ISSN (Print) : 2319-5940
ISSN (Online) : 2278-1021

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 2, Issue 4, April 2013

Ultrasonic anti crashing system for automobiles

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Abstract: Obstacle detection has been the topic of much research in the past and new ways for avoiding various types of obstacles in various surroundings have been experimented upon . But the focus has been mostly on obstacle avoidance by autonomous agents and that too was mostly limited to extruding obstacles. These tended to make the detection mechanism very system-specific and not much suitable for general purposes. In fact , even if the user has adequate control over a device , he/she may still benefit from such a detection mechanism. Now though much work has been done for detecting various sorts of protruding obstacles , depressed obstacle detection has been somewhat neglected. This project focuses on building an user-friendly device that specializes in detecting intrusions besides doing close range obstacle detection. Automobile safety can be improved by anticipating a crash before it occurs and thereby providing additional time to deploy safety technologies .Warnings can be like buzzer if the driver is approaching a pothole or any obstruction, driver may be warned in advanced regarding what the road entails. The project's ultimate aim thus finalized as, one to build a general, easy-to-use and versatile system that detect potholes, besides close objects , and give warning to the user accordingly.

Keywords: Complimentary Metal Oxide Semiconductor (CMOS), Microprocessor without Interlocked Pipeline Stages (MIPS), Permanent Magnet DC Motor (PMDC), Complex Instruction Set Computers (CISC), Universal Asynchronous Receiver Transmitter (UART).

I. INTRODUCTION

Most of the accidents in India can be accounted by two main reasons first being the dangerous road conditions. These are major distractions for safe and comfortable transportation. Keeping our roadways in good condition is a challenging problem .Because of harsh weather, unexpected traffic load, and normal wear and tear , degradation of even well-laid roads over relatively short periods of time takes place. The reason is that bad roads that damage vehicles, are sometimes hazardous to drivers and pedestrians, and, at the very least, are annoying to be used for transportation. Both , drivers and road maintenance staff are interested in fixing them as soon as possible. However, these conditions have to be identified first. Therefore , an intelligent surface monitoring system is the need of the day. Any system that can measure the underlying irregularities and can accurately depict the result to the driver of the automobile is aptly the saviour of millions of lives. Informing drivers of hazardous road conditions especially at night or when lighting is poor would be a useful feature in these navigation systems.The second main reason being Driver distraction. This is cited as a contributing cause in half of all accidents. In order to significantly reduce accident severity and occurrence, future safety technologies must move beyond 'passive.' To support this, vehicles will require new exterior pre-crash sensors to create an electronic awareness of the traffic situation. Pre-crash sensing may well have the most impact in reducing injuries from night-time accidents involving impaired drivers. However, the advanced safety features enabled by pre-crash sensing will provide a significant benefit in all cases of poor lighting, bad weather, or driver distraction.

II. RESEARCH BACKGROUND

There are certain technologies that already exists in the area of obstacle detection and warning . Some of them are as mentioned . Each of them deals with the obstacle in a similar way the only differentiation is the sensor and its technique in recognizing the obstacle and actions initiated after sensing the obstacle . The following are the different approaches that were implemented in previous attempts of solving the obstacle problem :

1. Enhancing riding safety and comfort, it is necessary to monitor the vehicle's status. "A Safety System for Intelligent Portable Hybrid Electric Bicycle "IEEE paper published in 2011 attempted to develop a safety system for intelligent portable hybrid electric bicycle. The safety system includes two functions: (1). Anti-crash warning system, (2). Balanced tire pressure monitoring system. Those are combined with ultrasonic ranging technology and sensor technology for electric bicycles. All of the messages are communicated through CAN-bus to the microcontroller and the peripheral systems.

2. "The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring" IEEE project published in 2008 focused on building an easily detachable and user-friendly device that specializes in detecting potholes besides doing close range obstacle detection. The device comprised of two systems, one that is mounted on the front of a vehicle such as baby strollers, carts etc and the other is worn by the user maneuvering the vehicle . The first system looks for an obstacle and sends a

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signal to the other system wirelessly when detecting an obstacle and the second system warns the user of the obstacle by vibrating and blinking LEDs. Obstacles are detected using two non-contact ultrasonic sensors modules. The pothole detection system is divided into three subsystems. First is sensing subsystem which senses the potholes encountered by it, about which it did not have the prior information. Second is communication subsystem which handles the information transfer between Wi-Fi Access Point and Mobile Node. Third subsystem is the localization subsystem which analyzes the data received from Access Points and warns the driver regarding the occurrence of potholes.

3. "An Ultrasonic Sensor for Distance Measurement in Automotive Applications "This IEEE paper published in 2001 describes an ultrasonic sensor that is able to measure the distance from the ground of selected points of a motor vehicle. The sensor is based on the measurement of the time of flight of an ultrasonic pulse, which is reflected by the ground. A constrained optimization technique is employed to obtain reflected pulses that are easily detectable by means of a threshold comparator. The sensor is composed of only low cost components, thus being apt for first car equipment in many cases, and is able to self-adapt to different conditions in order to give the best results.

III. BLOCK DIAGRAM

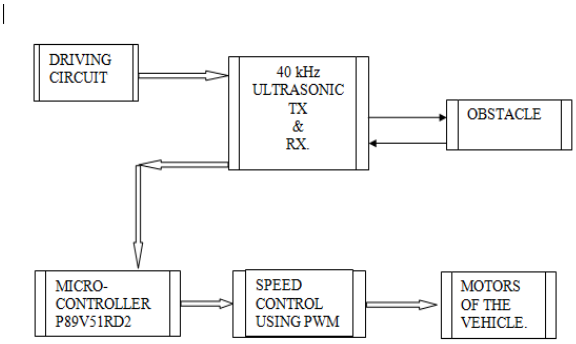

Fig. a

The block diagram consists of the following components:

- 40 KHz ultrasonic transducers
- P89V51RD2 microcontroller
- Driving circuit
- Motors

Ultrasonic Transducers **:**
An ultrasonic transducer is a device that converts energy into ultrasound or sound waves above the normal range of human hearing. While technically the term is more apt to be used to refer to piezoelectric transducers that convert electrical energy into sound, piezoelectric crystals have the property of changing size when a voltage is applied ,thus applying an alternating current across them causes them to oscillate at very high frequencies ,thus producing very high frequency sound waves.

Microcontroller **:**
The P89V51RD2 is a low power CMOS 8 bit microcontroller based on CISC architecture. By executing powerful instructions in a single clock cycle, the P89V51RD2 achieves throughputs approaching 1MIPS per Mhz allowing the system designer to optimize power consumption versus processing speed.

Driving circuit **:**
It consists of a 555 timer working in an astable multivibrator mode. This mode is designed to generate a square wave of frequency 40kHz.this circuit is responsible for pinging the ultrasonic transducer.

PWM **:**
This a feature of the development board which takes in a varying duty cycle digital wave and gives its corresponding analog value to one of the pins controlling the motors. This pin decides the speed of the motor ,thus a regulation in speed is achieved.

Motors **:**
We are using permanent magnet DC motors in this application . They have a maximum speed rating of 150 RPM. Two such motors along with wheels are interfaced to the microcontroller through motor drivers.

LCD(liquid crystal display) **:**
The LCD is a thin flat display device made up of microcontroller pixels arranged in front of the light source or reflector . it uses very small amount of the electric power and is therefore suitable for use in battery powered electronic devices.

Buzzer **:**
A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to the control unit that determines if and which button was pushed or if a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound.

IV. HARDWARE REQUIREMENTS

- Power supply 5v,9v DC - 7805,7809.
- LV-MaxSonar.
- Microcontroller -P89V51RD2.
- Buzzer - Switch.Freq -1 to 18 kHz.
- LCD - Liquid crystal display 2 x 16.
- PMDC motors.
- Motor drivers - L293DNE.

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Voltage Regulator **:**
A voltage regulator is designed to automatically maintain a constant voltage level.

LM7805/09 Regulator :
The LM7805/12 series is available with several fixed output voltages. Some of the key features are:
1. Output current in excess of 0.5A.
2. No external components.
3. Internal thermal overload protection.
4. Internal short circuit current-limiting.
5. Output transistor safe-area compensation.
6. Available in TO-220, TO-39, and TO-252 D-PAK packages.
7. Output voltages of 5V, 12V, and 15V.

LV-MaxSonar-EZ1:
The LV-MaxSonar- EZ1 provides very short to long-range detection and ranging, in an incredibly small package. The LV-MaxSonar-EZ1 detects objects from 0-inches to 254-inches (6.45-meters) and provides sonar range information from 6-inches out to 254-inches with 1-inch resolution. The interface output formats included are pulse width output, analog voltage output, and serial digital output.

LV-MaxSonar-EZ1 Timing Description:
250mS after power-up, the LV-MaxSonar-EZ1 is ready to accept the RX command. If the RX pin is left open or held high, the sensor will first run a calibration cycle (49mS), and then it will take a range reading (49mS). Therefore, the first reading will take ~100mS. Subsequent readings will take 49mS. The LV-MaxSonar-EZ1 checks the RX pin at the end of every cycle. Range data can be acquired once every 49mS. Each 49mS period starts by the RX being high or open, after which the LV-MaxSonar sends thirteen 42KHz waves, after which the pulse width pin (PW) is set high. When a target is detected the PW pin is pulled low. The PW pin is high for up to 37.5mS if no target is detected. The remainder of the 49mS time (less 4.7mS) is spent adjusting the analog voltage to the correct level. When a long distance is measured immediately after a short distance reading, the analog voltage may not reach the exact level within one read cycle. During the last 4.7mS, the serial data is sent. The LV- MaxSonar timing is calibrated to one percent at five volts, and in use is better than two percent. In addition, operation at 3.3V typically causes the objects range, to be reported, one to two percent further than actual.

Features:
- Continuously variable gain for beam control and side lobe suppression.
- Object detection includes zero range objects.
- 2.5V to 5.5V supply with 2mA typical current draw.
- Readings can occur up to every 50mS, (20-Hz rate).
- Free run operation can continually measure and output range information.
- Triggered operation provides the range reading as desired.

Microcontroller **:**
Criteria for choosing the Microcontroller
1. Meeting the computing needs of the task efficiently.
2. Cost effectiveness.
3. Availability of software development tools like assemblers, debuggers, C compilers, emulator, simulator, technical support.
4. Ready availability and reliability.

Features of P89V51RD2 :
- RAM is 256 bytes.
- 4.0V to 5.5V Operating Range.
- Fully Static Operation: 0 Hz to 33 MHz's.
- Eight Interrupt Sources.
- Three 16-bit Timer/Counters.
- 32 Programmable I/O Lines.
- Full Duplex UART Serial Channel.
- Fast programming time.
- 256 x 8-bit Internal RAM.

Buzzer **:**
The buzzer is connected between the supply rail (+v) and the input signal. This acts as a load on the driver.When the input signal coming into the buzzer subsystem is low, a potential difference across the buzzer causes the current to flow. It is this flow of current that causes the buzzer to sound.

Liquid crystal display **:**
LCD is a thin, flat display device made up of many number of color or monochrome pixels arrayed in a front of light source or reflector. It is prized by engineers because it uses very small amount of electric power and is therefore suitable for use in battery powered electronic devices.The LCD is interfaced to the microcontroller to display the distance to the object. The LCD can be further programmed to display the speed of the motor thus helps in debugging to a great extent.

PMDC Motors **:**
Permanent magnet dc motors are those whose poles are magnetized. Permanent magnet brushless dc motors are becoming popular with continuous cost reductions and performance improvements in the magnet materials. The main advantage of the PMDC motor is the high efficiency, high density and low maintenance cost due to the removal of the brushes.

Features **:**
1. Externally access for brush inspection and replacement.
2. High starting torque.
3. Permanently lubricated sealed ball bearings.
4. Class B insulation (Class F is optional).
5. Solid construction.

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L293DNE:

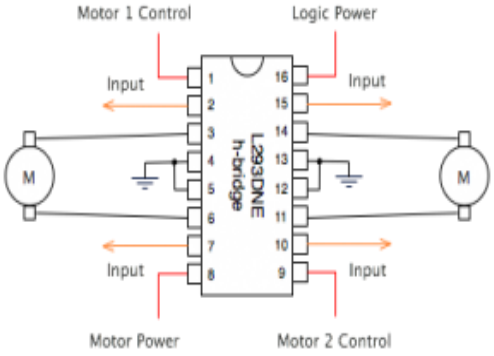
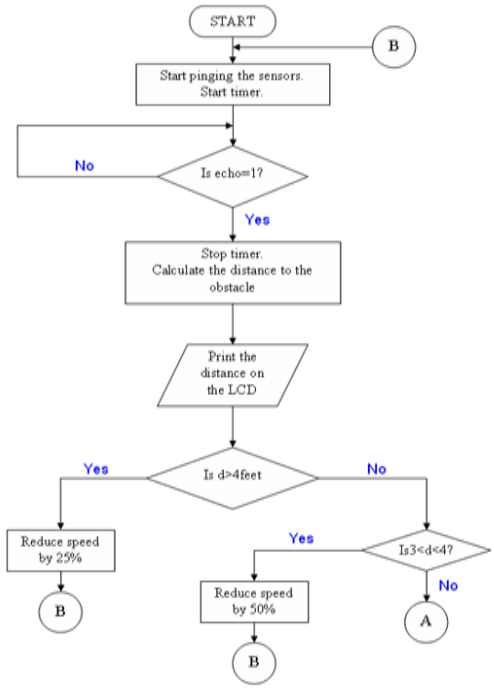


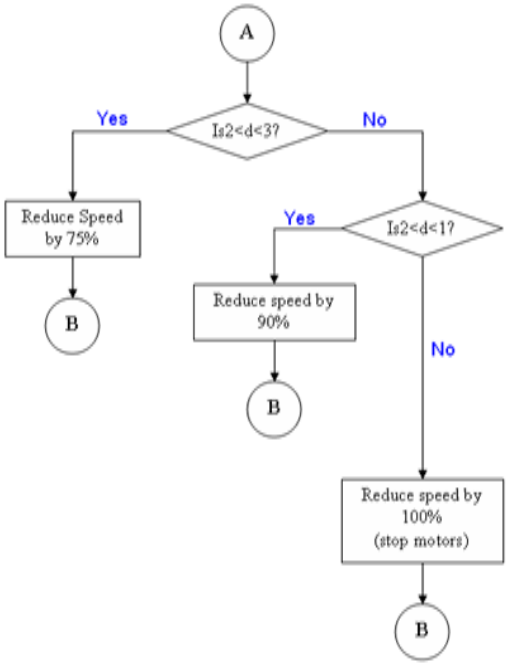
Fig. b

The L293DNE has 16 pins. Pin 16 is enable pin and should always be set to +5V. Pin 8 provides power for both motors. The motor power source should have its positive node connected to pin 8, and ground connected to the grounds of pins 4, 5, 12, and 13. Grounds for the logic control source should also be connected to the same pins.
The motor will be connected to pins 3 and 6. When power is supplied to pin 2, pin 3 will become positive and pin 6 will become ground for the motor. When power is supplied to pin 7, pin 6 will become positive and pin 3 will become ground. Depending on which control pin (2 or 7) is powered, the polarity of the circuit that's going through the motor will change. If neither 2 nor 7 is powered, there will be no current going through pin 3 and 6 and the motor will not be powered.

V SOFTWARE IMPLIMENTATION

The basic idea of the program is represented in terms of flowchart which can be implemented using any platform.





VI. EXPECTED RESULT

[1] To develop a safety system that includes Ultrasonic sensors which detects obstacles and is accompanied by gradual decrease in speed of motors.
[2] A prototype of the entire set up is developed that measures and monitors the road condition from a distance of about 3m from the obstacle.
[3] To develop a suitable warning and alarm system to notify the driver when under threat.
[4] To develop a cost effective alternative to the existing technology which can be implemented in a modest man's vehicle.

VII. CONCLUSION

An attempt has been made in this project to study and comprehend aspects of ultrasonics. The use of the anti crashing system will help in saving human lives . The design presents an anti crashing system which is installed on the moving vehicles . The key idea incorporated in the detection of an obstacle using ultrasonic sensors .Such detection is accomplished by the gradual decrease in the speed of the motors ,thus avoiding an accident. We are confident that in coming years our project if used in proper in efficient direction will become a boon and serve the mankind.

VIII. FUTURE SCOPE

- Phased array ultrasonics can be used instead of the single ultrasonic sensor. This is used for more robust functioning of the obstacle detector.
- Mobile sensor computing system to monitor and assess road surface conditions.

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- Pothole Detection and Warning System using Wireless Sensor Networks.
- The sensors can be mounted in a V fashion at the front and rear end of the vehicle to detect obstacle in any direction.
- A histogram in motion mapping which enables to estimate range accurately.
- Ranging multiple objects using ultrasonic to give a clear view as well as discretion to the user.
- Designing of cost effective ultrasonic sensors whose maximum distance measurement is higher than 30 m.

REFERENCE

[1] S.P. Bhumkar, V.V. Deotare, R.V.Babar " *Accident Avoidance and Detection On Highways*" International Journal of Engineering Trends and Technology- Vol-3,Issue-2, pp.247-252,2012.

2] Ming-Yi Dai, Hsin-Tsung Ho, Chih-Ching Hsiao, "*A Safety System for Intelligent Portable Hybrid Electric Bicycle*", IEEE 2010 International Conference on System Science and Engineering, pp.379-384,june 2010.

[3] William J. Fleming "*Overview of Automotive Sensors*" IEEE 2001 sensors journal, vol. 1, no. 4 , pp.296-308, December 2001.

[4] Alessio Carullo and Marco Parvis, "An Ultrasonic Sensor for Distance Measurement in Automotive Applications" IEEE 2001 sensors journal, vol. 1, no. 2, pp.143-147,Auust 2001

[5] Joon Ahn, Yi Wang, Bo Yu, Fan Bai, Bhaskar Krishnamachari "RISA: Distributed Road Information Sharing Architecture,IEEE 2012 Proceedings, INFOCOM , pp.1427-1502 , August 2012.

[6] Raymond Tatchikou , Subir Biswas, Francois Dion, "Cooperative Vehicle Collision Avoidance using Inter-vehicle Packet Forwarding", IEEE 2005 Globecom ,pp.2762-2766 , January 2005.

[7] Jakob Eriksson, Lewis Girod, Bret Hull,Ryan Newton, Samuel Madden, Hari Balakrishnan, "The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring", IEEE journals, June 2008.

[8] Artis Mednis, Girts Strazdins, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo,"Real Time Pothole Detection using Android Smartphones with Accelerom`eters" IEEE journals ,July 2011.