Grenze International Journal of Engineering and Technology, Jan Issue

Automatic Vehicle Speed Reduction System

Cheshta[1], Anand Garg[2] and Nishant Gupta[3]
[1-3]Department of Engineering & Computer Science, Sharda University of Engineering & Technology, Greater Noida, UP
Email: cheshtar2330@gmail.com, anandgarg7417@gmail.com, nishant.gupta@sharda.ac.in

***Abstract*— This research project aims to automatically control vehicle speed in zones with speed limits, such as those designated for educational and medical purposes, in addition to occurrences of U-turns. In select regions, transmitters operating at a frequency of 433 MHz are strategically positioned.**
These transmitters emit an uninterrupted radio frequency (RF) signal. Once a vehicle encounters this radiation, its internal receiver becomes operational. As a vehicle traverses into a designated area, it receives a signal that governs its velocity. Consequently, the vehicle's speed is reduced to a predetermined level and remains at that value until it departs the area. Subsequently, the vehicle may resume acceleration autonomously.

***Index Terms*— RFID, RF, IoT, Sensors, Automation and microcontroller, Speed control, Over Speeding.**

I. Introduction

The ensuing research project will be focused on the regulation of velocity in an automobile through the utilization of radio frequency (RF) transmitter and receiver, along with the assimilation of obstacle detection and accident prevention mechanisms facilitated by an alcohol sensor. The transmitter will be installed in designated locations where the speed limit of the vehicle is to be assessed, such as hospitals, schools, highways, government official buildings, and U-turns.[1]The transmission of signals by the transmitter will necessitate the installation of a receiver within the vehicle for the purpose of controlling the speed. As soon as the vehicle enters the transmitter zone, its velocity will be reduced to a predetermined threshold and maintained at a constant level until it exits the transmitter zone. Driving is an obligatory activity for most individuals who employ their cars to commute from one location to another. The number of vehicles on the roads is steadily escalating, thereby intensifying the risk of accidents. Nowadays, accidents are increasingly prevalent and unpredictable. [1] They can transpire at any time and in any place, resulting in extensive damage, grave injuries, and fatalities.
The main objectives of the following projects are.

- Making the roads more secure for every individual across the globe.
- To regulate the careless and dangerous behavior exhibited by vehicle operators. For controlling the irresponsible and reckless driving of the vehicle drivers.
- Controlling the velocity of automobiles within specifically designated areas wherein the velocity restriction of the vehicle is to be determined by the governing body.

II. Literature Review

When Amulya A. M. discussed the subject of intelligent vehicle speed controllers, their emphasis was on the

Grenze ID: 01.GIJET.10.1.224

automated prevention of vehicle collisions caused by exceeding the prescribed speed limit in restricted areas. To achieve this objective, the utilization of RF transmitter and receiver modules as well as embedded systems was considered appropriate. In areas where speed is restricted, the driver is required to manually reduce the vehicle's speed upon entering the zone. However, if the driver fails to do so, the electronic controller will intervene and regulate the vehicle's speed reduction. This will be achieved by receiving a signal from the transmitter located within the restricted area. The Arduino microcontroller will employ the received signal for the purpose of examining and transmitting a signal to the motor to control its speed. [2] In this situation, the confined area is predominantly determined through the utilization of an RF transmitter and receiver.

In this examination, Vaishal B. Niranjane delved into the subject matter of automated vehicle velocity regulating systems. They exemplified the functionality of their system within three clearly defined areas, wherein Zigbee technology prompts a subsequent drop in speed. These areas are specifically identified as the speed limit zone, the normal zone, and the quiet zone. By employing the microcontroller 8051 to invert the motor's rotational trajectory, the velocity is duly diminished. Upon approaching a predetermined vicinity such as a medical facility, the Zigbee transmitter is strategically positioned, thereby allowing the Zigbee receiver of the vehicle to acquire the corresponding signal. The velocity of the vehicle is juxtaposed with the designated velocity of the area. If the vehicle is within the higher velocity area, [3] the microcontroller decreases the vehicle's velocity; conversely, if it is situated within the noiseless region, the microcontroller deactivates the vehicle's horn.

[4] Amarnarayan has conducted a research study on the implementation of an automatic overspeed control system for vehicles. The primary objective of the authors is to effectively regulate the speed of vehicles to mitigate the occurrence of accidents near medical facilities, along curved roadways, and within areas characterized by significant elevation changes resulting from excessive speed. This can potentially be achieved through the utilization of the arm-7 microcontroller and ZigBee technologies. In the proposed system, the arm-7 microcontroller installed in the vehicle is responsible for detecting signals transmitted by the module and subsequently determining if the driver has been reducing their speed for a specific duration of time. The vehicle exhibits deceleration when the timer reaches its limit, because of the microcontroller dispatching a signal to reduce the motor's speed, all without any involvement from the driver.

Utilizing the Arm-7 microcontroller, the integration of wireless in-car road sign delivery system with speed control is achieved. The primary objective is to establish an electronic display controller for vehicles. By means of embedded technology, the implementation of speed control and zone monitoring becomes feasible. The dashboard exhibits comprehensive information pertaining to each zone. To accomplish this, the electronic display and control unit (Arm-7) as well as the zone status transmitting unit (ZSU-7) are employed. Within this framework, the controller processes the signals and promptly notifies the driver by presenting the sensitive zone visually and emitting a warning sound if detected by the car's receiver. [5] The presence of a timer enables the driver to decrease the velocity of the vehicle. Once the designated period has passed, the automobile automatically adapts to the predetermined velocity.

III. System Methdology

Both the radio frequency transmitter as well as the receiver are powered by either batteries or an external power source. They have the capability to operate continuously for several decades. These devices are equipped with a portable antenna that can be used externally in place of the internal antenna, which has a limited range. [6] The RF module utilizes a scanning antenna type, resulting in a limited signal range as it is the only antenna emitting the signal. When a contact is established between the RF receiver and the transmitter devices, the data transmitted by the transmitter is then transmitted to the receiver module located within the vehicle.

Transmitter Modules: RF transmitter modules are small devices capable of generating electromagnetic waves within the radio frequency spectrum. Their integration with microcontrollers simplifies the transmission of data. However, external factors such as noise, harmonics, and superfluous components within the surrounding environment can negatively impact the module's power output. To rectify this issue and enhance the performance of the transmitter, specific measures need to be implemented.

Receiver Modules: After the reception of the modulated RF signal, the RF Receiver module undergoes the process of demodulation. RF receiver modules can be classified into two categories, namely super heterodyne receivers, and super-regenerative receivers. Super-regenerative modules, which are known for their economic and energy-efficient nature, employ a series of amplifiers to extract modulated data from a carrier wave. However, these modules often exhibit errors due to their susceptibility to fluctuations in power source voltage and temperature. On the other hand, super heterodyne receivers outperform super-regenerative receivers by offering enhanced

accuracy and stability across a wider range of voltage and temperature variations. To achieve this heightened stability, fixed crystal fabrication is adopted, albeit at a slightly higher expense.

IV. Design Method And Iplementation

A. Transmitter

The transmitter is positioned on both edges of the speed-limiting zones, as seen in the diagram below. [7] This unit merely provides the vehicle speed data in that area, which can be adjusted to suit individual requirements. Information is sent from an RF transmitter to several receivers via the controller.

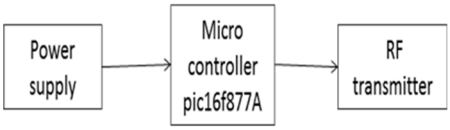


Fig. 4.1 Transmitter block diagram.

B. Receiver

Below is a diagram of the receiver block. The vehicle's speed is managed by the receiver, which receives information from the transmitter and processes it accordingly.[8] The RF receiver, LCD display, GSM modem, and motor make up the receiver modules. The information is displayed on an LCD to the driver of the vehicle.

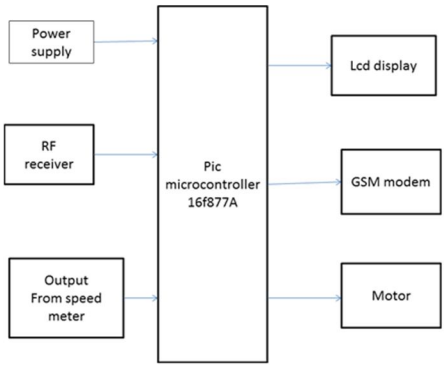


Fig.4.2 Receiver block diagram.

C. RF module

A radio frequency module, also known as an RF module, is a small electronic device that can transmit and/or receive radio signals between two other devices. A transmitter and a receiver are combined in an RF transceiver module. Although full-duplex modules are available, they are usually more expensive due to the additional complexity. The circuit is normally designed for half-duplex operation.

Fig. 4.3 RF Module

D. Arduino UNO

An ATmega328P-based microcontroller board is called the Uno. It contains a 16 MHz quartz crystal, 6 analog inputs, 14 digital input/output pins (six of which can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; all you need to do is power it with a battery or an AC-to-DC adapter or connect it to a computer via a USB cable to get going.

Distinctions from other boards: The FTDI USB-to-serial driver chip is not used by the Uno, setting it apart from all previous boards. As an alternative, it has the Atmega16U2 (or Atmega8U2 up to version R2) configured as a serial-to-USB converter.

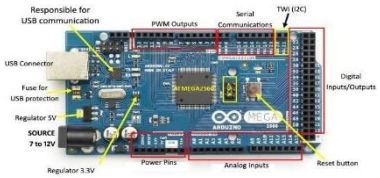


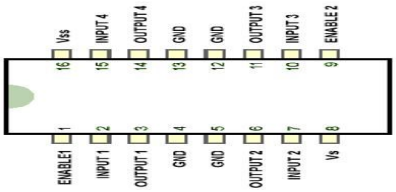
Fig. 4.4 Arduino MEGA 2560

E. Wheel

Four wheels were used in this project. As the system is a Four-Wheel-Drive (FWD) we attached the wheels with four dc motors. The image of the wheels is attached for further convenience.

F. Motor driver

A common example of a motor driver is the L293D integrated circuit, employed to regulate the flow of direct current in either the forward or reverse directions. Irrespective of the desired motion, this integrated circuits 16-pin arrangement enables the concurrent control of two direct current motors.



V. System Working

For the objective of using data transfer to regulate vehicle speed, a number of methods have been used. [9] The user's data set is encoded and sent to the receiver module when the RF transmitter is turned on.
After the data is decoded by the receiver module, it is sent to the Arduino for comparison with the embedded data. [10] The Arduino instructs the motor driver to do nothing, and the DC motor's speed stays the same if its speed falls below the limit zone. The Arduino tells the motor driver to limit speed in accordance with the zone if the speed exceeds the predetermined speed limit, preventing accidents.
The car keeps running at the same speed and doesn't stop operating when it gets into the approved area. On the other hand, there are speed restrictions in place once the car enters a restricted area. In these situations, a notification with the vehicle's maximum allowed speed inside the restricted area is sent by the transmitter module. This signal is then received by the receiver, and the speed information from the speed meter is also sent to the controller. Because the received signal is analog by nature, it must be converted to digital format before being processed. The microcontroller is capable of doing this.

VI. Experimental Analysis & Result

The RF transmitter module is a component of the circuit responsible for transmitting RF signals. We used a package called Virtual Wire in our project, which eliminated the necessity for an encoder. The voltage regulator circuit uses a 12-volt (1A) battery as a backup power source, giving the motor an unregulated 12-volt supply. [10]

The Arduino, motor driver, and receiver module, on the other hand, are all supplied with a controlled 5-volt supply. By using a motor driver, it is possible to interface with the DC motors.

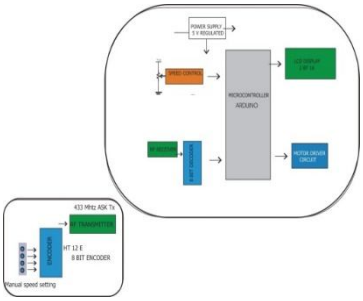


Fig.6.1 block diagram.

VII. Conclusion

This strategy can potentially be implemented in a multitude of contexts where the promotion of traffic safety is deemed necessary, such as in the vicinity of governmental edifices, educational institutions, and medical facilities. The installation of speed breakers is frequently observed in various areas as a means to decrease the speed of vehicles. As time elapses, speed limiters gradually lose their connotation as a safety component and instead become perceived as an obstacle hindering a pleasant driving experience. Enterprises are endeavoring to offer high-quality suspension systems and robust shock absorbers by utilizing state-of-the-art technology. This practice is a Iinfringement upon the rights of other drivers to engage in a secure and orderly commute. The affordable and straightforward design of our model will furnish a comfortable driving experience for all individuals engaging in daily commutes. Additionally, despite several preventive steps being taken by our government to curb the danger of excessive speeding, the problem is still out of control. As a result, we created this model as a deterrent to stop speeding and address one of the main problems with road safety.

Future Scope

In the future, this project may be integrated with other safety features, like automatic vehicle breaking before zebra crossing when the signal is on. Cars won't be able to impede pedestrians' path as they crossroads by doing this. Because cameras won't need to be installed on the signals to stop cars before zebra crossings, it will also be more affordable.

It is also possible to add some more sophisticated features that will allow a car to recognize speed limits on highways and roads from signage placed along the route.

In the current undertaking, a proposal is put forth for the implementation of a disciplinary framework that grants immunity to emergency vehicles, including but not limited to law enforcement automobiles, medical ambulances, and other comparable vehicles, from adhering to the designated velocity restrictions within areas established for the purpose of safeguarding public welfare. [11].

An integrated autonomous system that can autonomously ascertain the top speed limit for any given road or highway and pinpoint its precise location on the available urban cartography can be installed in the car.

References

[1] Vengadesh and K. Sekar, "AUTOMATIC SPEED CONTROL OF VEHICLE IN RESTRICTED AREAS," International Research Journal of Engineering and Technology (IRJET), 2015.

[2] Amulya A M, "Intelligent speed control system," 2018.

[3] V. B. Niranjane, "Automatic Vehicle Speed Control System Using Zigbee Technology," IJEECS, 2017.

[4] Amarnarayan, "Automatic Over Speed Controlling of Vehicle," 2016.

[5] G. Sattibabu, "Automatic Vehicle Speed Control with Wireless In-Vehicle Road Sign Delivery System Using ARM 7".

[6] A. Batra, "Automatic Car Speed Control with Wireless RF Control," 2018.

[7] M. M. M. S. Mahamud and M. S. R. Zishan, "An arduino based accident prevention and identification system for vehicles," in IEEE Region 10 Humanitarian Technology Conference , Dhaka, 2017.

[8] D. R. Dhote, P. R. Lakde, A. S. Pachare, M. A. Meharkure and M. Dongare, "Automatic Speed Control of Vehicle by using RFID Technology," International Journal of Research in Engineering, Science and Managemen, pp. 168--170, 2021.
[9] Munira, F. T. H. a. Akash, M. Hasan, Debnath, Sukanta, Shuvo, Moinuddin, Khan, A. Islam, Saha, Anup, Das and P. Kumar, "Automatic Vehicle Speed Reduction System Using RF Technology \& Accident Prevention system," 2015.
[10] CHANDRIAN, M. BALA, S. MUTHURAJA, ADITYA, E. PRAVEER, PRADEESH and S, "AUTOMATIC VEHICLE SPEED CONTROL USING RF MODULE".
[11] A. Mishra, J. Solanki, H. Bakshi, P. Saxena and P. Paranjpe, "Design of RF based speed control system for Vehicles," International Journal of Advanced Research in Computer and Communication Engineering, 2012.
[12] Chavan, D. B, Makandar, A. Rahim, Khan, F. Hakeem, Inamdar and S. Azimuddin, "Automatic Vehicle Speed Reduction System Using Rf Technology," pp. 13--16, 2014.
[13] Sharma, Sandeep; Kishore, India Sumit; Mishra, Shrey; Girotra, Dhruv; Talwar, Hardik, "AUTOMATIC VEHICLE SPEED REDUCTION & ACCIDENT PREVENTION SYSTEM USING RF TECHNOLOGY," Int. Journal of Engg. Applied Sc. and Technology, pp. 292--295, 2020.