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Smart Drive Safe Zone System Using Rfid Techonology for Vehicle Speed and Traffic Control

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***Abstract*—The system works by installing RFID tags at specific critical zones, each embedded with zone-related information. Vehicles are equipped with RFID readers and a microcontroller-based driver circuit. As a vehicle approaches a tagged zone, the reader detects the RFID signal and the microcontroller interprets the zone type. Based on this identification, the system either slows down the vehicle, stops it, or triggers an alert.**

In school and wildlife zones, the system automatically reduces vehicle speed, ensuring safety for children and animals. In wildlife zones, if animal movement is detected, a buzzer alert is activated to warn the driver. In traffic zones, the RFID tag is activated only when the signal is red upon detection, the vehicle is automatically stopped, preventing accidental signal violations.

***Index Terms*—Arduino, Safety, IOT, Embedded System**

I. INTRODUCTION

The project presented here is aimed at automatically sensing the areas / zones like “School Zone”, “Traffic signal zone” or “Wild area Zone”. We are developing a system which will sense such traffic signs automatically and accordingly inform the driver and also assist him in controlling the vehicle. As the design of this system goes, the project proposed here consists of a set of units: Zone / Area Unit and Vehicle Unit. In convention, these special zones or areas are indicated at the roadside on a pillar or road sign poles. As an example, near school zone, the sign board displays “School Zone Ahead, Drive Slowly”, or “Curve Zone Area-Do not go fast”.

Figure 1(system explanation)

Drivers go at very high speed as usual near school zone, or operate the harsh driving causing accident in the curve zone. As a result, making the whole concept of displaying warning sign and messages on the roadside boards does not help. To provide a better alternative, one can develop a system which will automatically sense such traffic signs automatically and accordingly inform the drives and also assist him in controlling the vehicle voluntarily or forcibly. All in all, resulting in a very effective and fail proof system to provide traffic regulation, safety and convenience of the people. As the whole project not just limited for these few functions, this project can be made mandatory. That way one can provide a more reliable security device and streamline traffic flow. Few additional features which can be integrated with this system are, “Anti-collision”, “Auto breaking with curve detection” and “Auto Speed limit Sensor”.

II. PROBLEM STATEMENT

Uncontrolled vehicle speed in sensitive zones such as school areas, wildlife crossings, and traffic signals poses significant risks to pedestrians, animals, and other vehicles. Traditional methods rely heavily on signboards or traffic lights, which are often ignored or unnoticed by drivers, leading to accidents and unsafe driving behavior. There is a critical need for an automated system that can dynamically detect critical zones and regulate vehicle speed or operation without depending solely on human intervention.

III. OBJECTIVES

To develop an intelligent zone-based vehicle control system using RFID technology that automatically identifies sensitive zones and adjusts the vehicle's speed or operation accordingly, ensuring safety in high-risk areas such as schools, wildlife zones, and traffic intersections.

IV. LITERATURE BACKGROUND

A. Vehicle speed control and security system

Toufiq Aziz, Tarek Mahmud Faisal and Heung-Gyoon Ryu Due to the lack of a security system on the road, the theft of the vehicle is a common issue in society. The security system of the vehicle becomes one of the main issues for every vehicle user. This paper introduces a multi-layer security system which is including a theft alerting feature, owner speed-limiting system, and emergency monitoring vehicle feature. If the vehicle is robbed, a location information can be delivered to the owner from anywhere in the world. The application of Raspberry Pi in our system gives a capable and strong security to the vehicle.

B. Predictive speed control for automated vehicles in urban area using speed zones

Peter Szilassy, Balazs Nemeth and Peter Gaspar. The paper proposes a predictive control for speed trajectory design and tracking in urban area. In the method the urban area is divided into speed zones, in which the reference speed for the automated vehicle is determined by the type of the road. In the paper a Model Predictive Control (MPC) based strategy is provided, which contains various constraints, e.g. on keeping safe distance from the surrounding vehicles or on the achievable acceleration of the vehicle. The result of the optimization is an acceleration profile for the automated vehicle, with which the safe distance from the vehicles in the urban area can be guaranteed. The effectiveness of the design method is illustrated through VISSIM simulation examples.

C. Development of a connected vehicle dynamic free-way variable speed controller

Hossam M. Abdelghaffar, Maha elouni, Youssef bichiou. Traffic congestion is a major challenge in urban areas, and is associated with longer travel times, increased vehicle emissions, and numerous vehicle crashes. Creating an efficient mobility system is difficult, given that each driver is usually trying to optimize their individual trip within the network without accounting for other road users. However, new technologies in modern vehicles, especially connected vehicle technologies, make it increasingly possible to nd solutions to network efficiency problems. Connected technologies allow data sharing between vehicles, allowing for greater system optimization. This work takes advantage of connectivity to develop a global framework to increase transportation network efficiency and address the aforementioned challenges. To enhance mobility, this paper presents a dynamic freeway speed controller based on the sliding mode theory, which uses the fundamental equations governing traffic dynamics in combination with variable speed limit control in order to provide advisory speeds for connected vehicles. Simulation results on a downtown Los Angeles network show sign can't reductions in trip times and delays both on freeways (where the control was activated) and network-wide (i.e., freeways and other roadways). Specially, the results for the entire network showed a 12.17% reduction in travel time and a 20.67% reduction in total delay. These results had the secondary effect of reducing fuel consumption and therefore CO_2 emissions by 2.6% and 3.3%, respectively.

V. PROPOSED METHODOLOGY

The proposed setup consists of RFID transmitters placed in specific zones (school, wildlife, and traffic sections) and RFID readers installed on vehicles. Each zone's transmitter continuously or conditionally emits a signal:

School Zone / Wildlife Zone: Emits RFID signal continuously. Upon receiving it, the vehicle's driver circuit limits speed, and in wildlife zones, an animal detection alert buzzer is also triggered.

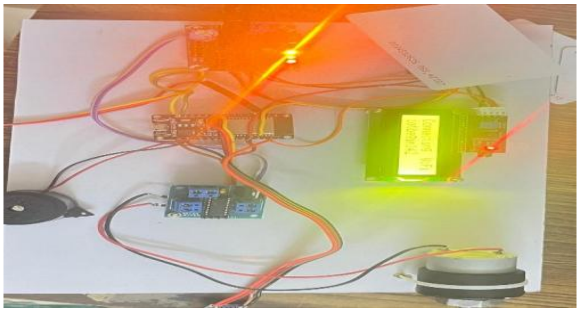

Figure 2 (working model)

Traffic Signal Zone: The transmitter sends a signal only when the signal turns RED. On detection, the vehicle is automatically halted.
The RFID reader on the vehicle detects zone entry, the microcontroller processes the signal, and actuates the driver circuit to control speed or stop the vehicle. This ensures automatic speed regulation or vehicle shutdown based on the environment, improving safety compliance with minimal driver intervention.

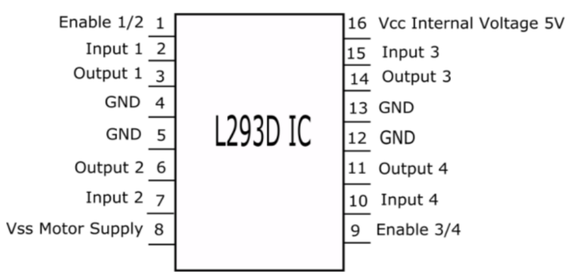

Figure 3 (Connection Map)

Table I. speed control based on zone

SPEED	ZONE	DISTANCE
60 km/h	School Zone	1km
40 km/h	Wild Life Zone	3km
0 km/h	Red Signal	100m

VI. RESULTS AND DISCUSSION

A. Cycle Time Reduction
Cycle time was reduced from 107 s to 79 s a reduction of 28 seconds (26.17%). In mass production, this reduction translates to substantial cumulative output gains. Over a monitored 30-hour window, output increased from 780 to 1,170 components, a net gain of 390 parts.

B. School Zone Speed Control
The vehicle speed is automatically reduced from 100 to 80 when entering a school zone, ensuring safety for pedestrians and students.

C. Wildlife Zone Speed Control
In the wildlife zone, the system reduces speed from 100 to 60 to prevent harm to animals and ensure controlled driving.

D. Traffic Signal Control (Red Signal)
At a traffic signal (red), the vehicle speed is reduced to 0, bringing the vehicle to a complete stop automatically.

E. Speed Restoration After Zone Exit
The system successfully restores the vehicle to normal speed (100) after exiting each zone.

F. Overall System Performance
The system demonstrates automatic, reliable, and real-time speed control based on RFID zone detection without requiring driver intervention.

VII. LIMITATIONS

The proposed RFID-based Smart Drive Safe Zone System has certain limitations. The RFID reader has a limited detection range, which requires precise placement of tags for proper operation. The system also depends on the installation and maintenance of RFID tags in all designated zones, and any damage or absence of tags can affect performance. Additionally, environmental factors such as interference from metal objects or weather conditions may reduce detection accuracy. There is also a possibility of system tampering within the vehicle, which can disable automatic speed control. Furthermore, large-scale implementation requires proper infrastructure, increasing initial setup cost.

VIII. FUTURE SCOPE

In future implementations, the system can be enhanced by integrating GPS and IoT technology for more precise zone identification and remote monitoring.

Machine learning algorithms may be added to predict driver behavior and adapt control actions accordingly. The setup can also be expanded with camera-based surveillance and cloud connectivity for centralized traffic management. Furthermore, integration with smart city infrastructure and electric vehicle ecosystems can make the system more versatile, supporting large-scale adoption for safer and smarter transportation networks.

IX. CONCLUSION

The proposed RFID-based system provides an intelligent, automated approach to regulate vehicle behavior in critical zones. By integrating RFID technology with microcontroller-based decision-making, it ensures automatic speed limitation in sensitive areas and vehicle halting at red signals. This not only enhances safety for pedestrians, school children, and wildlife but also reduces traffic violations by minimizing human dependency. The system is low-cost, scalable, and reliable, making it suitable for smart transportation infrastructure in urban as well as rural environments.

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REFERENCES

[1] S. Calvert, H. Mahmassani, J.-N. Meier, P. Varaiya, S. Hamdar, D. Chen, X. Li, A. Talebpour, and S. P. Mattingly, "Traffic flow of connected and automated vehicles: Challenges and opportunities," in *Road Vehicle Automation 4*, Lecture Notes in Mobility. Springer, 2018, pp. 235–245.

[2] P. Gáspár and B. Németh, *Predictive cruise control for road vehicles using road and traffic information*. Berlin, Germany: Springer, 2019.

[3] B. Németh, P. Gáspár, D. Szőcs, and A. Mihály, "Design of the optimal motions of autonomous vehicles in intersections through neural networks," *IFAC-PapersOnLine*, vol. 51, no. 9, pp. 19–24, 2018.

[4] N. Mattern and G. Wanielik, "Camera-based vehicle localization at intersections using detailed digital maps," in *Proc. IEEE/ION Position, Location and Navigation Symp.*, May 2010, pp. 1100–1107.

[5] T. Quack, F. Heßeler, and D. Abel, "Infrastructure-based tracking of road users in urban intersections for partially available, variable-delay sensor data," in *Proc. 26th Mediterranean Conf. Control and Automation (MED)*, Jun. 2018, pp. 1–7.

[6] Y. Gao, A. Gray, H. E. Tseng, and F. Borrelli, "A tube-based robust nonlinear predictive control approach to semiautonomous ground vehicles," *Vehicle System Dynamics*, vol. 52, no. 6, pp. 802–823, 2014.

[7] C. E. Beal and J. C. Gerdes, "Model predictive control for vehicle stabilization at the limits of handling," *IEEE Trans. Control Syst. Technol.*, vol. 21, no. 4, pp. 1258–1269, 2013.

[8] J. Y. Wong, *Theory of ground vehicles*. Hoboken, NJ, USA: John Wiley & Sons, 2008.

[9] N. A. Spielberg, M. Brown, N. R. Kapania, J. C. Kegelman, and J. C. Gerdes, "Neural network vehicle models for high-performance automated driving," *Science Robotics*, vol. 4, no. 28, 2019. [Online]. Available: http://robotics.sciencemag.org/content/4/28/eaaw1975

[10] P. Arora, D. Corbin, and S. N. Brennan, "Variable-sensitivity Road departure warning system based on static, mapped, near-road threats," in *Proc. IEEE Intelligent Vehicles Symp. (IV)*, 2016, pp. 1217–1223.