iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** III **Month of publication:** March 2025

DOI: https://doi.org/10.22214/ijraset.2025.67776

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue III Mar 2025- Available at www.ijraset.com

Automatic Vehicle Speed Control System

Kanika Wason[1], Vineet Sarda[2], Ashna Saeed[3], Adith Rajeev[4], Prajwal[5], Dr.Suma[6]
Jain (Deemed-to-be) University, India

Abstract: ***The advancement of automotive technology has led to significantdevelopmentsinvehiclesafetyandcontrolsystems. Among these innovations is the *Automatic Vehicle Speed Control System*, which aims to assist drivers in maintaining optimal speed based on real-time road conditions, traffic patterns,andsafetyregulations.Thispaperexploresthedesign, functionality, and implications of automatic vehicle speed control systems, focusing on their role in reducing road accidents, improving fuel efficiency, and complying with trafficregulations.Thesystem'sarchitecture,components,and algorithms will be reviewed, alongside a discussion on challenges and future advancements.***

Keywords:
AutomaticVehicleSpeedControlSystem(AVSCS) Road Safety
Traffic Flow FuelEfficiency Cruise Control
IntelligentSpeedAdaptation(ISA) Sensors
GlobalPositioningSystem(GPS) LIDAR
ElectronicControlUnits(ECUs)
Vehicle-to-Vehicle (V2V) Communication Vehicle-to-Infrastructure (V2I) Communication Real-TimeAdjustments
ControlAlgorithm
DataCollection&Processing Predictive Models
Actuators
SafetyRegulations
CompliancewithSpeedLimits Sensor Reliability
System Latency EthicalConcerns
AutonomousVehicles
MachineLearningIntegration Autonomous Speed Control Challenges and Limitations Future Directions
SmartCities
TrafficManagement
EnvironmentalImpact(CO2Emissions)

I. INTRODUCTION

A. *Background*

As the number of vehicles on the road increases, maintaining safespeedsiscriticalforminimizingaccidents,enhancingroad safety,and improving traffic flow. Manual speedcontroloften leads to variability in response times, speeding violations, and human errors, which contribute to road accidents. With the integration of electronics, sensors, and intelligent control algorithms, the *Automatic Vehicle Speed Control System* (AVSCS) offers a solution by automating the speed regulation process.

B. *Objectivesof the Study*

Thisresearchaimsto:

1) Understand the structure and components of automatic vehicle speed control systems.
2) Explorethemethodologiesemployedinthesesystemstoregulate vehicle speed.
3) AssesstheadvantagesandlimitationsofimplementingAVSCS.
4) Investigatetheimpactofthesesystemsonroadsafety,traffic management, and fuel efficiency.

II. LITERATURE REVIEW

A. *Overview of Speed Control Systems*

Vehicle speed control has evolved from manual systems to advanced driver assistance systems (ADAS). Earlier approaches, such as cruise control, allowed drivers to set a constant speed, while newer systems use sophisticated sensors and algorithms to dynamically adjust speed.

©IJRASET: All Rights are Reserved

Thesesystemsare key in maintaining a safe distance between vehicles, adhering to speed limits, and avoiding collisions.

B. Technologies In Use

AVSCSintegratesmultipletechnologies:

1) Sensors:

- Measure the distance and speed of objects in front of the vehicle, enabling dynamic speed adjustment.

2) GlobalPositioningSystem (GPS):

- Assists in identifying speed zones and determining optimal speeds based on location data.

3) CamerasandLIDAR Systems:

- Detect roadsigns, pedestrians,and vehicles,feeding real- time data to the control system for safe navigation.

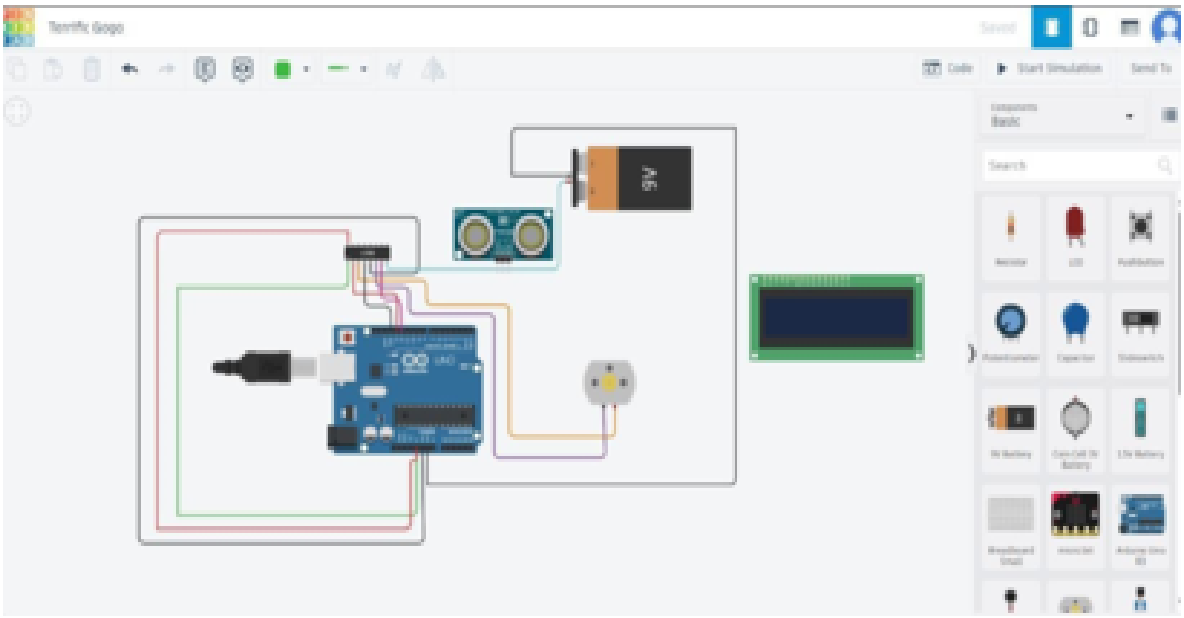
4) ElectronicControlUnits(ECUs):

- Actasthebrainofthesystem,analyzingsensorinputsand adjusting throttle and braking to control speed.

C. IntelligentSpeedAdaptation (ISA)

AsubsetofAVSCS,*IntelligentSpeedAdaptation*(ISA),uses GPS data and onboard cameras to ensure that vehicles comply with speed limits. ISA systems can be either advisory, providingwarnings,orinterveningdirectlytopreventspeeding violations by reducing the throttle or applying brakes.

D. System Design and Architecture



Components of Automatic Vehicle Speed Control Systems

The core components of AVSCS include:

1) Sensors: Radar,LIDAR,andcamerastogatherdataaboutthe vehicle's environment.

2) Controller: AnECUthatprocessessensordataandcalculatestherequired actions.

3) Actuators: Mechanisms that control the throttle and braking systems to adjust speed.

4) CommunicationModules: Enable data exchange between the vehicle, external infrastructure, and other vehicles for collaborative decision-making(e.g.,Vehicle-to-Infrastructure(V2I)and Vehicle-to-Vehicle (V2V) communication).

E. Algorithmic Approach

The control algorithm inAVSCS typically follows a feedback loop,wheresensordataiscontinuouslymonitored,andvehicle speedisadjustedinrealtime.Keystagesinthecontrolprocess include:

1) *Data Collection:* Sensors gather information about the environment, speed limits, and surrounding vehicles.
2) *DataProcessing:* The ECU processes sensor data using predictive models and machine learning algorithms to anticipate road and traffic conditions.
3) *ControlDecision:* Basedontheprocesseddata,thesystemdecideswhether to accelerate, decelerate, or maintain current speed.
4) *Actuation:* The vehicle's throttle or braking system is adjusted accordingly.

F. Advantages of Automatic Vehicle Speed Control Systems

1) Enhanced RoadSafety

By maintaining a safe speed and distance from other vehicles, AVSCS significantly reduces the risk of accidents caused by human error, speeding, and delayed reactions.

2) ImprovedTrafficManagement

Through real-time adjustments, AVSCS helps maintain smoother traffic flow, reduce congestion, and prevent bottlenecks. V2V communication allows vehicles to coordinatemovements,improvingoverallroadefficiency.

3) FuelEfficiency

Optimal speed control minimizes unnecessary acceleration and braking, leading to more efficient fuel consumption. This reduces CO2 emissions and contributes to more environmentally friendly driving.

4) Compliance withSpeed Regulations

AVSCS ensures that vehicles comply with speed limits, reducing the likelihood of fines and legal violations. Intelligent systems also adapt to changing speed limits in work zones or other dynamic environments.

III. CHALLENGES AND LIMITATIONS

A. Technical Challenges

Sensor Reliability: Sensors may malfunction in adverse weather conditions such as rain, fog, or snow, leading to inaccurate data.
System Latency: Real-time decision-making requires high processing power, and delays in response can lead to unsafe driving situations.
Integration with Legacy Systems: Retrofitting older vehicles withAVSCS technology can be expensive and complex.

B. Ethical and Legal Concerns

TheautomatednatureofAVSCSraisesconcernsaboutliability intheeventofaccidents.Thedivisionofresponsibilitybetween drivers and automated systems must be clearly defined. There are also concerns regarding privacy, as these systems often collectandtransmitdataaboutthevehicleanditssurroundings.

C. Future Directions Autonomous Vehicles

The development of fully autonomous vehicles (self-driving cars) is the next frontier forAVSCS. Integrating speed control systems with complete automation can remove the need for human drivers, reducing the likelihood of human error and increasing overall safety.

D. Enhanced Communication Systems

ImprovementsinV2VandV2Icommunicationcanenhancethe responsiveness and adaptability of AVSCS, enabling more accurate real-time decisions. With the growth of smart cities, infrastructure that communicates directly with vehicles will make speed regulation more efficient and precise.

E. Machine Learning Integration

Machine learning algorithms can makeAVSCS more adaptive by learning from past driving patterns and conditions. Predictive modelling can anticipate road conditions more accurately and allow for more intelligent decision-making processes.

IV. CONCLUSION

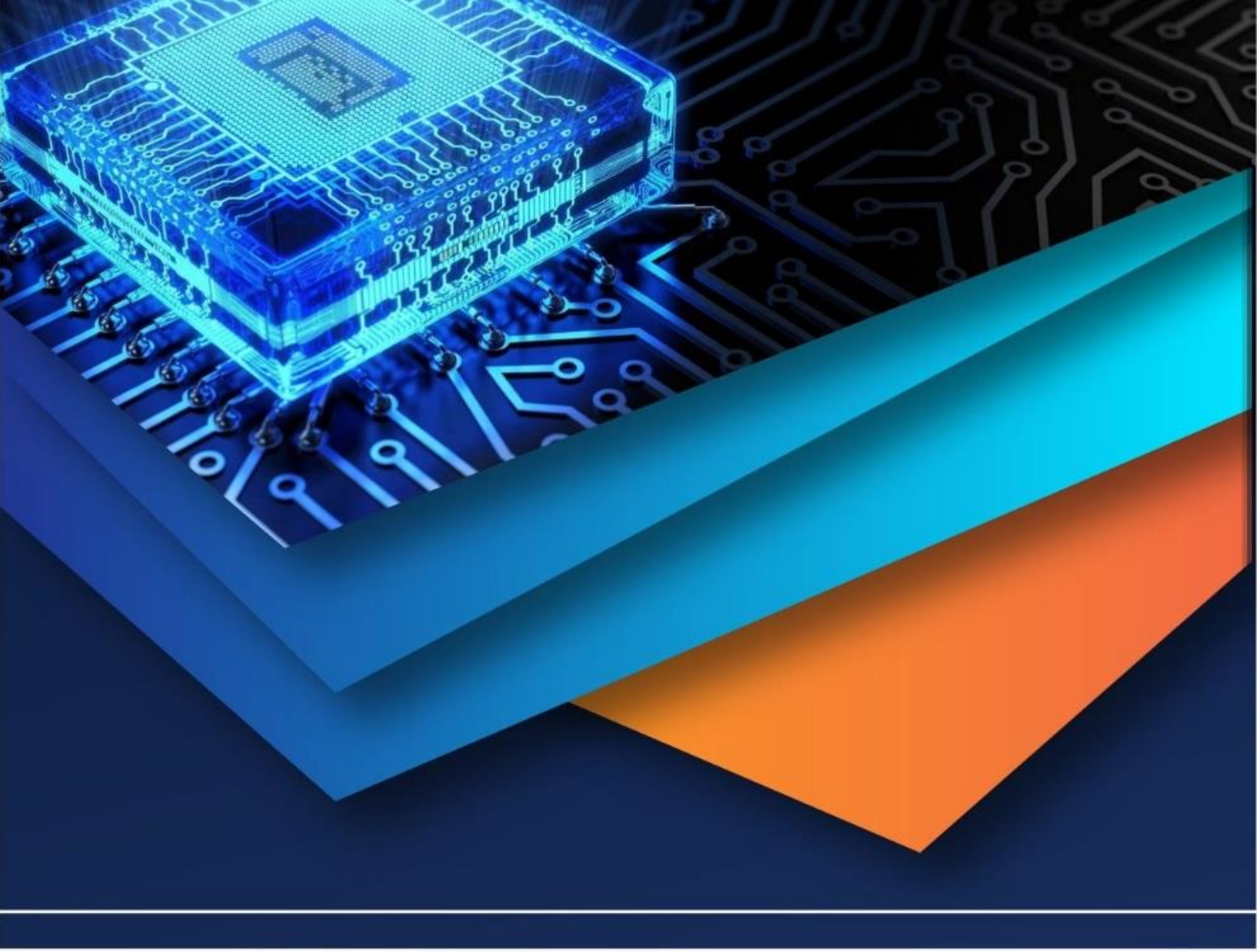
The *Automatic Vehicle Speed Control System* represents a significantleapforwardinautomotivesafetyandefficiency.By automating the process of speed control, AVSCS minimizes human error, enhances road safety, and contributes to better traffic management. While there are challenges in implementation, particularly regarding sensor reliability and ethical concerns, advancements in technology will continue to refinethesesystems.Astheautomotiveindustrymovestoward fully autonomous vehicles, the role ofAVSCS will be integral in shaping the future of transportation.

REFERENCES

[1] A.K.Dwivedi,"VehicleSpeedControlSystemUsingRadar andGPS,"*InternationalJournalofAutomotiveEngineering*, vol. 15, pp. 123-130, 2020.
[2] D. S. Kumar, "Design and Implementation of Intelligent Speed Adaptation Systems," *Journal of Intelligent Transportation Systems*, vol. 25, pp. 105-112, 2022.
[3] Y. T. Lin, "Autonomous Vehicle Speed Regulation and Traffic Management," *IEEE Transactions on Vehicular Technology*, vol. 66, no. 8, pp. 1239-1249, 2021.
[4] B. Smith, "Legal and Ethical Challenges in Autonomous Speed Control," *Transportation Ethics Review*, vol. 14, no. 2, pp. 23-35, 2021.
[5] L.Yu and R.Wang, "Researches on adaptive cruise control system:Astateoftheartreview",ProceedingsoftheInstitution of Mechanical Engineers Part D: Journal of Automobile Engineering, vol. 236, no. 2–3, pp. 211-240, 2020.
[6] P.S.KimandS.Y.Kim,"ADCmotorspeedcontrolsystem with disturbance rejection and noise reduction", IAENG International Journalof Applied Mathematics, vol.52,no.4, pp.918-927,2022.

This paper out lines the essentials of automatic vehicle speed control systems, delvingintoits components, advantages, and challenges while offering insight in to its future potential within the automotive industry.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)