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Automatic Speed Braker Controller

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Abstract*: This project presents the development of an automatic speed brake controller utilizing the Arduino Uno microcontroller. The primary objective is to enhance vehicle safety by automating the braking process based on real-time speed data. The system comprises several key components: speed sensors, the Arduino Uno, and a braking actuator.*

Speed sensors are strategically positioned to continuously monitor the vehicle's velocity, transmitting this data to the Arduino Uno. The microcontroller processes the incoming speed data and compares it against predefined speed thresholds. When the vehicle's speed exceeds these thresholds, the Arduino Uno activates the braking actuator to decelerate the vehicle safely and effectively.

The automatic speed brake controller is designed to address common safety issues such as delayed human reaction times and errors in manual braking. By providing a rapid and automated response to speed changes, the system aims to reduce the risk of collisions and enhance overall road safety. Additionally, this project demonstrates the integration of sensor technology with microcontroller-based control systems, showcasing the potential for advanced automation in vehicular safety features

Keywords: vehicle safely

I. INTRODUCTION

Rash driving is the cause of many road accidents all over the world. More than 140,000 people were killed on India's roads last year, according to figures released by the government. The traffic population has increased considerably in India as there is no means to control or monitor the speed of vehicles running on roads. This system proves highly effective in detection of over speed driving. In this project, two IR sensors, IR transmitter (IR LED), one IR receiver (photo diode) are placed on the Arduino board. When any vehicle crosses the two-car sensors, both IR sensors are connected to the interrupted pin of Arduino and identify the fall wave and the time between activating the Arduino's internal timer sensor. And then they measure the speed display on a 16x2 LCD screen. If the speed is more than 80 kmph then the Arduino will transmit the RF signal through the RF transmitter, and that signal is received by the RF Receiver placed in the car and the car speed is controlled automatically and also the speed braker get activated if speed is more than the limit.

II. LITERATURE SURVEY

[1] Vishal Pande et.al has proposed a framework for autonomous speed control of over speeding vehicle using Radio Frequency to design a controller to control vehicles speed and display to monitor the zones which can run on an embedded system platform.

[2] Monika Jain presented a device to detect the rash driving and alerts the traffic authorities in case of any violation. This frame of reference intends to design a system aimed at early detection and alerts vehicles driving patterns which is related to rash driving.

[3] Ni Hlaing et.al designed a system that detects the speed of the vehicle in the roads, main highways and the places where the drivers over speed. If the speed exceeds the limit, the information will be sent to PC (Personal Computer) which starts the camera which captures the vehicle of over speed.

[4] Amarnarayan et.al developed speed estimation system that alerts drivers about driving conditions, robust and reliable and helps to avoid joining traffic jams is an important problem.

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III. PROBLEM STATEMENT

An important part of the accidents happens because the individual was either not wearing a helmet, or the accident was not revealed in time, or the person couldn't be safe in view of the late induction to an emergency clinic, or on the grounds that the person was riding while smashed.

IV. METHODOLOGY

Developing an automatic speed brake controller using an Arduino Uno involves several steps. First, define the requirements and objectives, such as the speed threshold for braking and the types of sensors and braking mechanisms needed.

Gather the necessary components, including an Arduino Uno, a speed sensor, a braking mechanism and appropriate power supplies.

Next, design the circuit by connecting the speed sensor to a digital input pin and the braking mechanism to a PWM output pin on the Arduino, ensuring all components receive the correct power.

Develop an algorithm to initialize components, read sensor data, calculate speed, and control the brake based on the speed threshold.

Test the system in a controlled environment, calibrate parameters as needed, and use the serial monitor for debugging.

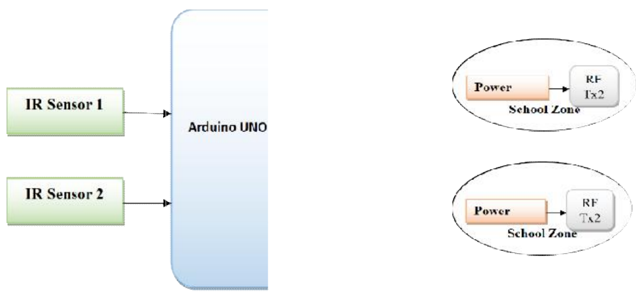

Fig 4.1: Block diagram of transmission part

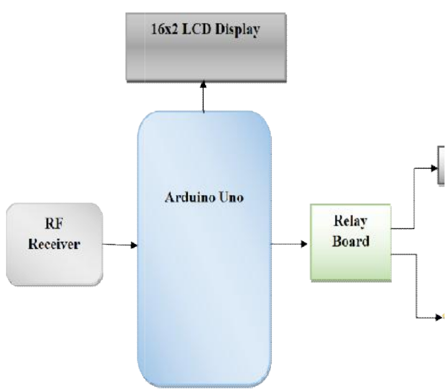

Fig 4.2: Block diagram of vehicle part

V. REQUIREMENTS

5.1 HARDWARE COMPONENTS

For designing this hardware many types of devices are used to make it perfectly working. All the devices are purchased from different manufacturers. These components are soldered on a soldering board. The following list of hardware is required for this system.

Components Required:

- Arduino Uno
- IR Sensor module

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- RF Tx& Rx modules
- 16x2 LCD
- Servo Motor
- DC Motor
- Buzzer
- Relay module
- Connecting Wires
- General Purpose PCB
- Power supply 12v 1-amp

5.2 SOFTWARE COMPONENTS

- Arduino IDE
- Embedded C

VI. FUNCTIONAL OVERVIEW

- **Speed Sensing:** To continuously monitor the speed of the vehicle. Speed Sensor (e.g., Hall Effect Sensor). The speed sensor is attached to a rotating part of the vehicle, such as a wheel or driveshaft. It detects the passage of a magnet or a metal gear tooth to generate pulses.
- **Data Handling:** Each pulse generated by the speed sensor is counted by the Arduino, which uses this count to determine the wheel's rotational speed. To convert the pulse count from the speed sensor into a meaningful speed value. The Arduino records the time interval between pulses using its internal timer.
- The number of pulses in a given time period (e.g., one second) is counted. Using the wheel's circumference, the number of pulses per rotation, and the time interval, the speed is calculated. For example, if the wheel's circumference is known and the sensor provides two pulses per rotation, the formula for speed can be derived. The calculated speed can be in meters per second (m/s) and then converted to kilometers per hour (km/h) or miles per hour (mph) as needed.
- **Speed Monitoring:** To compare the calculated speed with a predefined speed limit. The Arduino continuously compares the current speed with the speed limit set in the code. If the speed exceeds the limit, a flag or a control signal is activated to engage the braking system. To automatically apply the brakes when the vehicle exceeds the speed limit. Brake Actuator (e.g., Servo Motor or Solenoid). When the Arduino detects that the speed exceeds the limit, it sends a signal to the brake actuator. The actuator engages the braking mechanism (e.g., by moving a lever or pressing a brake pad).
- **Control Logic**: The braking action should be smooth to avoid abrupt stops. This can be achieved by gradually increasing the actuator's position rather than an immediatefull engagement.
- **User Feedback**: To provide real-time feedback to the user about the vehicle's speed and the status of the braking system. LCD Display or Serial Monitor. The Arduino can be programmed to display the current speed on an LCD. It can also show messages indicating whether the brakes are engaged or released. For debugging and monitoring purposes, speed and status information can be sent to the Arduino Serial Monitor.

VII. RESULTS AND DISCUSSION

The results of the system is as shown below.

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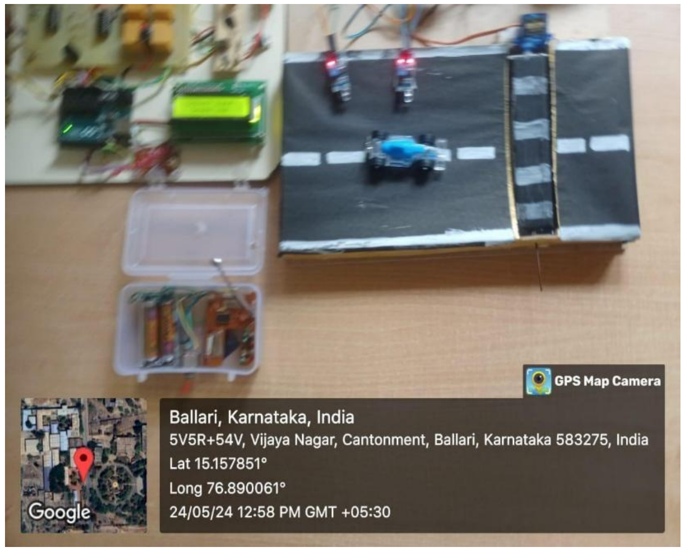

Fig 7.1: Model of the project

VIII. CONCLUSION

This project presents a solution to control the speed of the vehicle automatically using the RF signal. Here the vehicle speed is controlled automatically without the help of a driver in the defined zones. This strategy is created for the most part in the intention of decreasing the demise rates that are lost amid mishaps. Hence it is concluded from the above study that the uses of Area Based Vehicle Speed Control System minimize unwanted accidents to a great extent compared to normal behavior. It is an easily conveyable and cost efficient system. So, this project notifies that the idea and the review of an Area Based Vehicle Speed Control System is a relatively more reliable option.

IX. FUTURE SCOPE

The future scope of an automatic speed brake controller using Arduino Uno is promising, particularly given advancements in automotive technology, smart cities, and IoT (Internet of Things). Enhanced safety features can be integrated, allowing the controller to use sensor data to detect obstacles, pedestrians, or other vehicles, and apply brakes automatically to prevent collisions, paving the way for fully autonomous driving systems. In smart cities, these controllers can be part of traffic management systems, adjusting vehicle speeds in response to real-time traffic conditions, weather, and road hazards, thus improving safety and traffic flow. Further development can lead to adaptive cruise control systems where the Arduino-based controller adjusts the vehicle's speed based on road conditions, speed limits, and traffic signals. For logistics and transportation companies, these systems can monitor and control the speed of fleet vehicles, ensuring compliance with speed regulations, reducing fuel consumption, and minimizing wear and tear. By integrating with IoT, vehicles equipped with these controllers can communicate with each other and with infrastructure, creating a network of smart vehicles that adjust their speeds based on real-time data.

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