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Variable Vehicle Speed Limiter For Accident Avoidance Using Rf And Light Fidelity (Lifi) Technology

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Abstract

Safety of vehicles and safety of passengers in vehicle are important parameters to be considered while driving. Most of the accidents occur especially at curves and hair pin bends or due to the presence of any obstacles in front of the vehicle along with the violation of proper safety measures that is to be considered. The proposed system can be utilized forthe prevention of such accidents by issuing prior indication to the driver and it also reduces the vehicle speed, if required. Most of the accidents take place at curves and hair pin bends due to improper line of sight of the drivers, and hence a special kind of transmitter tuned at a frequency of 433MHZ is mounted in the vehicle. These transmitters continuously radiate a RF signal for certain distance and area. The transmitter used here is a coded transmitter which is encoded by a 4-bit binary data which is serially transmitted to transmitter. If the vehicle comes within this radiation, the receiver mounted in the vehicle gets activated. Limiting the speed of the vehicle may cause accidents if executed without precautions. This can be overcome by sending the information to the neighbouring vehicle. This can be implemented using LiFi technologies which need not to be paired, since it is a line of sight communication.

Keywords— *Safety measures, Reducing speed, Transmitter, Frequency 433MHz,4-Bit Encoder, LiFi technology*

I. INTRODUCTION

Over speeding is one of the major issues for the occurrence of accidents in day to day life. Many solutions have been proposed to overcome such situations but most of them involves complex algorithms and more economic. This proposed system ensures that the vehicle runs within the speed limit which is predefined for that particular area or road using RF transmission. The RF transmitter fixed at the road sides transmits the signal regularly. The signal indicates the speed limit within which the vehicle has to move in that road. The vehicle on reaching that particular range receives the signal and is send to the controlling unit fixed at the receiving end. The controlling unit consist of Arduino which compares the current speed of the vehicle with the fixed limit which was received earlier. Based on this the control of the vehicle's speed is either taken by the controlling unit or given as usual to the driver. Speed control of the vehicle is initiated by the controlling unitthat employs PWM (Pulse Width Modulation) technique by varying the duty cycle of the pulse, hence the gradual slowdown is ensured rather than sudden stopping of the vehicle.

The system also uses the LiFi technology to indicate the neighbouring vehicle about the current vehicle speed to avoid unexpected accidents. The over speeding vehicle gradually slows down and sends the indication to the neighbouring vehicle through LiFi for safety measures. Thus, the main aim of this work is to minimize the accident rate and also aims to establish communication with neighbouring vehicles to avoid collision using LiFi technology. The whole system has simple algorithms which could be implemented without much effort and cost. The sections are arranged as follows: section II discusses various techniques and the related works and techniques that are already in use are discussed. The details of the existing system and its drawbacks are discussed in

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Section III. The proposed method is explained in section IV and the section V elaborates the conclusion.

II. RELATED WORKS

Until early 1990s, many of the cars around the world were fitted with a fairly straight forward throttle control [1]. A person can press on the accelerator pedal, and the throttle is opened by pushing the mechanical throttle cable between the driver's foot and the engine throttle body that makes the air to flow into the engine, and the air mixes with gasoline and gets burnt. This process of burning powers the wheels of the car, and drives the vehicle down the road. If a person has to drive faster, all he has to do is to press the accelerator down harder and the throttle will open wider which in turn gives the car more power to drive fast.

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In some cars electronic signals are also employed. When a person step on the car's gas pedal, accelerator pedal module is activated, instead of opening the throttle, which produces an electric signal from the pressure applied on the pedal into an electric signal. That signal is then sent to an electronic control unit, which takes the given inputs into account, as well as outside variables and accordingly opens the throttle for optimum efficiency and performance. It is a complex system, but has a lot of benefits in minimizing the engine wear and tear, improved performance and improved efficiency

III. EXISTING SYSTEM

Existing systems does not involve any such system or they are implemented using visual methods such as recognizing the road signs by capturing the images of sign boards and recognizing it through image processing [2]. This system is limited since the system is only activated and deactivated around the vicinity of the sign boards and also it is not possible to extend it up to a particular distance. The procedure is illustrated in Fig 1.

MOTOR CONTROL

The motor control module passes a command to the electric motor on the throttle body to open the throttle a certain amount, the throttle motor opens or closes the actual throttle blade, which increases or decreases the power output of the engine.

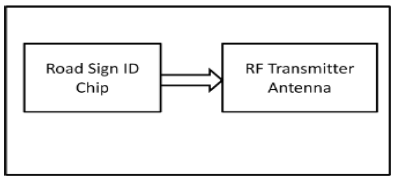

Fig 1. Block diagram of RF transmitter

RFID TECHNOLOGY

Radio Frequency Identification (RFID) technology [3–6] projects its applications various fields like medical science, security, logistics, access control etc. The RFID system is comprises of a three components system consisting of a tag, a reader and database. The access control provides the detection of the entry to or exit of IDs from the range area of the RFID reader. Here the Transponders or Tags has the appropriate circuitry needed to harvest power from the electromagnetic fields generated by the interrogator, the necessary memory elements, as well as the different control circuits. This transmits the information to the receivers so that the speed zone limit is sent to every receiver that are fitted in the car [7].

DRAWBACKS

Existing system involves the capture of road signs using a camera (i.e.) it involves visual methods and further process involves image processing techniques, which is too complex and expensive. Also, the activation range of the existing system is fixed and is very difficult to extend it to meet the requirements. The communication with the neighboring vehicles to avoid collision is done with the simple methods using buzzers or LEDs, which are not so effective due to the carelessness of the drivers.

IV. PROPOSED SYSTEM

This system uses RF frequency for recognizing the particular road sign such as school sign, if school sign is recognized then vehicle is automatically slowed down. Sign board will be always transmitting a particular key to any receiver this can be a car or any vehicle. When this is activated the car will communicate this information to the car behind it through LiFi technology so the second car would also slow down accordingly. The operation of the system that is proposed is shown in Fig 2 and Fig 3. ARDUINO ATMEGA 328 is the backbone of the unit that processes the signals by taking the input from various modules performing relevant operation.

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ARDUINO ATMEGA 328

Arduino Atmega 328 has high performance ratio and requires sufficiently low power for operation. It comes under microcontroller family with advance RISC architecture. Some of the Features of this hardware unit include 1 kilobyte of electrically Erasable Programmable Read Only Memory (EEPROM) and Static Random Access Memory (SRAM) in terms of memory architecture. Also, it consists of 6 channels10-bit ADC in PDIP packaging style with a programmable serial USART. The software units include Arduino IDE and Embedded C.

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Arduino AT MEGA is used in the receiving unit which has several interfaces such as LCD, motors and LiFi module. LCD is used to alert the driver in case of over speeding of the vehicle. Motor interface is to control the speed and LiFi interface is used for indication about the state of current vehicle to the neighbouring vehicles. Initially two inputs are read, one is the current speed of the vehicle and the other one is the fixed speed limit from RF transmitter. Further Work Flow of the system goes on as shown.

LIFI MODULE

LiFi exchanges data rapidly and more securely at much lower power levels. It is fully networked and bidirectional and has an effective bandwidth utilization for more efficiency. It is used in the system for alerting the neighbouring vehicles about the slow downing process of the over speeding vehicle in the front. Since the alert is given the possibility of occurring damage or accidents are avoided.

VEHICLE NODE 1

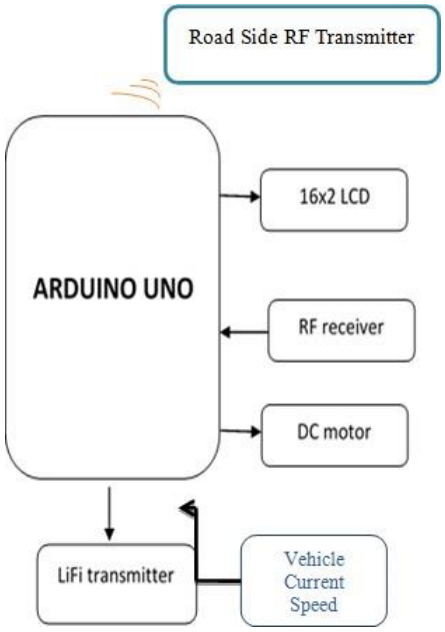

Fig 2. RF Transmitter and receiving Module

PULSE WIDTH MODULATION

The concept of PWM and its duty cycle is employed to initiate speed control of the motors.

OPERATION:

The RF receiver fitted at the vehicle's top receives the RF signal from the RF transmitter, when the vehicle enters into the receiving range. The workflow process initiates as soon as the vehicle receives the RF signal from the road side transmitter. The process involves the continuous comparison of the current momentum of the vehicle with the input speed limit, till the vehicle reaches the other end of the road. The current momentum of the vehicle is detected using the speed sensor at every instance of time and is used for comparison.

From the results of the comparison, if the speed of the vehicle lies below the specified speed limit of that road, no action is performed by the controller unit but the vehicle is driven manually. In other case, if the vehicle's speed exceeds the specified speed limit, the driver gets an initial alert and is provided with sufficient time to get back the speed of the vehicle down the limit. The controller takes the control of the vehicle to reduce the speed gradually, if the speed is not reduced manually even after the sufficient time provided. This automatic and gradual speed control is done using PWM technique by varying the duty cycle of the pulse.

The automatic control of the vehicle speed may result in collision of vehicle with the behind or neighboring vehicles. Proper methods have to be deployed to take care of this issue. Hence the

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system is made to use the LiFi technology which sends the information about the speed of the vehicle to its neighbors during the slow down process. This will effectively reduce the chances of collision to occur during controller action.

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VEHICLE NODE 2

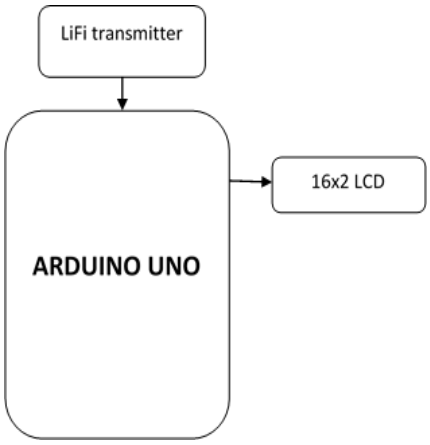

Fig 3. LiFi Module for receiving indication

WORK FLOW DIAGRAM

The work flow diagram in Fig 4 represents the project work flow from the time the receiver receiving the RF signal till the process gets completed (i.e.) till the vehicle's speed is limited in case the over speed is detected. The loop keeps on checking the current speed of the vehicle with the input limit of speed till the vehicle reaches the other end of the road. In case the speed is outside the range the driver gets the alert through LCD display. The control of the vehicle is taken by the controlling unit if the speed is not reduced within the given time limit after the initial alert. Simultaneously the neighbouring vehicles get the indication of the slow downing vehicle using the LiFi technology.

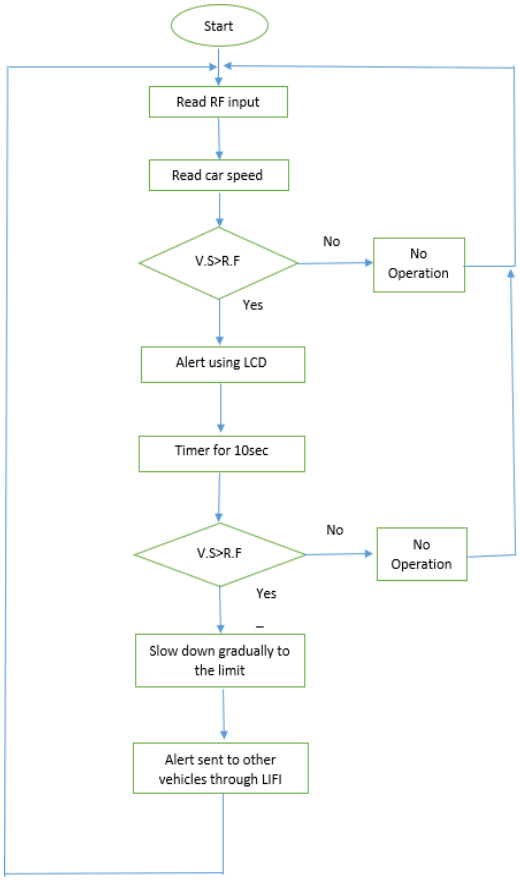

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Fig 4. Flow diagram of the System

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V EXPERIMENTAL RESULTS

The attached snapshot of the work Fig 5(a) to Fig 5(d) shows the LCD display indicating the speed of the vehicle and also the speed which is gradually reducing below its limit when over speed occurs.

Assume the receiver mounted in the vehicle received the signal from the RF transmitter and the vehicle has exceeded the speed limit of 55 rpm. Now the vehicle is moving at the speed of 78 rpm approximately. Since the speed is way above the speed limit of the vehicle is reduced gradually below the original speed limit as shown.

Fig 5(a). LCD displaying the current speed of the vehicle

Fig 5(b).LCD displaying the speed while reducing automatically

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Fig 5(c). LCD displaying the reduced speed of the vehicle

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Fig 5(d). LCD displaying the speed reduced below the limit

ADVANTAGES OF PROPOSED SYSTEM

Proposed system uses RF technology, which involves the use of RF frequency for communication. Hence the complexity and the cost is reduced with the added advantage of extending the range of vicinity for effective reception of the RF signal. It uses LiFi technology for communication with the neighboring vehicles, which is more effective than the existing methods to avoid collision during slow down process.

VI. CONCLUSION

The system introduces a new and effective way of avoiding over speeding of vehicles using RF technology which eventually results in reduced number of accidents. RF technology involves transmission and reception of RF signals which has to be made effective for desired results. This is the major parameter to be considered while designing the RF transmitter block. The way in which this is resolved in this project, is by placing the transmitter in the receivable range near the barriers or speed bumps. This can make way for effective receptionof the RF signal when the vehicle slows down near the barriers. Simple hardware makes the system viable under any circumstances and the software involving simple algorithms are easy to implement. The focus of the present work is on four wheelers especially on electric cars. The future work may be further extended on two wheelers and other vehicles.

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