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Design And Development of Speed-Breaker Detection and Automatic Speed Control System in Vehicle

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Abstract- *India faces the large number of accidents and accidental fatalities in the world. In order to prevent accidents resulting from over speeding of vehicles, speed-breakers are employed. However, accidents occur regardless of presence or absence of speed-breakers. When vehicle approaches a speed-breaker at a speed greater than some threshold velocity, the risk of accident or injury is substantial. Speed-breakers are inconspicuous in low visibility conditions, like at night or when there is fog, rain or snow. This problem is particularly acute in developing countries where speed-breakers don't always accompany with warning signs. We propose a system where vehicle will detect speed-breaker from distance with help of Ultrasonic sensor and automatically control speed of vehicle regardless of driver's attentiveness with help of Arduino and Control system.*

Keywords: Automatic Speed Control, Speed-breaker detection, Arduino, Ultrasonic sensor.

1. INTRODUCTION

Today India is the most important developing country in the world. India is the largest country in the use of various types of vehicles. As the available resources to run these vehicles like quality of roads, and unavailability of new technologies in vehicles are the causes for accidents. The number of people who die during vehicle accidents is also very large as compared to the other causes of death. Though there are different causes for these accidents, proper technology of the Speed-breaker detection system and technology to reduce the damage during accidents mainly effects on the accident rates. So today the implementation of a speed-breaker detection system to prevent accidents and to reduce the risk of life to drivers and passengers is must for vehicles. To achieve this system modification goal, we design this Automatic speed control system. Nowadays vehicle accidents are the major problem. The purpose of this system is based on an intelligent electronically controlled automatic speed control system. This system also improves the response time of vehicle bumping to keep safe distance between two vehicles.

Over the years, automotive safety has gained attention from the general public, governments, and the car industry. Traffic accident statistics more than justify this focus, as each year around 1.2 million people die in road traffic accidents. Almost since the invention of the automobile, cars have been used to move people or other objects. Over the last few years, automobile technology has evolved. Recently, the automobile is thought of as a daily necessity. Car makers in Europe and Japan are developing safety features such as collision and preventive safety and advancing car technology for intelligent cars such as intelligent transport system (ITS), Auto-parking system in hybrid car and electric car. In an effort to prevent accidents, car makers are starting to build high-end car equipment with systems that access road conditions using cameras, radar, sensors, and other devices. Traffic accidents are increasing as automobile production has been increasing. It is crucial to prevent collisions and to safeguard the driver and passenger when they do occur. Therefore, Automatic speed control system will be demanded. The Automatic speed control is to prevent vehicle accidents on roads with poor visibility by using a sensor network to find invisible vehicles and speed-breakers which are to be detected by autonomous on-vehicle sensors. The Automatic speed control system processes the sensor data and controls the vehicle speed to prevent accidents caused by careless driving. The development of such systems to automatically control vehicles and avoid accidents will accelerate in the future.

In conventional vehicles there are different mechanisms operated for braking systems like hydraulic, pneumatic, air, mechanical, etc. But because the driver is the only one providing the signal or input power to all of these braking devices, they are all manually operated. The driver may not be able to pay the full attention during night travelling so there are many chances of accidents. There is no provision to minimize the damages of automobiles after an accident. To overcome these unwanted effects, we have to design the Automatic Speed Control System.

1.1 Objective

- To design and develop Arduino based microcontroller system.
- To develop suitable code for Arduino.
- Development of prototype Speed-breaker detecting model and Automatic Speed Controller Model.
- Testing of actual prototype model.

1.2 Need for System

- Speed has become an important factor in human life in the fast-changing world. In the world of rapid speed,

there are two points of view: maintaining pace and maintaining safety media.

- There is a common practice of having concrete speed breakers on the road for safety purposes, to avoid road accidents. They're found solid all the time on the road in the case of traditional concrete speed-breakers.
- So, there is need of speed-breaker detection and automatic speed control system in vehicle to avoid jerk and accident of car.

1.3 Problem Statement

Many accidents happen due to the driver losing control of vehicle and the main reason is that the speed breaker is not visible and some pedestrian come in front of vehicle, so we can use "Automatic Speed-Breaker Detection and Speed Controlling" technique to reduce it to some extent.

1.4 Present Theory

In conventional vehicles there are different mechanisms operated for braking systems like hydraulic, pneumatic, air, mechanical, etc. However, all of these braking mechanisms receive the signal or input power directly from the driver, making them entirely manual. Sometimes driver cannot see speed-breaker due to environmental condition like fog or rain. Due to this the driver fails to give the proper input to the braking system and proper working does not occur. Also, the driver may not be able to pay the full attention during night travelling so there are many chances of accidents. After the accident occurs, there is no provision to minimize the damages of vehicles. So, this system never reduces the damage of both vehicles and passengers

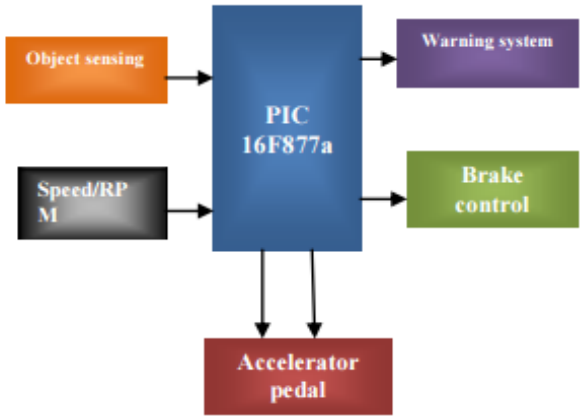
2. Literature Review

Apeksha S. Chavan, et al [1] discussed sleep related accidents tends to be more severe, possibly because of the higher speeds involved and because the driver is unable to take any avoiding action, or even brake, prior to the collision. When the driver fails to change the mode of the light and at the same time when the car comes sleep related accidents tend to be more severe, possibly because of the higher speeds involved and because the driver was unable to take any avoiding action, or even brake, prior to the collision. Author described typical sleep related accidents as ones where the driver runs off the road or collides with another vehicle or an object, without any sign of hard braking before the impact.

B.Praveenkumar, et al [2] described about Accident due to drowsy is prevented and controlled when the vehicle is out of control. Additionally, adding an alcohol detector in the car also helped to avoid drunk driving. The term used here for the reorganization that the driver is drowsy is by using eye blink of the driver. Currently, one of the main factors contributing to traffic accidents is tiredness. These incidents happened because the driver was drowsy and was not able to operate the car when he or she woke. Drowsiness is identified by the frequency and closure of eye blinks using an infrared sensor attached to the driver's glasses frame. The vehicle won't let the driver start the vehicle, if the buzzer signals that the driver is drunk.

Mohit Jain, et al [3] described about an early warning system that employs a smartphone application to notify the driver when the car is nearing a speed breaker ahead of time. In addition, the software constantly analyzed the smartphone's accelerometer for previously detected motion. Speed-breakers that aren't well-known. Because it does not involve any programming the proposed detection approach is simple to implement reorientation of the accelerometer. Because earlier systems needed expensive computations to rotate the accelerometer, this is one of the primary contributions of our study. The system was tested utilising 678 kilometers of driving data from 22 different drivers, five different types of vehicles (bus, auto rickshaw, cycle rickshaw, motorcycle, and automobile), and four different smartphones.

Dr. P. Poongodi PPG, et al [4] discussed the need for safety of vehicles by reducing the impact of crash by applying a smooth or partial braking with the help PIC 16F877a micro controller is proposed. When constructing this work, the possibility of the driver detecting an object from a specific distance and failing to notice it within the crucial limit was taken into consideration. The developed machine itself takes control of the accelerator pedal if the brake is not pressed within the necessary distance whenever a circumstance similar to this is encountered, without interfering with the safe throttle of the vehicle.



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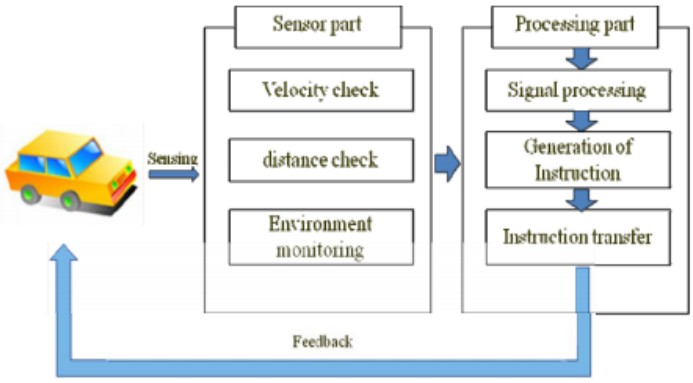
EungSoo Kim [5] described about how, the Auto-Braking System was designed by VHDL and fabricated to keep a distance between two cars. It provided Precrash Safety System for Intelligent Car. If the driver does not reduce the speed of the automobile, this module can detect the distance between the front vehicle and the driver's vehicle to maintain a consistent distance and activate the brake system forcibly. The system showed the distance between the two

cars as well as car's speed. The performance of the system was good. The sensor embedded in vehicle will detect the road environment, such as self-velocity, distance from front vehicle, and surroundings vehicles, using infrared sensor and ultrasonic sensor. These sensors were operated all the time during driving. The processing section received the signal from the sensors, processed it, produced instructions, and then sent the generated instructions to the vehicle's transmission and brake control units.



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Takahiro Wada [6] described about how to reduce rear-end crash of automobiles, it is important to judge necessity of deceleration assistance as earlier as possible and initiate the assistance naturally. Based on the developed brake profile model and brake initiation model of expert drivers, an automatic braking system for collision avoidance will be suggested in this study to achieve smooth, secure brake assistance naturally.

David Lee [7] discussed about Collision Warning Systems (CWS) are safety systems designed to warn the driver about an imminent collision. A CWS monitors the dynamic state of the traffic in real time by processing information from various proprioceptive and exteroceptive sensors. It assessed the potential threat level and decides whether a warning should be issued to the driver through auditory and/or visual signals. For threat assessment, a number of measures have already been established, and different CWS have been suggested in the literature. In this paper, they had focused on two time-based measures that assess both front and rear collision threats. The time-to-last-second-acceleration (Tlsa) danger measure for lead vehicles in rear-end collisions is specifically suggested and contrasted with its equivalent, the time-to-last-second-braking (Tlsb). The Tlsa is a novel time-based approach that focuses on the lead vehicle (as opposed to the following vehicle).

Erik Coelingh, et al [8] discussed how governments, the public, and the auto industry are all becoming more and more interested in automotive safety. The statistics on traffic accidents, which show that 1.2 million people die on the roads each year. Because of these factors, safety is still a top priority for Volvo Cars. Some of the most recent advancements in active safety at Volvo Cars were discussed in this study. Driver distraction, which results in a failure to respond in time, is a prevalent factor in incidents that include rear-end crashes.

J. T. Wang [9] The E/R bumper is intended to automatically extend in situations in which there is a high risk of frontal impact to prepare the vehicle for crash and retract when the risk subsides. The E/R bumper was used in the construction of two experimental cars as well as a working demonstration vehicle. In order to aid in the design of these vehicles and forecast how they would perform in full, offset, and oblique impact testing, analytical and nonlinear finite element models were used. A crash preparation feature, the extendable and retractable bumper, had been studied with analytical methods, nonlinear finite element analysis, experiments and demonstration vehicles. This showed that the E/R bumper will provide additional crush space in an at-risk situation of frontal impact prepare the vehicle for a subsequent crash and retract when that risk subsides. The study further showed that the additional crush space realized by extending the bumper can reduce the severity of the crash pulse and the amount of structural intrusion to the vehicle compartment.

Dr. Pikesh Bansal, et al [10] discussed in this system, they used a transmitter antenna that is placed on critical region and it sends a particular frequency of speed in certain region. If any vehicle receives this frequency of speed, then speed of vehicle automatically set on particular speed of that place. This is very efficient and power full idea. This idea is for saving of Fuel energy and provide perfect controlling of vehicle. This system provides automatic speed control in hazard region. They interface the RF with the help of encoder and decoder IC that sense hazard field & distance. According to distance it takes an appropriate decision and according to condition it automatically control the speed of vehicle and if it senses the critical condition of distance then system will stop the vehicle. The ultrasonic sensor system continuously keeps sending the signals and monitors that of any vehicle or other obstacles that are in front of the car. The distance of the working of ultrasonic sensor is limited to 4 meters. As soon as any obstacle or vehicle is detected by the ultrasonic sensor system it will send signal to the Arduino. After receiving of this signal Arduino sends a revert signal to the motor of the vehicle to stop the vehicle immediately. The controller is used to compare the speed. If it exceeds the limited speed value of the zone, the controller sends alert signal to the driver.

Surinder Singh Arora, et al [11] discussed on the area of proper and automated speed controlling of cars using the traffic signal automated system by using light sensitive sensors. In general speed control automation, there are GPS integrated speed controlling or locating system of speed

controlling to ensure the safety of the vehicles. In this research, they have developed a system in which the traffic signal lights will be embedded or laded on the streets and the cars would be having the light detecting sensors at the bottom which will differentially detect the colours of the lights emitted and would accordingly signal the car to de-accelerate. In case of any emergency purposes the car will ensure its safety by manual control detecting the speed and the obstacle. It ensured the traffic controlling and the hustle and bustle of the traffic in a way smother than old township model ensuring a countable safety of the passengers. The proposed design was made for avoiding the further unwanted accidents and proper systematic traffic management, this will result in lesser number of accidents, it will provide a controlled route for the hospitality and the ambulances. It will ensure the passengers safety and will reduce unwanted traffic jams. It will work as a future scope for the people smart-city development and with proper safety measures.

Sathiskumar S, et al [12] discussed about the whole system which is being controlled by an Arduino uno as a microcontroller. The main reason for choosing this as a controller, their advantage of having higher processing speeds and their ability to handle multiple inputs and outputs at the same time without compromising the accuracy and precision of the outputs. This Arduino UNO which has enough capacity to process the input from the Zigbee receiver. The main purpose of the processor is to process the signal from the Zigbee transmitter which receives by the receiver. By using these input signals Arduino Uno process these signals and actuate the respective relays and the processor accordingly generates output signals. This specific board can also be connected to a computer for easy implementation or modification of the code that basically is the brain for the processor to control the activities. High influence on the design and component selection of the automatic vehicle speed control system and suggested that Zigbee wireless communication can be employed in the system instead of an RF communication module and an RFID tag for real-time functioning systems in the vehicle. The method for recognizing the restricted zone is done through the Zigbee transmitter in the zone and the Zigbee receiver is placed on the vehicle which is inferred from the review.

J. Borenstein, et al [13] explains about Vector Field Histogram (VFH). VFM permits the detection of unknown obstacles and avoids collisions while simultaneously steering the mobile robot toward the target. The VFH method uses a two-dimensional Cartesian Histogram Grid as a world model. This world model is updated continuously and in real-time with range data sampled by the onboard ultrasonic range sensors. The VFH approach then calculates a one-dimensional Polar Histogram that is built around the robot's current location based on the acquired environmental data. The Polar Histogram's sectors each include the density of polar obstacles in that direction. Finally, the algorithm chooses the Polar Histogram sector with the lowest obstacle density as the most suited one, and the robot steers in that direction. This paper introduces Vector Field Histogram (VFH) method, a real-time obstacle-avoidance method for fast-running vehicles that constitutes a significant improvement over the Virtual Force Field method. The controlled vehicle moves smoothly around unexpected and densely populated obstacles thanks to VFH control.

3. Design

3.1 Components used in Prototype

- Ultrasonic sensor
- Wheel assembly
- 12V ,5Amp battery
- Wiper motor
- Chain and Sprocket setup
- Arduino Uno
- Control unit with power supply

3.2 Calculation

As we don't have to enhance or reduce speed of prototype as load on battery will be negligible. Hence size of sprockets are taken same.

Sprocket Ratio

$$R = \frac{Number\ of\ teeth\ on\ driver\ wheel}{Number\ of\ teeth\ on\ driven\ \ wheel}$$

$$R = \frac{22}{22} = 1$$

Velocity ratio of chain drive is given by,

$$V.R = \frac{N1}{N2} = \frac{T2}{T1}$$

Where, N1= Speed of rotation of driven sprocket

N2= Speed of rotation of driver sprocket

T1= No. of teeth on the driver sprocket

T2=No. of teeth on driven sprocket

$$\frac{30}{N2} = \frac{22}{22}$$

N2 = 30 rpm

Average velocity of the chain, $V = \frac{\pi.D.N}{60}$

Where,

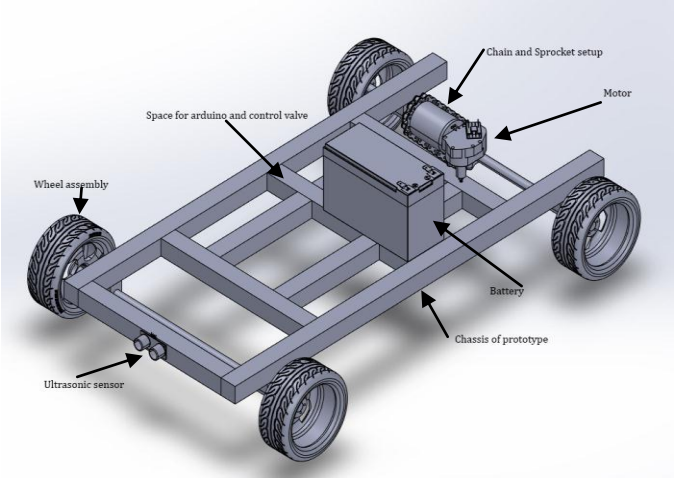
D= pitch circle diameter of sprocket,

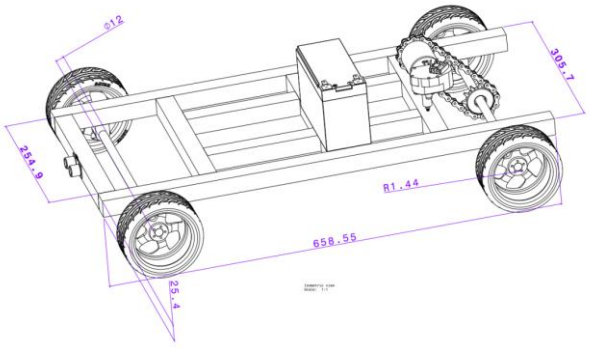
in meter=0.0191m

V= π× 0.0191×30/60

V= 0.030 m/s

Prototype model is designed on basis of car frame of Jeep J8 model.





Drafting of prototype model

4. Future scope

This system can be used in electric vehicle in low cost. Further research and optimizations of the automatic vehicle speed control system will allow us to implement in vehicles for improved safety for roadside pedestrians, passengers, and other road users.

5. Outcome of Project

- A new deceleration control method as a driver assistance system.
- Model successfully detect speed-breaker and reduce speed in vehicles.
- Automatic brake actuation without driver's attention.
- This method will be applied to other wide range of traffic environment such as curve deceleration control etc.

6. CONCLUSION

The proposed design is made for avoiding the further unwanted accidents due to speed-breakers. It will ensure the passengers safety and will reduce unwanted traffic jams. It will work as a future scope for Smart vehicles with proper safety measures. This study shows the role of reducing vehicle speed automatically and its contributions to the safety of driver and passengers. Hence it is concluded from the above study that the use of Speed-breaker detection system and Automatic vehicle speed control systems in vehicles minimize unwanted accidents to a great extent compared to normal behavior.

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