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HIGHWAY CRUISE CONTROL SYSTEM FOR VEHICLES USING LOW-POWER RF TECHNOLOGY AND CAN PROTOCOL

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Abstract— Many individuals perish in frequently occurring incidents today due to reckless driving. Occasionally, it may be impractical to perceive the warnings displayed on signboards by the Highway Department, thereby heightening the risk of accidents. The advancement in processor technology and microcontrollers has enabled the creation of a novel system designed to prevent accidents resulting from drivers' failure to notice traffic signals and other anomalies on the road. As a result, low-power RF technology is employed to alert drivers about specific zones and autonomously regulate speed. The primary objective is to craft an embedded system-based Electronic Display controller tailored for vehicle speed control and zone monitoring, seamlessly fitting into a dashboard to provide vehicle-related information. If adopted by a jurisdiction, this approach could significantly reduce accidents caused by drivers losing control over their vehicles at speed bumps or neglecting traffic signals. This project facilitates speed control in accident-prone areas and safety zones for a predetermined duration. The Zone Status Transmitter Unit, Electronic Display and Control Unit, and the Project constitute distinct components. Upon receiving road sign signals from the zones, the vehicle's Electronic Display Controller Unit prompts the driver to reduce speed, utilizing the CAN Protocol to automatically decrease speed if the driver does not respond promptly.

I-INTRODUCTION

The engine's governor harnesses centrifugal force to regulate the throttle position and speed in response to varying loads. Vision-impaired mechanical engineer and inventor Ralph Teetors conceptualized the modern cruise control, often referred to as a speed stat, in 1948. His inspiration stemmed from frustration with his chauffeur's tendency to alter speed while engaged in conversation.

The development of cruise control was significantly influenced by the 35 mph (56 km/h) speed limit imposed in the US during World War II to curb gasoline consumption and tire wear. Upon reaching the desired speed, a user-controlled device made it challenging to further depress the

accelerator pedal. Ralph Teeter's invention of a dashboard speed selector received a patent in 1950, featuring a driveshaft-connected mechanism and a tool for applying pressure to the gas pedal.

Teeter also incorporated a speed lock feature in the vehicle, ensuring continuous movement until the driver applied the brake pedal or deactivated the device. Certain cruise control systems in vehicles include a speed limiter, preventing acceleration beyond a predetermined maximum, typically disengaged by fully depressing the accelerator pedal. While most systems restrict acceleration by reducing engine speed, they may not intervene with braking on steep descents or prevent the vehicle from exceeding the chosen speed during idle engine conditions.

The surge in accidents, leading to a higher fatality rate, is attributed to the inefficiencies of existing systems—marked by their lack of precision, posing challenges in accident avoidance, and their inadequacies in traffic scenarios. Our system comprises two distinct components: the Zone Status Transmitter Unit, housing an ARDUINO UNO, and a Transceiver, communicating through SPI for serial data transmission; and the transmitter, utilizing the UART protocol for wireless connection to dispatch message bits to the receiver.

A plethora of options with varied price points exist, with some boasting a 500-foot transmission range. RF CMOS technology is commonly employed in constructing RF modules. The focus of the proposed article is leveraging an RF transmitter and receiver module to enforce speed limits for vehicles. The Transmitter conveys the maximum permissible speed restriction for a given route to the receiver, strategically positioned beside a speed signboard on the roadside.

Operating within a range of up to 200m, the Transmitter continuously transmits data regardless of the car's presence. The vehicle system encompasses the receiver system, featuring an LCD, Buzzer, Ultrasonic sensor, and Arduino Uno ATMega328 microprocessor.

II-PROBLEM STATEMENT

The current system, leveraging RFID innovation, is being incorporated into commercial transportation; a notable illustration of an RFID-based framework is the highway toll collection system. The label requiring minimal effort for installation on sign panels has garnered popularity due to this characteristic. The label generates an ID code for recognition by the end user. A manufacturer affixes one label to traffic lights or sign panels as part of the RFID framework, each label having specific codes for various types of data. Another component in the architecture is the incorporation of RFID pre-users within the vehicle.

These pre-users identify and validate the label ID, subsequently influencing and controlling the vehicle's speed based on the received data. An electronic control unit (ECU), specifically a motor control unit, is integrated into the vehicle, overseeing a set of actuators on an internal combustion engine to ensure optimal motor performance.

III-LITERATURE SURVEY

Automatic Vehicle Speed Control System in a Restricted Zone

Cars must ensure safety to diminish the likelihood of collisions in areas with speed restrictions, thereby reducing both the loss of life and property. Recent surveys highlight a significant surge in accidents near hospitals, schools, and other sensitive locations over the past few years, primarily due to drivers' haste in reaching their destinations promptly. Consequently, the imperative to restrict vehicle speed has gained prominence. This study aims to present a practical, manageable, and uncomplicated design for an autonomous vehicle speed control system that must be promptly deployed in schools, colleges, hospitals, and sharp turning zones to curtail accident rates.

Employing the microcontroller-based architecture of the Arduino Uno board, this automatic speed-control system was devised. The Arduino was programmed to embed the recommended speed limit in the transmitter unit, transmitting signals subsequently received by the vehicle's receiver through Zigbee wireless communication technology. Consequently, the vehicle's speed was automatically governed by the input signals from the receiver, facilitated by a speed encoder sensor. The implementation of this technique is anticipated to swiftly reduce accidents, accompanied by a decrease in driver frustration.

RF-Based Speed Control System for Vehicles

People drive at high speeds, leading to frequent accidents and the unfortunate loss of lives due to reckless driving in various settings, including school zones, steep terrain, and highways. To mitigate such incidents, the highway department has strategically placed signboards to caution drivers, prevent these accidents, and enforce speed limits in critical areas. However, there are instances where certain types of signboards may go unnoticed, increasing the risk of accidents.

As a solution, the driver is automatically alerted to specific zones and speed limits through RF technology. The primary goal of this project is to develop an embedded system featuring an RF-based speed control system for automobiles, aimed at regulating speed and monitoring zones. A customizable Smart Display and Control (SDC) unit, designed to seamlessly integrate into a car's dashboard, serves to display essential vehicle information.

The project comprises two distinct components: an ultrasonic sensor, a speed display and control unit, and a transmitter unit for zone status. Upon receiving data from the zones and sensor, the embedded unit in the vehicle promptly notifies the driver to reduce speed in the designated zone. If the driver does not respond promptly, a brief waiting period ensues, during which the SDC unit automatically reduces speed, and the sensor determines the obstruction's distance, thus averting potential vehicle crashes.

Design & Analysis of Vehicle Speed Control Unit Using RF Technology

In the present day, individuals drive at high speeds, leading to frequent accidents that result in the loss of lives and property. To mitigate such incidents and regulate vehicle speed, the primary objective is to employ RF technology in creating an embedded system, specifically a Smart Display controller designed for vehicle speed control and zone monitoring. The Smart Display & Control (SDC) unit, responsible for presenting vehicle information, can be tailor-made to seamlessly integrate into a car's dashboard.

This project comprises two distinct modules: the zone status transmitter unit and the reception unit (speed display and control). The embedded unit within the vehicle automatically notifies the driver to reduce speed upon receiving information from the designated zones. In the absence of a prompt response within a brief delay, the vehicle's SDC unit takes the initiative to automatically decrease speed.

IV- PROPOSED MODEL

connecting it to a USB port or a 12V power source. Each module's voltage supply and ground pins are individually connected to the standard VCC and ground, while the remaining components draw power from the Arduino board's 5V output.

The Zone Transmitter device is comprised of Zone Selector Toggle switches connected to the digital pins of the Arduino Uno and an NRF transceiver module linked to the UART interface of the microcontroller.

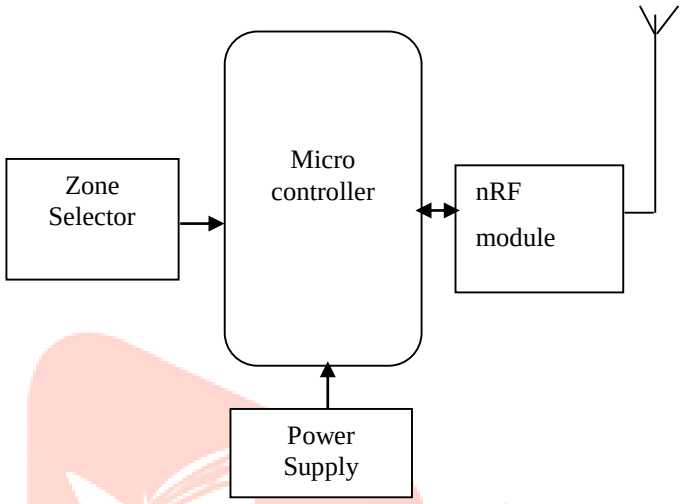

Fig.1 Block Diagram of Zone Selector Unit

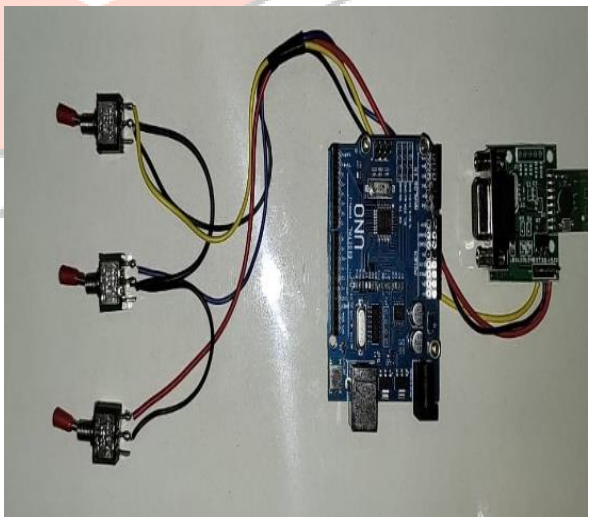

Fig.2 Model of Highway Cruise Control

Utilizing Low Power, Specific Zone Information is communicated within the NRF transceiver modules' operational current range of 9mA to 12.3mA. The vehicle control unit's SPI interface establishes a connection between the NRF and MCP2515 CAN Controller Module with the controller (VCU). The MCP2515 CAN Controller Module governs the throttle position on a high-speed CAN Controller Bus, operating at 1 Mb/s over CAN. Within the cruise control unit, a servo framework is incorporated, with the servo's signal

wire linked to the Arduino's PWM pins after connecting the servo's positive and ground wires to the Arduino's 5V and ground, respectively. To facilitate fuel cut control and ensure the proper air-fuel mixture, the servo plays a crucial role in managing the throttle valve position.

V-CONCLUSION

Based on the data, there is a consistent increase in the number of street accidents. Each day, nearly 1000 lives are lost due to accidents in India. Therefore, adopting the CAN convention offers a substantial solution to this issue. The utilization of low-power radio frequencies proves to be more effective compared to other systems popular among consumers in our country.

Upon implementation by a state, this framework has the potential to significantly decrease traffic accidents caused by drivers neglecting traffic signals or speeding cars losing control at speed breaker intersections. This project introduces an alternative approach to regulating vehicle speed for a predetermined duration in congested and safe areas. We assert that this project is easily executable within the current framework, straightforward, robust, ensuring the highest level of passenger safety, and accessible. Furthermore, the driver can receive all relevant street information without being distracted, even in adverse weather conditions, and with minimal power consumption.

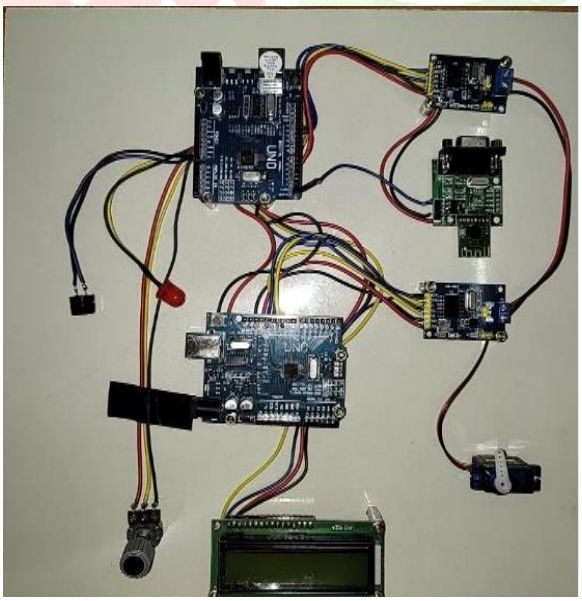

Fig.4 Model of Highway Cruise Control

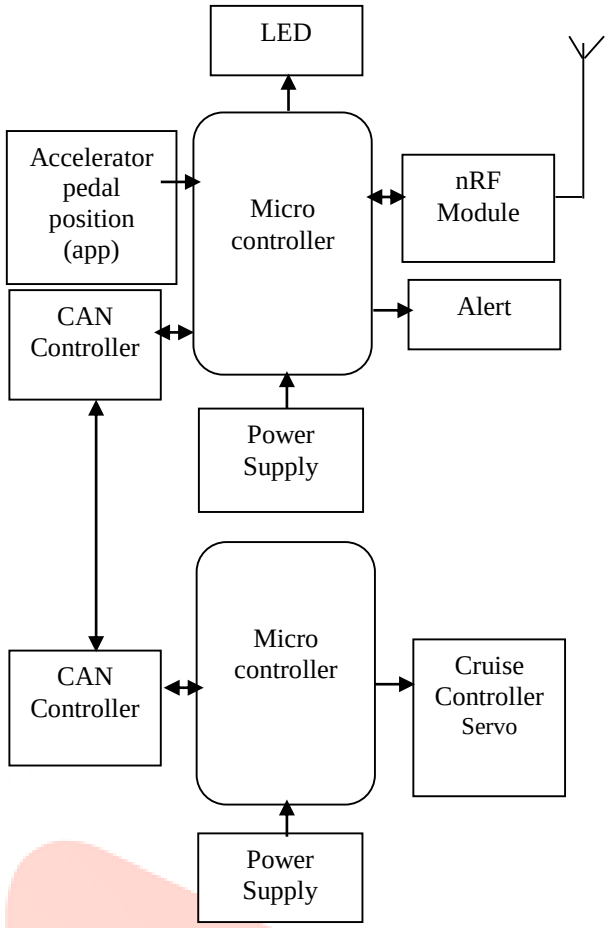

Fig.3 Block Diagram of Vehicle Control

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