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Rf Based Mems Collision Avoidance System Using Controller Area Network

[1] R.ARUL RAJ,[2] J.PRANESH, Mr. K.SABARINATHAN

Department Of Electronics And Communication Engineering

[1]arulrajr95@gmail.com,[2] jpranesh96@gmail.com

ABSTRACT

In modern world leads to growth of different technologies for the purpose of avoiding collision between the vehicles in highway .Driver and passenger safety is one of the prime concerns in modern day vehicle. The work proposes an intelligent embedded system that assists the driver in avoiding various end collision. It is a mechanism that monitors the side of the vehicle ends and also braking intensity of vehicle and depending upon its intensity alerts with light indication. The device on the following vehicle is immediately alerts for the reaction of front vehicle. In order to overcome that situation the project has been develop in a simple manner using the devices like PIC controller, MEMS sensor, Ultrasonic sensor, CAN protocol. MEMS sensor works to analyze the pedal pressure of front car it will pass an information through the RF transmitter and received in back vehicle with the help of RF receiver.

Keywords- Collision warning system, MEMS sensor, Rear-end collision, RF Communication, Ultrasonic sensor**.**

1. INTRODUCTION

Now a day's as population increases, on the High way and roads, the number of vehicles increases. Due to this results heavy accidents occurred. To secure the person we design a project in simple manner using devices like MEMS sensor, ultrasonic sensor, and controller area network etc as per the report provided by times of India, 400 road deaths per day in India up 5% to 1.46Lakh or one life snuffed out every 3.6 minutes. To reduce the number of road accidents, speed control system is designed. The system uses sensor to detect an imminent crash. When detection occurs, the system takes action autonomously without any driver input. Generally cars on the same direction in highway keep a safe distance one another with a similar speed. On the other hand, due to prolonged periods of continuous driving, the driver's distraction, or even a sudden deceleration of the previous car, a serious clash may occur if the driver can not react in time to brake. Therefore developing a front-obstacle warning system is important in collision avoidance. To avoid traffic jam, accidents instantaneously we design a project in simple manner. We design a project based on MEMS application. We need to secure and protection in vehicle and focus on eco-friendly safety. Everyone has to reach his/her home in safe condition with avoiding accident occurred in any areas. Collecting the required data from sensors Which is attached to PIC microcontroller and monitor each moment at vehicle condition. An accident in which a rear of a vehicle is hit by a trailing car, due to immediate change in car's speed as a result of emergency or hard brake applied is termed as rear end collision.

2. EXISTING SYSTEM

To decrease the present high statistics of accidents caused by rear-end collisions, many ideas have been proposed for essential advancement in developing system meant for collision warning. A system based on vision and image processing was proposed that could employ a camera to take video images and extract features from behavior of the vehicles in front and draw conclusion to avoid collisions. A similar collision avoidance system was modeled using laser scanner and collision prediction algorithm using Kamm's circle. Global positioning system (GPS) was also used to locate the vehicles in front and evaluate their relative velocity to find a solution to avoid collision. Instead of vehicle to vehicle communication, an external infrastructure to vehicle based system is also proposed that maintains a network of all vehicles in coverage area and informs the vehicle of any situation which can lead to collision, pre-hand, so that they can take necessary action. Systems enabled with Wi-Fi to receive surround cars information and Zigbee to receive infrastructure information was also propose to mitigate collisions. Fuzzy logy based controllers have

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been deployed to develop and implement Collision Warning System (CWS) and Collision Avoidance System (CAS).

3. PROPOSED SYSTEM

This paper proposes an implementation for data communication based on CAN protocol by using Microcontroller. CAN communication which is mainly used for vehicular communication. The proposed system concentrates on crash avoidance system using MEMS Sensors that is placed within a vehicle to reduce the speed when there is any dangers that may lie in front of the vehicle. The alert warning system mounted on the leading vehicle is responsible for alerting the Collision Avoidance System of following vehicle to warn its driver and mitigate a crash that may be due to an impending rear-end collision. The desired mode of communication required is straight optical lambertian range of communication to notify only the vehicles following the leading vehicle.

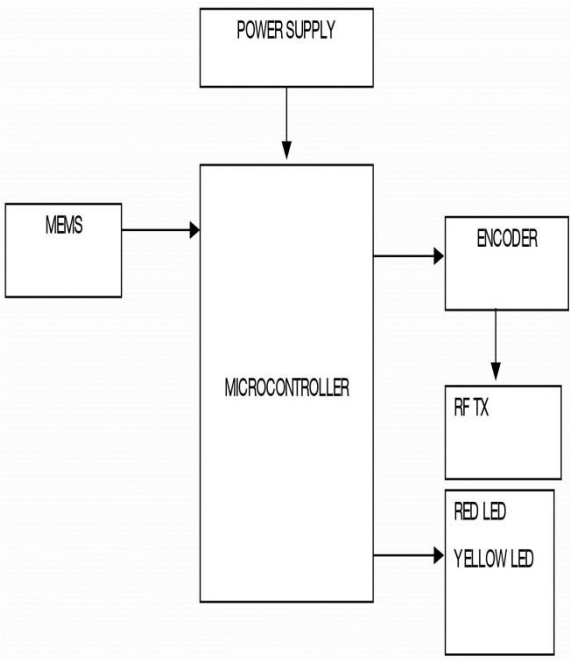

Fig 1: BLOCK DIAGRAM FOR TRANSMITTER

In this project a high speed wired communication is required since the accidents are happening within few seconds. For that purpose here CAN protocol is introduced. CAN is especially meant for high speed communication between the ECUs of the car. A sensor called MEMS is used to find the braking angle of the car-1. With that information, using RF Transmitter the indication is sent to the car-2 which is following back.

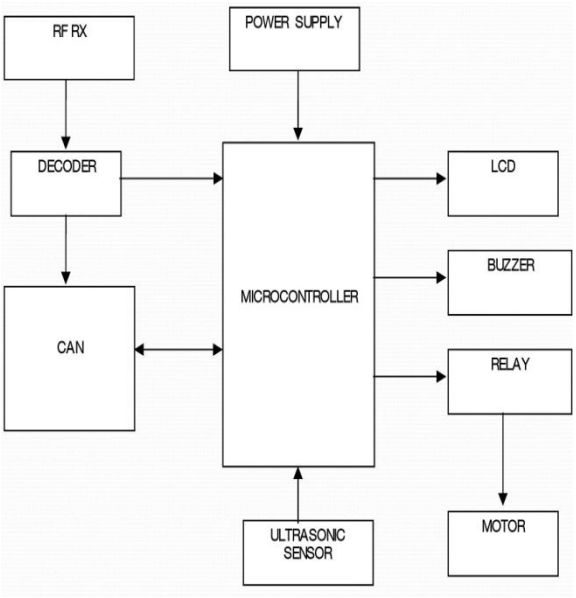

Fig 2: BLOCK DIAGRAM FOR RECEIVER

RF Receiver is used to receive the information from the car-1. According to the value of the MEMS, the motor of the car-2 is automatically controlled. For additional safety, 2 LEDs (Red, Yellow) are provided at the back of the car-1 to indicate the force applied to the brake.

3.1 POWER SUPPLY

Almost all basic household electronic circuits need an unregulated AC to be converted to constant DC, in order to operate the electronic device. All devices will have a certain power supply limit and the electronic circuits inside these devices must be able to supply a constant DC voltage within this limit. The DC power supply is practically converted to each and every stage in an electronic system. Thus a common requirement for all this phases will be the DC power supply. All low power system can be run with a battery.

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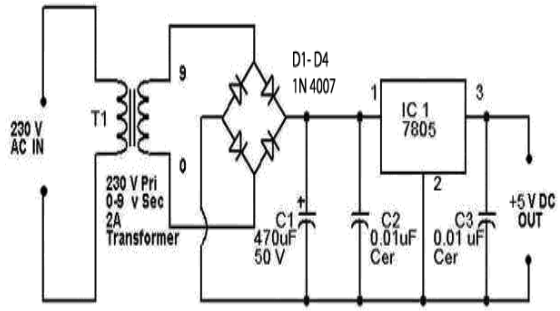
CIRCUIT DIAGRAM



But, for long time operating devices, batteries could prove to be costly and complicated. The best method used is in the form of an regulated power supply a combination of a transformer, rectifier and a filter.

3.2 MEMS SENSOR

MEMS technology has gone from an interesting academic exercise to an integral part of many common products. This sensing method has the ability of sensing both dynamic acceleration (i.e. shock or vibration) and static acceleration (i.e. inclination or gravity). the X and Y axis acceleration signals each go through a 32KOhm resistor to an output pin (Cx and Cy) and a duty cycle modulator The output signals are voltage proportional to acceleration and pulse-width-modulation (PWM) proportional to acceleration. Using the PWM outputs, the user can interface the ADXL2O2 directly to the digital inputs of a microcontroller using a counter to decode the PWM.

3.3 MICROCONTROLLER

PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range of applications, high quality, and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on. The PIC 16F877 features all the components which modern microcontrollers normally have. The figure of a PIC16F877 chip is shown.

3.4 ENCODER

An encoder is a device, circuit, transducer, algorithm or person that converts information from one format or code to another, for the purposes of standardization, speed, secrecy, security, or saving space by shrinking size.

3.5 RF TRANSMITTER

In general, the function of a radio frequency (RF) transmitter is to modulate, up convert, and amplify signals for transmission into free space. An RF transmitter generally includes a modulator that modulates an input signal and a radio frequency power amplifier that is coupled to the modulator to amplify the modulated input signal. The radio frequency power amplifier is coupled to an antenna that transmits the amplified modulated input signal.

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3.6 RF RECEIVER

Radio frequency (RF) is a rate of oscillation in the range of about 3 kHz to 300 GHz, which corresponds to the frequency of radio waves, and the alternating current which carry radio signals.

3.7 DECODER

A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved. The same method used to encode is usually just reversed in order to decode.

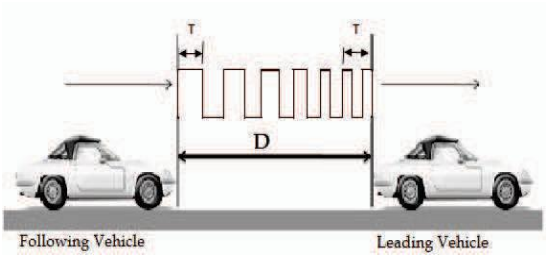
3.8 CAN BUS

Controller area network (CAN or CAN-bus) is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within a vehicle without a host Computer. CAN is a message based protocol, designed specifically for automotive applications but now also used in other areas such as industrial automation and medical equipment. Development of the CAN bus started originally in 1983 at Robert Bosch GmbH. The protocol was officially released in 1986 at the Society of Automotive Engineers (SAE) congress in Detroit, Michigan. The first CAN controller chips, produced by Intel and Philips, came on the market in 1987.

3.9 ULTRASONIC SENSOR

If the distance is less than threshold value the automatic brake is applied by the microcontroller.
Ultrasonic sensors (also known as transceivers when they both send and receive) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor. Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object.

Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed.



3.10 LCD DISPLAY

Liquid crystal display is composed of several layers which include two polarized panel filters and electrodes. LCD technology is used for displaying the image in notebook or some other electronic devices like mini computers. Light is projected from a lens on a layer of liquid crystal. This combination of colored light with the grayscale image of the crystal (formed as electric current flows through the crystal) forms the colored image. This image is then displayed on the screen.

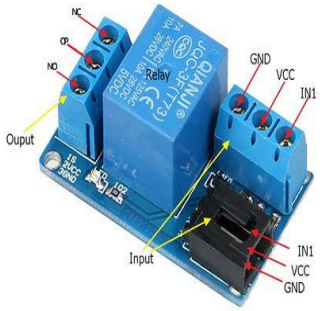
An LCD is either made up of an active matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

3.11 BUZZER

Buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc.

3.12 RELAY

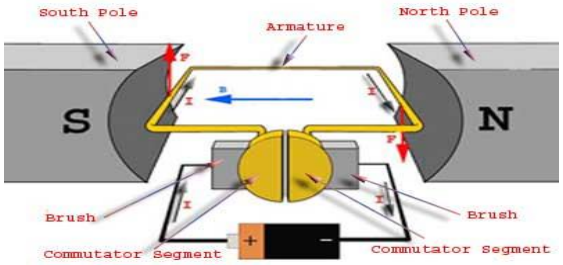
A relay is an electromagnetic switch operated by a relatively small electric current that can turn on or off a much larger electric current. The heart of a relay is an electromagnet (a coil of wire that becomes a temporary magnet when electricity flows through it). Relay is a switch it on with a tiny current and it switches on another appliance using a much bigger current.



Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

3.13 DC MOTOR

A DC motor in simple words is a device that converts direct current (electrical energy) into mechanical energy. It's of vital importance for the industry today, and is equally important for engineers to look into the working principle of DC motor in details that has been discussed in this article. In order to understand the operating principle of DC motor we need to first look into its constructional feature.



CONCLUSION

The proposed system uses an PIC Microcontroller known for quick response time and effective and efficient control response. The system has advantages over the other available system in terms of response time and independency on external infrastructure. It is also cheap in terms of cost and reliable when tested in actual environment. The system does not intend to notify other running vehicles except the ones that are following it or is in the of ultrasonic sensor. These following vehicles are the most probable cause of rear end collision. Hence RF was chosen

over other radiation technologies like IF, Zigbee and Directional broadcasting of message was found to be undesirable in rear end collision avoidance of vehicles. The integration of system with the CAN network makes it possible to achieve robust control action to avoid a rear-end Collision along with its diagnostics. Advanced algorithms as steering the vehicle to change lane and advanced cruise control can be incorporated as the future features. An embedded Diagnostic system that can improve the Driver and passenger safety with its diagnostics and help its own service during repair time is proposed. It can be further sophisticated with autoregressive tests with on- road test conditions.

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