAR, and AI-driven decision-making systems to modify vehicle speed in response to road conditions, traffic dynamics, and driver preferences. The system operates by persistently tracking speed and external factors, subsequently adjusting the power delivered to the motor drive as needed. A PID (Proportional-Integral-Derivative) controller is typically employed to facilitate smooth acceleration and deceleration, while AI and fuzzy logic algorithms contribute to enhanced adaptive control. Additionally, regenerative braking is incorporated to boost energy efficiency by transforming kinetic energy back into electrical energy. In the context of autonomous or semi-autonomous vehicles, this system can autonomously manage speed, thereby minimizing human error and optimizing battery usage in electric vehicles.

433 MHz Transmitter and Receiver

An Automatic Vehicle Speed Control System (AVSCS) utilizing a 433 MHz RF transmitter and receiver represents a wireless communication technology aimed at remotely managing vehicle speed. This system is particularly advantageous for applications such as automated traffic management, enforcement of speed limits, and collision prevention within intelligent transportation networks. By merging RF communication with a motor drive, the system facilitates real-time speed modifications in response to external inputs from traffic control units, road sensors, or automated checkpoints. The 433 MHz RF transmitter transmits control signals to the vehicle's RF receiver, which is linked to the motor drive system. Upon entering designated areas (such as school zones, highways, or regions prone to accidents), the receiver identifies signals from roadside transmitters and automatically modifies the vehicle's speed in accordance with established limits. Subsequently, the motor drive adjusts the speed of the electric motor based on the received signals, ensuring seamless acceleration and deceleration. This wireless methodology removes the necessity for manual control, thereby enhancing the efficiency and reliability of speed regulation.

Block Diagram

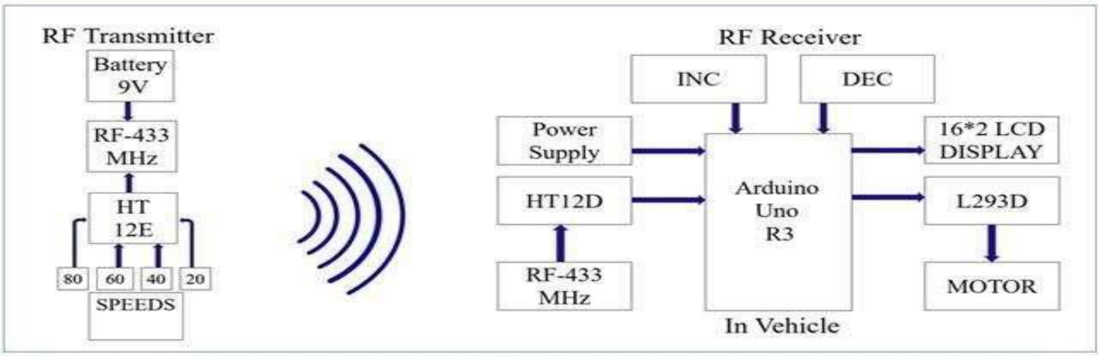

Fig. Block Diagram for Automatic Vehicle Speed Control System

Flow Chart

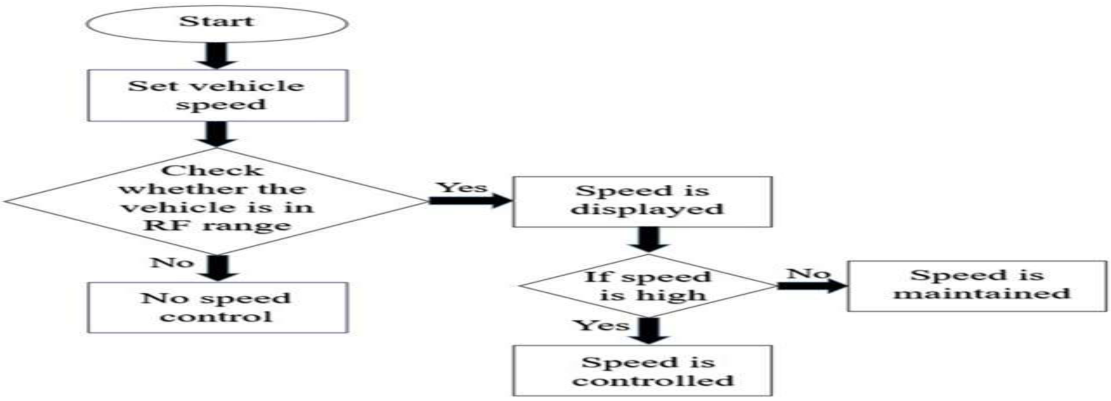

Fig. Flow Chart for Working of Automatic Vehicle Control System

Conclusion

The deployment of an Automatic Vehicle Speed Control System (AVSCS) utilizing a 433 MHz RF transmitter and receiver presents a significant advancement in promoting road safety, optimizing traffic management, and improving energy efficiency in contemporary vehicles. This system leverages wireless communication to facilitate remote speed control, ensuring that vehicles adhere to established speed limits in specific areas, including school zones, highways, and locations prone to accidents. By integrating an RF receiver with a motor drive system, the technology allows for instantaneous speed modifications, thereby reducing the necessity for manual adjustments and lessening the likelihood of human error. This innovation is especially advantageous for both autonomous and semi-autonomous vehicles, where automated systems are essential for enhancing driving efficiency and safety.

The incorporation of PID controllers or AI-driven algorithms guarantees seamless speed transitions, which helps to avoid abrupt changes in acceleration or deceleration, thus improving passenger comfort.

Furthermore, the system aids in energy conservation for electric vehicles by optimizing power consumption in response to varying traffic and environmental conditions.

References

[1] Himesh Gupta and Aditya Pundir presented the "RF Module Based Speed Check and Seat Belt Detection System" published in Second International Conference on Computational Intelligence & Communication Technology IEEE2016.

[2] Aamir Sarwar Jahan, and Imdadul Hoq, presented the "GPS Enabled Speed Control Embedded System Speed Limiting Device with Display and Engine Control Interface" published in 2013.

[3] Ankita Mishra, Jyoti Solanki "Design of RF based speed control system for vehicles," International Journal of Advanced Research in Computer and Communication Engineering, Vol. 1, No 8, 2012.

[4] Christoph Kandler and Tim Koenings presented the "Stability Investigation of an Idle Speed Control Loop for a Hybrid Electric Vehicle". This article has been accepted for inclusion in a future issue of this journal. Content is final as presented, with the exception of pagination. IEEE2015.

[5] Vinod Rao, Saketh Kuma, "Smart Zone Based Vehicle Speed Control Using RF and Obstacle Detection and Accident Prevention," International Journal of Emerging Technology and Advanced Engineering, Vol.4, No.3, 2014.

[6] Gummarekula Sattibabu, Satyanarayan, "Automatic Vehicle Speed Control with Wireless In-Vehicle Road Sign Delivery System Using ARM 7," International Journal of Technology Enhancements and Emerging Engineering Research, Vol 2, No. 8, 2014.

[7] Deepa B Chavan, Abdul Rahim Makandar, "Automatic Vehicle Speed Reduction System Using Rf Technology," International Journal of Engineering Research and Applications, Vol.4, No.4, 2014.

[8] [4]. Martin Treiber and Arne Kesting2 presented the "Automatic and efficient driving strategies. While approaching a traffic light" published in 17th International Conference on Intelligent Transportation Systems (ITSC) IEEE2014.

[9] Jyothi Kameswari, Satwik, "A Design Model for Automatic Vehicle Speed Controller," International Journal of Computer Applications, Vol.35, No.9, 2011.

[10] Santhana Krishnan, Mohanraj, Mohana Deepak, Vinoth Kumar, Prabu, "RF Based Automatic Speed Limiter for Vehicles", International Journal of Research and Scientific Innovation (IJRSI) | Volume V, Issue IV, April 2018 | ISSN 2321–2705.

[11] Vijay Deep Bhatt, Sachin Singh Khati, Diwesh Pandey, Hem Chandra Pant, "Wireless traffic system with speed control" 2nd International Conference on Computer and Automation Engineering (ICCAE), 2010.

[12] V Kranthi Sai Reddy, V Sai Jahnavi, Prathima Sheela, "Intelligent Smart Zone Based Vehicle Speed Control", International Journal of Research in Electronics and Computer Engineering IJRECE Vol. 6 Issue 4 (Oct- Dec 2018).

[13] Md. EftekharAlam, Naznin Nahar Nipa, Kaniz Fatima, Mohammed Abdul Kader, "An efficient model to limit the vehicle speed and horn sound in sensitive public zone with encrypted wireless communication." Int. Conf. on Innovations in Science, Engineering and Technology (ICISET), 27-28 October 2018.

[14] Martin Treiber and Arne Kesting2 presented the "Automatic and efficient driving strategies. While approaching a traffic light" published in 17th International Conference on Intelligent Transportation Systems (ITSC) IEEE2014.

[15] You-Ren Chen, Keng-Pin Chen, and Pao-Ann Hsiung presented the "Traffic Light Optimization and Control System" published in 19th International Conference on Intelligent Transportation System (ITSC) IEEE2016.