

Vehicle Deceleration & Braking Indicator for Enhancing Safety

Vivek Yakkundi^{1#}, Rupendra Nehete^{2*}, Premkumar Joshi^{3#}

^{1#} Principal, Lokmanya Tilak College of Engg, Navi Mumbai, India

^{2*} Head of Mechanical Engg Dept, Agnel Polytechnic, Vashi, Navi Mumbai, India

^{3#} Professor, Agnel Polytechnic, Vashi, Navi Mumbai, India

Abstract

Expressways facilitate high-speed cruising of vehicles / cars at speeds in excess of 100 kmph. However during nights when the visibility is not up to the mark, the driver is unable to make out if the vehicle ahead is slowing down. Since the vehicles are at high speed, the fraction of time available for the driver to act and brake is small. Such a scenario may end up with collision & resulting in piling up of vehicles one after the other. Therefore to alert the driver an intermediate position to braking is proposed. In the proposed design, the deceleration in excess of predetermined value is sensed by infrared sensor. The sensor will sense either wheel speed or the propeller shaft speed in ideal conditions. This signal is sent to Arduino, UNO microcontroller to which LED (Brake light) is interfaced. When the deceleration is more than predetermined value, the LED will blink for four times. When the vehicle is braked & the wheel tends to attain zero speed the LED will glow as per the existing brake light designs. The proposed arrangement of blinking & glow is to be done in the brake light module itself, thus avoiding confusion. In the prototype we have used motor with a disc mounted on its shaft. The disc speed is sensed by infrared sensor which is interfaced with Arduino UNO microcontroller. Thus the idea is demonstrated with the help of prototype.

Keywords: Deceleration, Braking, Arduino UNO, IR sensor

I. INTRODUCTION

This project is an Arduino microcontroller based “Deceleration and Brake Indicator” for vehicles, especially cars. When on an Expressway or a Freeway where automobiles cruise with speeds in excess of 100mph a driver usually faces three major issues affecting a rider’s or driver’s safety. The first is, automobile decelerates by means other than brake pedal i.e. by releasing the accelerator pedal, engine braking and down shifting of gears, thus eliminating the function of brake lights, which does not blink during these speed reductions. The second problem is that there are many distracted drivers, so the brake light does not prove effective enough to address the issue. The third and the most major issue are even if someone behind knows that the vehicle is decelerating they may not know if the vehicle is slowing normally or due to hard braking. So the

prototype is designed which to a great extent can address these three issues.

The indicator we are using detects the sudden deceleration caused by down shifting or engine braking by the help of a sensor and if it senses the deceleration to be drastic, it glows the LED indicator by blinking it at the rate of 4 times per second, thus it catches the eye of the vehicle driver driving behind him and thereby reducing any chances of collision at the rear if the vehicle. The LED indicator used flashes in two fashions depending upon the type of urgency i.e. if the vehicle is decelerating very fast it warns the driver behind you by flashing the lights at the rate of 4 per second but if the driver applies brake the lights glow just like any brake indicator. Thus the paper serves two purposes at the same cost and a space of one indicator which was traditionally used.

II. LITERATURE SURVEY

The following patented & non patented literature was reviewed to preserve the novelty of the idea.

Alfred S. Braunberger, Beau M. Braunberger, US8571776B2, Application No US12/499,616, this patent title is *Absolute acceleration sensor for use within moving vehicles* [1]. As mentioned in this invention, it uses accelerometer a gyroscope & control logic configured to detect deceleration which is displayed by the indicator unit. It also has a braking system engagement detector. It thus alerts the trailing vehicle driver about the decelerating vehicle by integrating two signals. When the brake is applied the light glows as usual & when the brake pedal is released the communication system is activated.

Rex M Tajiri, US8482397B1, Appn No US12/762,982 [17], this patent title is Deceleration-activated brake lights. In this invention the sensed parameters are speed, brake force / position, throttle position & engine brake. The microcontroller receives signals from these sensors & converts them to appropriate brake indications. In this case the speed sensor & brake sensor are responsive as compared to throttle position and engine braking as the time lag in these two is more.

Frank H. Speckhart, Nathan T. Davis, Anthony L. Spezia, III, Benjamin S. Jordan US

10/367,330 [5] This patent title is Integrated warning device for providing flashing brake lights. In this invention the system integrates accelerometer with brake light system. It gives flash lights when the deceleration is more than a predetermined value & gives indication of brake lights as usual. This invention uses a device which senses g-force.

W. Brooks Bussard, US09/490,508 [21], this patent title is Brake warning method and system. In this invention, the system provides a highly visible warning to succeeding cars of braking, a warning signal for deceleration of the vehicle and a warning signal that a preceding vehicle is urgently braking. For the purpose the system uses brake force sensor, a processor circuit which can give signals proportional to the brake force applied. The system also takes into account the proximity of the trailing vehicle & conditions like fog, nighttime etc to change the intensity of flashlights.

Luis A. Perez, Brian S. Corzilius, US09/533,743 [15], this patent title is Severe braking warning system for vehicles. In this invention the system has an accelerometer connected to microprocessor which sends signals to the brake lights as per the deceleration levels of the vehicle as sensed by accelerometer. The microprocessor is programmed in basic language to interpret the signals received from accelerometer. However the brake lights function normally with a common switch. It is mentioned that the said arrangement could be integrated as a third brake light.

John Bloomfield, Niall Lynam US10/178,425 [14], this patent title is Anti-collision safety system for vehicle. In this invention the system has a microprocessor which has one or more inputs & controls the output of at least one indicator. An accelerometer is used to give deceleration signals to the microprocessor. The microprocessor modulates the signal independent of brake switch & is able to give signals of different frequency, intensity & colour.

Winholtz; William Stevenson US 08/633,041 [22], this patent title is Brake Light System. In this system the deceleration is detected with the help of transducer & with the help of control circuitry the flashing of an illumination device is achieved. Accelerometer is used for sensing the deceleration. The pattern of flashing will depend upon the extent of acceleration i.e. Normal / Moderate / Hard.

Asim Tewari US 12/051,312 [2] patented titled Method and apparatus for vehicle brake light control. In this invention the system has a brake light controller which receives signals from sensors. The parameters sensed are brake position & deceleration

mainly. The indication given is on / off or in the form of change of intensity of lights.

Scott Terrell L US 07/787,548 [18], this patent title is Vehicle deceleration alert system. In this invention the auxiliary brake light & deceleration light are both connected to a current source through a brake switch. A timer control module circuit is used for causing brake lights flash on / off. When the brake pedal is made free, the light continues to flash for a predetermined time.

Bailey Christopher Lee, Jason Harrington, Armentrout Nathan Ross PCT/US2015/020844 [3], this patent title is Automatic braking indicator. The processor receives signals from the sensor corresponding to the plurality of accelerations of the vehicle, filters the signals from the sensor to remove signals from vehicle vibrations, compares a first signal corresponding to a first acceleration of the vehicle to a first set amount and sends a brake signal to the brake light switch to turn a brake light on if the first acceleration of the vehicle is less than the first set amount.

Volker Oltmann, Bernd Woltermann US 12/097,456 [20], this patent title is Motor Vehicle Having a Rear-end Impact Warning Device. In this invention the system consists of rear-end impact warning device, which includes a surroundings sensor system, arranged at a rear end of the vehicle, that determines at least a distance to a following vehicle from backscattering of a signal and which rear-end impact warning device outputs light signals in a situation-dependent flashing mode by means of lights at the rear end of the vehicle, to provide traffic behind with a warning of a rear-end impact if the following vehicle approaches to within a critical distance; wherein the vehicle has deceleration sensing device. The indicator flashes when the vehicle is at a critical distance & the braking also takes place simultaneously. In this system the flashlight works as a third brake light & conventional brake lights work independently. Also, in order to determine a braking process, the activation of the brake pedal, the braking pressures and/or the release of the accelerator pedal, the speed of the vehicle, the deceleration of the vehicle and the deceleration time period are monitored.

Stephen Christopher Blackmer US 08/886,613 [19], this patent title is Vehicle deceleration sensor and indicator, this patent the system has a vehicle deceleration sensor and indicator. The sensor is configured to measure the rate of deceleration experienced by a vehicle and signal the rate of deceleration to persons outside of the vehicle. The system comprises of a pendulum attached to the shaft, rotary switch that aids shaft rotation, and signaling means connected to the rotary switch for actuation thereby providing a visual indication of the

rate of deceleration of the vehicle. Summary of the cited patent states that a sensor and indicator system indicates deceleration regardless of whether a vehicle's braking system is activated. Further, in the last paragraph of the patent it is mentioned that the deceleration sensor does not depend on vehicle braking but is actuated by any deceleration of the vehicle, whether accompanied by brake activation or not.

The following are the non-patented reviews. Calvin- Minds in the making, 2013 titled Smart Dashboard [4]

The above cited non-patent literature suggests the integrated unit comprising of accelerator, microcontroller and brake lights, wherein the accelerator sends signal of acceleration and deceleration to microcontroller and microcontroller transmits signal to pulse the brake lights accordingly. It is also mentioned that the system will measure the deceleration of the vehicle and flash the brake lights if the vehicle decelerates quickly to alert following vehicles.

Strobewise Technologies [7]

It has been suggested that the technologies use deceleration activated high/low beam headlamp flasher. Further, intelligent brake lights warn following vehicles of deceleration and a pending slowing or stopping event. Furthermore, the system drives brake lights, auxiliary lights, or warning lights at customer's discretion. This non-patent literature may be of interest with reference to the disclosure of intelligent brake light system indicating deceleration. Niveditha P.R and S. Gowri [6] Collision Warning System using Ultrasonic Sensors and Automatic Brake System, this art search the publication discusses about the technologies to detect obstacles & auto braking. The technologies used are cameras & ultrasonic sensors.

III. THE METHODOLOGY

The following algorithm is proposed for the arduino uno programming

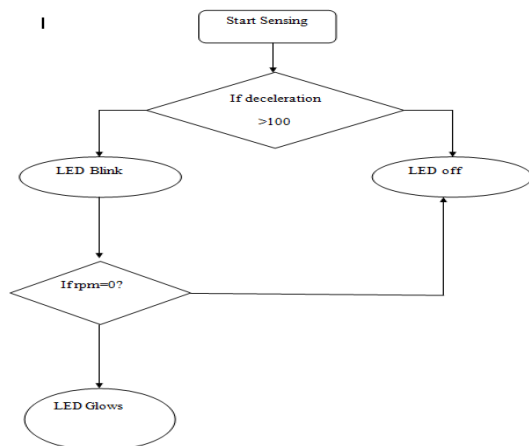


Fig1. The Algorithm

IV. WORKING

- Initially the system is powered on by providing a power supply.
- The sensor starts sensing speed continuously and sends signal it to Arduino.
- If the deceleration is greater than 100 rpm the LED indicator blinks for about 4 times in 2 sec.
- If the rpm is 0 then the Arduino directs the LED to glow continuously.

The stage model of the proposed idea is as shown in figure 2 and 3;

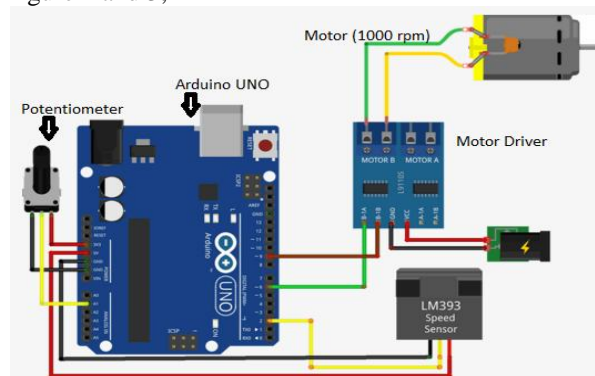


Fig2. Basic Circuit / Schematic Diagram of Controller

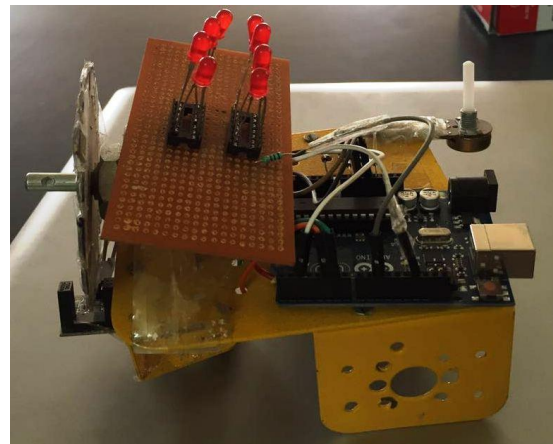


Fig3. The Working Model (Hardware)

The hardware for the system consists of Arduino microcontroller, IR Sensor LM 393, Potentiometer , Encoder disc & Motor driver L293D & the interface is as shown figure 4.

The Arduino Uno is an 8 bit microcontroller board based on the ATmega328 datasheet. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection for loading the programme, a power jack, an ICSP header, and a reset button.

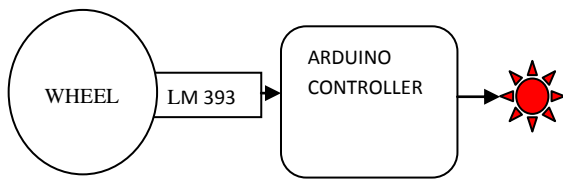


Fig4. The Interface

The figure above illustrates the concept of our speed sensing and indicating system. Each vehicle is equipped with 3 modules namely, LM393 speed sensor, Arduino UNO & LED indicator. The sensor will be installed near the vehicle wheel on the side of encoder disc which will be used to calculate RPM of the wheel. The sensor will continuously send the digital value to the controller. The indicator LED will be placed behind the vehicle. The Arduino controller (can be replaced by embedded system of the vehicle) is used for controlling the LED depending on the value of the speed sensor. The job of controller is to calculate the RPM value using the digital input from the sensor and control the blink of LED indicator. The system is coded in such a way that if the speed drops by 100 RPM suddenly the controller will direct the LED to blink 4 times in 2 seconds indicating the driver behind the vehicle about the deceleration. At the same time if the vehicle stops the LED indicator will glow continuously which act as the brake light.

The code in C sharp is written for LED blinking, potentiometer, controlling motor & final integrated code.

V. CONCLUSION

Overall development in the field of automobile has led to the inventions of refined & very high speed engines & efficient powertrains to gel with, but the danger arising with this high speed cannot be neglected. Also the number of vehicles on the road heavily affects the safety issue at freeways and expressways. Every commuter wants to reach his destination in shortest possible time even overlooking his safety. Therefore in this project it is tried to enhance the traditional brake indicator with a new 2 in 1 indicator thereby increasing the safety of the person on the wheels. The literature survey shows that such collision avoidance systems & inventions do exist but the one presented in the paper is a variant of such systems in terms of use of sensors & speed sensing. These indicators can only be used as a precautionary safety device.

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