ACCIDENT PREVENTION USING ULTRASONIC SENSOR

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Abstract

In India transportation is a booming field where the number of vehicles is increasing day by day. Safety of those vehicles is a risky one. Many researchers worked on monitoring vehicles and alerting in case of accidents & digital locking system previously & still the research is going on. Going further, the system will be more advanced when it will help to avoid accidents. Proposed system will help to reduce the number of accidents by avoiding vehicle collisions. For this purpose, 2 ultrasonic sensors are fitted on the front & back side of the vehicle. These sensors will measure objects in front & back of the vehicle. IR sensor is used for speed measurement. A prototype for this system consists of a toy car with battery & a remote control for demonstration. By making a combination of speed & nearby objects, it will decide time to apply breaks.

Keywords: Collision avoidance, accident prevention, Arduino, smart vehicle, electric vehicle.

I. INTRODUCTION

A collision avoidance system is a currently emerging technology in the field of automobiles. It is also known as pre-crash system, forward collision warning system or collision mitigating or car anti-collision system. An automated car anti-collision system is an automobile safety system design to reduce the accidents as road traffic accidents are the largest cause of injury-related deaths worldwide .When driver himself is not concentrating on driving or any other parameters, that time it may cause damage to vehicle (car) as well as a life, that time automated ant-car collision device can play an effective role regarding the danger ahead. An automated anti-collision system device is placed within a car to warn its driver of any dangers that may lie ahead on the road. Once the detection is done this system either provides a warning to the driver when there is an imminent collision or takes action autonomously without any driver command (by braking or steering both). This system runs by a microcontroller that detects obstacles with a speed sensor and stops the vehicle by 2 giving instruction to the actuator. With the advancement in technology it is possible to minimize the human errors and avoid the casualties.

- Replacement for animal power & human effort.
- Reduces tilling time

The machine makes use of a wheel with welded angles to provide efficient gripping on soil. The wheel design is developed to provide a firm grip on soil strong enough to drag the cultivator forks while tilling. A switch provided on The handle is used to switch on and off the machine. The machine is driven by an electric motor which uses a sprocket chain arrangement to drive the pulling wheel.

A battery is used to power the motor with a force capable of pulling the forks through soil. The 3 x cultivator forks allow for easy and narrow tilling exactly as needed for farming. The portable lightweight design makes it easy to control the direction of the machine while in use. Also, it can be easily carried around in vehicles or by hand for transporting the machine. Thus, the electric power tiller provides a smart innovative fuel free mechanism to farm and garden tilling.

II. WORKING MECHANISM

A prototype for this system consists of a toy car with battery & a remote control for demonstration. By making a combination of speed & nearby objects, it will decide intensity to apply breaks. System will show speed on the LCD display & provide buzzer alert when objects are close.
2 different alert situations are:
1. Alert when vehicle is at low speed & object is at short distance.
2. Alert when vehicle is at high speed & object is at long distance.
When another vehicle comes too close. the vehicle will move forward or reverse automatically to avoid collusion.
It will also blow horn to get the attention of the driver.
Another feature of the project is. slow breaking. In this mode. while stopping the vehicle. It will gradually reduce the vehicle speed

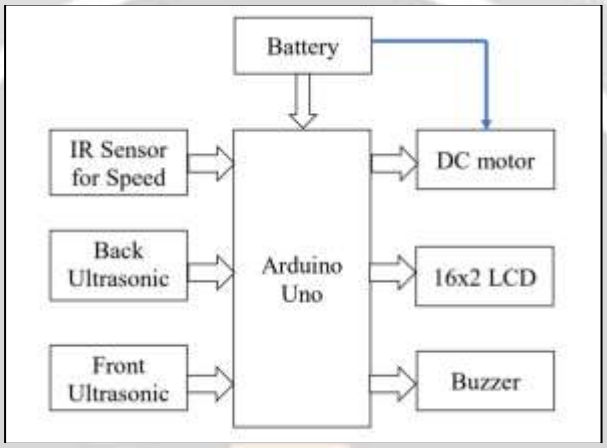


Fig. 1. Block Diagram

III. Selection of Components

Arduino uno:
Arduino Uno is ATMEGA328P microcontroller board based. It has 14 digital input/output pins of which 6 can be used as PWM outputs and 6 analog inputs/outputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. Features of Arduino uno board are as follows:


Fig.2 Arduino Uno

Features:
• Microcontroller: ATmega328.
• Input Voltage: 7-12V.
• Input Output Pins: 20
• DC Current: 40mA.
• Programming Software: Arduino IDE
• Programming Language: C

Ultrasonic Sensor:
Ultrasonic sensor HC-SR04 is used to measure distance in the range of 2cm400cm with an accuracy of 3mm. The ultrasonic sensor module works on the natural phenomenon of ECHO of sound. The distance of the obstacle from the sensor is simply calculated by the formula given as: Distance= (time x speed)/2.

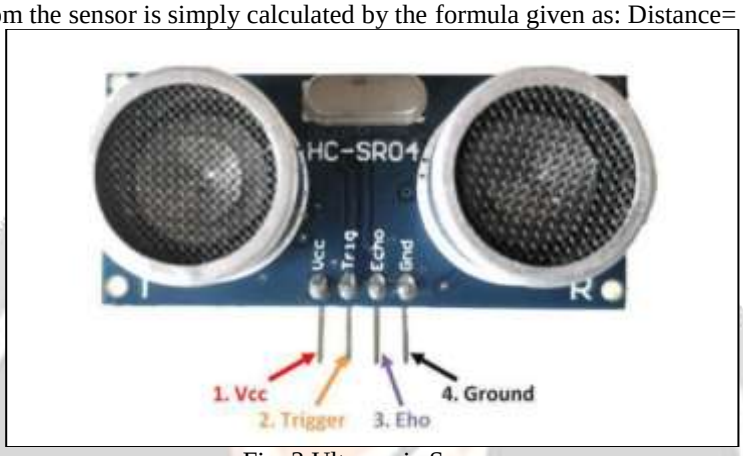


Fig. 3 Ultrasonic Sensor

Specifications:
• Operating voltage: +5V.
• Theoretical Measuring Distance: 2cm to 450cm.
• Practical Measuring Distance: 2cm to 80cm.
• Accuracy: 3mm.
• Measuring angle covered: <15°.
• Operating Current: <15mA.
• Operating Frequency: 40Hz.

LCD 16X2:
LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is a very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. the 16×2 LCD is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16*2 LCD, hence we are using it here. All the above mentioned LCD displays will have 16 Pins and the programming approach is also the same and hence the choice is left to you. Below is the Pinout and Pin Description of 16x2 LCD Module.

Fig. 4 LCD Display

4-bit and 8-bit Mode of LCD:

The LCD can work in two different modes, namely the 4-bit mode and the 8- bit mode. In 4 bit mode we send the data nibble by nibble, first upper nibble and then lower nibble. For those of you who don't know what a nibble is: a nibble is a group of four bits, so the lower four bits (D0-D3) of a byte form the lower nibble while the upper four bits (D4-D7) of a byte form the higher nibble. This enables us to send 8 bit data. Whereas in 8 bit mode we can send the 8-bit data directly in one stroke since we use all the 8 data lines. But 8-bit mode is faster and flawless than 4-bit mode. But the major drawback is that it needs 8 data lines connected to the microcontroller. This will make us run out of I/O pins on our MCU, so 4-bit mode is widely used. No control pins are used to set these modes. It's just the way of programming that changes. Read and Write Mode of LCD: As said, the LCD itself consists of an Interface IC. The MCU can either read or write to this interface IC. Most of the time we will be just writing to the IC, since reading will make it more complex and such scenarios are very rare. Information like position of cursor, status completion interrupts etc. can be read if required, but it is out of the scope of this tutorial. The Interface IC present in most of the LCD is HD44780U, in order to program our LCD we should learn the complete datasheet of the IC.

Pin number	Pin Name	Pin Description/Function
1	Vss = Ground	Connect this to your system ground or reference
2	Vdd (Logic power)	Logic voltage to drive LCD, this could be 5V or 3.3V. 5V is best for colder temperatures.
3	V_E	Contrast adjust to lighten or darken the character with respect to the background. This is a variable between max logic power and ground.
4	RS = Register Select	Connect this to your microprocessor to shift between Command and the data register
5	RW = Read/Write	Used to read or write data between the LCD and the microprocessor. This can be tied to ground if you only plan to write data.
6	Enable	0 or 1 to communicate with the microprocessor
7	DB0	DB is Data Bit from 0 to 7
8	DB1	These are connected to the microcontroller to send/receive up to 8 bits of data at a time. It is possible to only use four data bits if you have limited I/Os. (In/Outs)
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	LED +	This is the power for the LED and is independent of the LCD voltage. About 50% of the LCDs have pin 15 as positive and 16 negative, the other 50% are reversed. LEDs are DC(Direct Current) and have polarity.
16	LED -	

Fig. 5 16x2 LCD Display Pin Description

LCD Commands:

There are some preset commands instructions in LCD, which we need to send to LCD through some microcontroller.

Specifications:

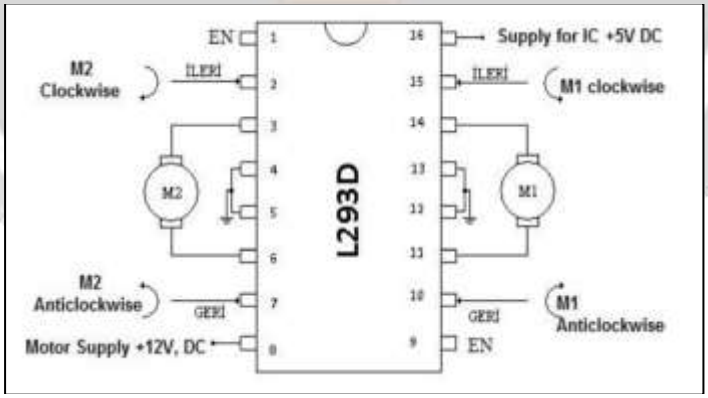
Operating voltage: 5V DC
Operating current: 50mAmp
Display capacity: 2 lines of 16 characters each.
Communication type: Parallel
Memory storage: EEPROM inbuilt
Maximum operating temperature: 45 Degree Celsius.

Battery:

Fig. 6 Battery

A rechargeable battery is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. In our project we are using a 12V-1.3AH lead acid rechargeable battery.
Features:
16 Absorbent Glass Mat (AGM) technology for efficient gas recombination.
Up to 99% and freedom from electrolyte maintenance or water adding.
Can be mounted in any orientation.
Computer designed lead, calcium tin alloy grid for high power density.
Long service life, float or cyclic applications.
Maintenance-free operation. Low self-discharge.

L293D motor driver module:



L293D:
The L293 and L293D are quadruple high-current half-H drivers. The L293NE is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. This device is designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications. All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudoDarlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enabled input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

Features:
Wide Supply-Voltage Range: 4.5 V to 36 V

Separate Input-Logic Supply
Pin compatible with L293D
Internal ESD Protection
Thermal Shutdown
High-Noise-Immunity Inputs
Output Current 0.6 A Per Channel
Peak Output Current 2 A Per Channel
Output Clamp Diodes for Inductive Transient Suppression

DC Motor:
These motors are simple DC Motors featuring gears for the shaft for obtaining the optimal performance characteristics. They are known as Center Shaft DC Geared Motors because their shaft extends through the center of their gear box assembly.

Fig. 6. DC Motor

Features:
• DC supply: 12V
• RPM: 150 at 12V 18
• Torque generated: 5Kg
• Type: Brush motor
• Stator: Permanent magnet
• Geared motor
• Motor diameter: 36mm
• Shaft diameter: 6mm

Infra-Red:
Sensor The Multipurpose Infrared Sensor is an add-on for your line follower robot and obstacle avoiding robot that gives your robot the ability to detect lines or nearby objects. The sensor works by detecting reflected light coming from its own infrared LED. By measuring the amount of reflected infrared light, it can detect light or dark (lines) or even objects directly in front of it. An onboard RED LED is used to indicate the presence of an object or detect line. Sensing range is adjustable with an inbuilt variable resistor. The sensor has a 3-pin header which connects to the microcontroller board or Arduino board via female to female or female to male jumper wires. A mounting hole for easily connecting one or more sensors to the front or back of your robot chassis.

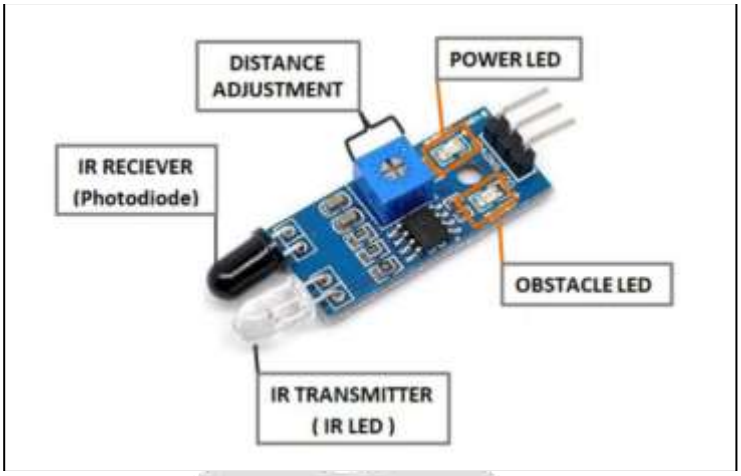


Fig. 7. Infra-Red Sensor

Features:
5VDC operating voltage.
I/O pins are 5V and 3.3V compliant.
Range: Up to 20cm.
Adjustable Sensing range.
Built-in Ambient Light Sensor.
20mA supply current.

Buzzer:
A buzzer or beeper is an audio signal device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke. If the embedded system is misplaced from the dashboard, the IR sensor becomes active. The signal is sent to the microcontroller to ring the buzzer. It is connected to the pin no.28 of the microcontroller.

Fig.8. Buzer

Features:
Operating voltage: 4V to 8V DC.
Operating Temperature: -25°C to +80°C.
Sound Output at 10cm*: ≥85dB.
Resonant Frequency: 2300 ±300Hz.
Tone : Continuous.

EXPECTED RESULTS:

Expected Result of System:

During the design of system prototype there are some terms considered. There are as follows Vehicle is at highest speed (MaxSpeed) > 120 RPM Vehicle is at high speed (HighSpeed) > 80 & <120 RPM Vehicle is at safe speed (SafeSpeed) <= 80 RPM Object at lowest distance (leastDist) < =25cm Considerable object at distance (minDist) >25cm & <30cm Not considerable object at distance (OkDist) >50cm These distance are considered with respect to sensors used and need to update with further advancement. Depending on these terms there are different cases on which system responds. These are cases are given in below table:

Sr. No.	Object Distance	Vehicle speed	Conclusion	Break Action	Buzer & Display
1.	Front distance < least Dist	Not concidered	Front object is so close	Apply immediate breaks. Make speed=0	Buzer=ON Display: Front object so close
2.	Front distance < minDist	Speed > MaxSpeed	Speed is highest & object is so close	Apply immediate breaks. Make speed=0	Buzer=ON Display: Object so close
		Speed > HighSpeed	Speed is high. Object at considerable distance	Reduce speed gradually to 0 (Slow stop)	Buzer=ON Display: Object Coming
3.	Front > OkDist	Not concidered	No close objects on front	No action	Buzer=OFF Display: Driving good
4.	Back distance < least Dist	Not concidered	Back object is so close	No action	Buzer=ON Display: Back object so close
5.	Back distance < minDist	Speed > MaxSpeed	Speed is highest & object is so close	No action	Buzer=ON Display: Back Object so close
		Speed > HighSpeed	Speed is high. Object at considerable distance	No action	Buzer=ON Display: Back Object Coming
6.	Back > OkDist	Not concidered	No close objects on back	No action	Buzer=OFF Display: Driving good

Table no. 2 Results

CONCLUSION:

People are always in a rush to reach their destination as early as possible to save their time or to reach their destination on time without thinking about their lives' value, what would happen if they met up with an accident which means colliding with another vehicle for their tendency to go somewhere within a flash. This results in injury or loses of their lives. In this project the prototype for vehicle collision avoidance system is implemented successfully for electric vehicles. The prime motive behind the project is to reduce the accidents. In this project,, vehicle stops automatically when any object come closer to it. It also considers vehicle speed while considering distance. Use of Arduino board and IDE was so helpful during development of project. We also learn to design circuits in Proteus design software. Though till now, complete design is ready, actual hardware implementation will begin in the next phase of the project.

FUTURE SCOPE:

System can be attached to steering of the vehicle, so that it will change its direction with steering to detect objects and obstacles on turns. This system can be modify & use with trains. Since trains travel in a straight line, it will provide good results.

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