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AUTOMATIC SPEED CONTROL OF A CAR TO AVOID COLLISION

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Abstract*-The main objective of this project is to design a car that automatically detects the obstacles and speed control of a car to avoid accidents on its path through a pair of ultrasonic sensor. This system needs a microcontroller and a battery for power supply. In this system, the ultrasonic sensor pair is connected to the microcontroller to sense the obstacles. The motors are controlled by the motor driver IC, which is interfaced to the microcontroller. Whenever the vehicle goes on the desired path, the ultrasonic sensor transmits the ultrasonic waves continuously from its sensor head. Whenever an obstacle comes ahead of it such as this distance is 5 cm, the ultrasonic waves get reflected back from the obstacle and the information is passed to the microcontroller. The microcontroller controls the motors speed based on the ultrasonic signals received. In this project to control the speed of motor, the pulse width modulation technique is used. The model is designed so that the car stopped for any obstacle within 5 cm and for obstacle larger than 5 cm the car is moving.*

Keywords: Ultrasonic sensors, Microcontroller, DC motor, PWM

1. INTRODUCTION

According to the National Sleep Foundation 2005 report, 60% of adult drivers about 168 million people say, they have driven a vehicle while feeling drowsy in the past year, and more than one-third (103 million people), have actually fallen asleep at the wheel! In fact, of those who have nodded off, 13% say that they have done so at least once a month. Approximately eleven million drivers admit they have had an accident or near accident because they dozed off or were too tired to drive. The National Highway Traffic Safety Administration conservatively estimates that 100,000 police-reported crashes are the direct result of driver fatigue each year. This results in an estimated 1,550 deaths, 71,000 injuries, and $12.5 billion in monetary losses. These figures may be the tip of the iceberg, since currently it is difficult to attribute crashes to sleepiness [1]. This is one of biggest reason that causes accident because driver due to drowsiness cannot cope up with a changed situation and hence causes accident. This project is designed to develop a new system that can solve this problem where drivers may not brake manually but the vehicles can stop automatically due to obstacles. Automatic braking technologies combine sensors and brake controls to help prevent high speed collisions [2].

2. MAIN COMPONENTS

To design a car the following parts required (as shown in Table 1).

Table 1: Parts of a speed control car

Ultrasonic sensors(HC-SR04)	Power supply(12V)
Microcontroller(PIC16F73)	Bero-board
Motor driver L298N	Resistance
LM7805 voltage regulator	Capacitor
Crystal(20MHz)	DC motor
Relay	Transistor

3. PROJECT ALGORITHM

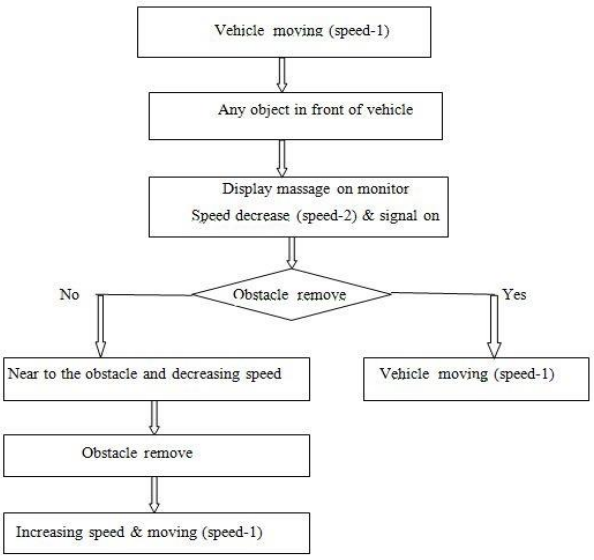

Fig.1: Project algorithm

4. STRUCTURAL DESIGN AND FABRICATION

4.1 Ultrasonic Sensors:

In this project I used to HC-SR04 model of ultrasonic sensors. It has transmitter and receiver section. Ultrasonic ranging module HC-SR04 provides 2cm-400cm non-contact. The ranging accuracy can reach to 3mm. The normal frequency range for hearing of humans is roughly around 20 to 20,000 hertz. Ultrasonic sound waves are the sound waves that are above the range of human hearing capability and, so have a frequency above 20,000 hertz. Any frequency which is above 20,000 hertz may be considered as ultrasonic sensors. [4]

Fig.2: Ultrasonic sensors.

The ultrasonic transducer produces ultrasonic signals. These signals propagate through a sensing medium and the same transducer can be used to detect the returning signals. Ultrasonic sensors usually have a piezoelectric ceramic transducer that converts an excitation electrical signal into ultrasonic energy bursts. This energy bursts travel from the ultrasonic sensor, bounce off objects, and are returned towards the sensor as echoes. Transducers are the devices that convert electrical energy to mechanical energy, or vice versa. [5] The transducer converts the received echoes into analog electrical signals that are outputs from the transducer. This sensor interface with micro controller with one output named as the trigger and one input named as echo. If echo signal reflected by obstacle and high width is detected is in predefined range, then obstacle detection is considered and same time left motor and right motor signals to stop running as soon as obstacle removed.

Test distance = velocity of sound (340M/S)* high level time /2

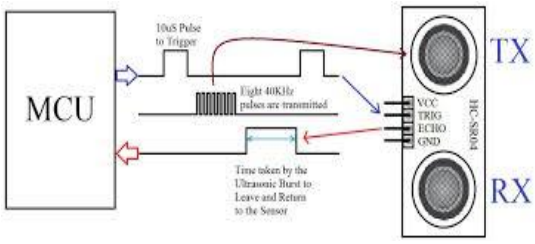

Fig.3: Microcontroller interfacing with ultrasonic sensors

4.2: Microcontroller:

I use PIC16F73 microcontroller. It has 28 pin. To make this PIC16F73 is used which has three ports called PORTA, PORTB & PORTC. A program is loaded in the microcontroller for the speed control of a car. This program is written by microC language.

Key reference manual features a PIC16F73:

- Operating Frequency : DC- 20 MHz
- RESETS and Delays: POR,BOR,(PWRT,OST)
- FLASH Program Memory –(14-bit words, 1000E/W cycles) : 2K
- Data Memory –RAM(8-bit bytes): 128
- Interrupts : 8
- I/O Ports : PORTA, PORTB, PORTC
- Timers : Timer0, Timer1, Timer2
- Capture/Compare/PWM Modules : 1
- Serial Communication : SSP
- 8-bit A/D Converter : 5 channels
- Instruction Set : 35 [8]

DIP, SOIC, SSOP

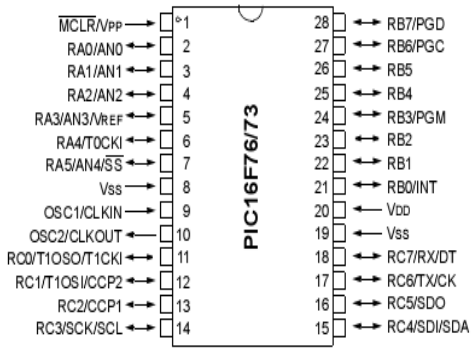

Fig.4: PIC16F73 Microcontroller pin diagram

4.3 DC motor:

The device that converts electrical energy into mechanical energy is called as a motor. The motor that utilizes a DC supply to produce mechanical output is DC Motor. [6] DC motor is connected to the motor driver L298N. Battery must be translated to the 12V needed by the DC motors, and regulated in such a way as to provide speed, acceleration, and directional control to the car. The motor speed can be controlled by motor driver L298N. Motor driver is also interfaced with microcontroller.

4.4. PWM (Pulse Width Modulation Technique):

Microcontroller provides PWM to the motor driver. Pulse width modulation (PWM) is a method for binary signals generation, which has 2 signal periods (high and low). The width (W) of each pulse varies between 0 and the period (T). The main principle is control of power by varying the duty cycle. [3] Here the conduction time to the load is controlled. Let for a time t1, the input voltage appears across the load i.e. ON state and for t2 time the voltage across the load is zero.

5. PROPOSEDM SYSTEM

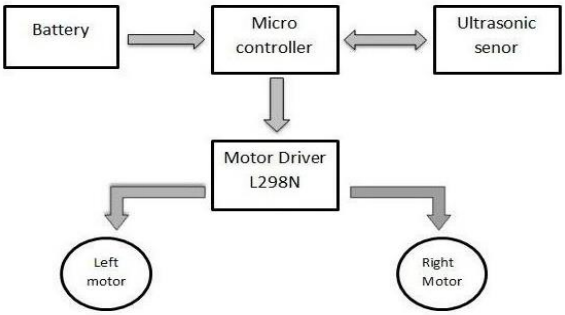

Fig.5: Block diagram of model

The block diagram consists of microcontroller, ultrasonic sensors and motor driver. The heart of the system is microcontroller. The scope of this work is to develop a safety car braking system using ultrasonic sensor and to design a car without human to the driving. Currently in cars there aren't technologies to prevent accidents. But they have introduced sensors that would detect any obstacles. Besides this it also gives an alert to the driver. In this work we are introducing automatic brakes, which would get its input from the sensors, which will then generate the brakes and avoid from collisions to take place. There is a transmitter which is kind of like an ultrasonic wave which is used to detect any kind of physical obstacle. While transmitting the ultrasonic wave, there is a part which is ultrasonic wave generator that functions to generate ultrasonic wave. The sound waves that are transmitted are totally reflected from a particular target and then back to the transmitter. The targets could have any kind of reflective form- also round objects. There are variables which could affect the working of the ultrasonic. After ultrasonic waves were produced, ultrasonic transmitter transmits the ultrasonic waves toward a road surface to find out the obstacle. The range that obstacle detected is depends on the range of ultrasonic sensors that used. The ultrasonic wave detects any kind of physical obstacle; hence it will produce a reflected wave. Once the obstacle is detected there is a reflector which reflects the ultrasonic waves. An ultrasonic receiver is used for this which does the receiving of the ultrasonic waves, reflected from the road surface to generate a reception signal. There is ultrasonic transducer that will transform back the sound wave to electrical energy. Once this is complete the sensors give an alarm as to an obstacle detected. Hence calculate the distance. The processed signal will be send to the microcontroller. A program is loaded in the microcontroller. Then microcontroller provides PWM signal to the motor driver for controlling the motors.

5.1: CIRCUIT DIAGRAM:

In this circuit, the microcontroller gives input to the ultrasonic sensors by pin RC0 and receives output from the ultrasonic sensors by pin RC3. Microcontroller provides PWM signal to the motor driver at pin ENB and ENA by using pin RC1 and RC2. Motor driver input such as N1, IN2, IN3 and IN4 is connected to the microcontroller pin RC4, RC5, RC6 and RC7. LCD is also connected at microcontroller PORTB.

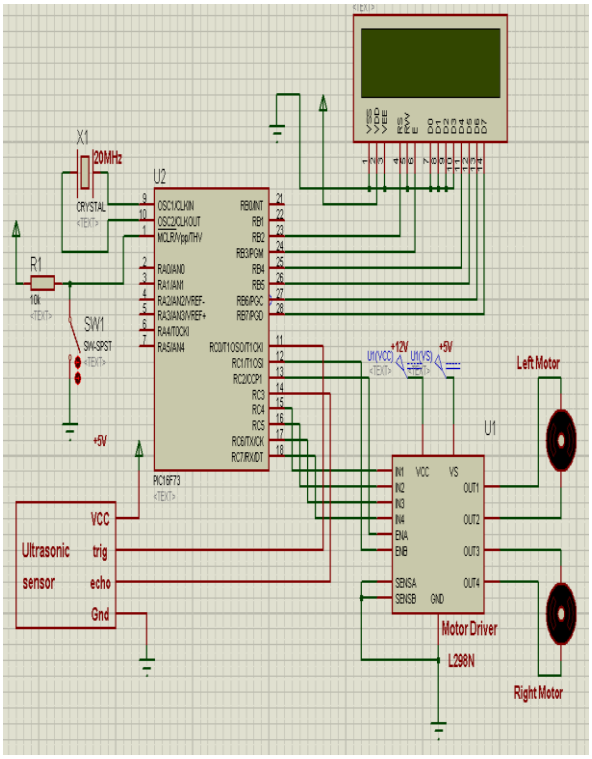

Fig.6: Circuit diagram

5.2: TOTAL SETUP:

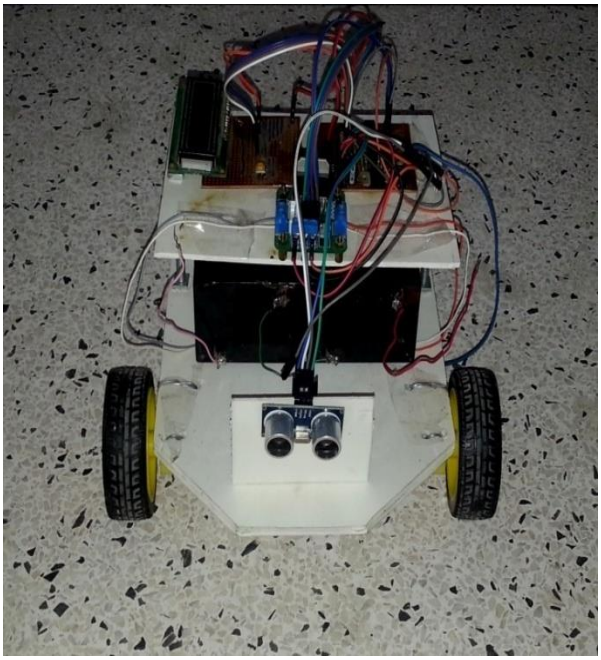

Fig 7: Structural model (a)

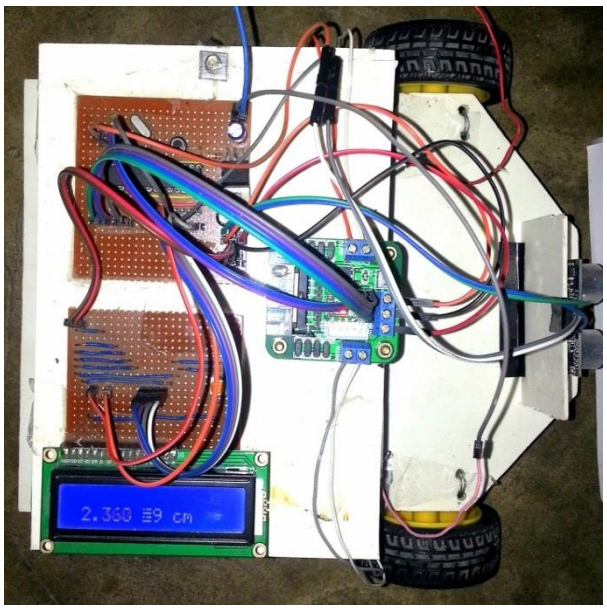

Fig 8: Structural model (b)

6. CONCLUSION

The main purpose of this project is to reduce unnecessary accident without human effort. Ultrasonic sensors measure the distance easily. DC motors have speed control capabilities, which means that speed, torque and even direction of rotation can be changed at anytime to meet new condition. The microcontroller will maintain the motor speed when there is a variation of distance. By changing the PWM signal from microcontroller to the motor driver unit, motor speed can be controlled. The design of this system is very sensitive and should be handled with most care because there are number of subprojects combined together. So every parameter should be given important while designing and interfacing circuit between the microcontrollers, ultrasonic sensors, motor driver, LCD display.

Application:

- ✓ By the using of this system we can control the speed very easily.
- ✓ We can easily detect the obstacle.
- ✓ The unnecessary speed brake made in the road is avoided.
- ✓ Transportation applications.

7. ACKNOWLEDGEMENT

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