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Vehicle Automation and Accident Avoidance by Detecting Pedestrian Using Multiple Sensors

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***Abstract*—Now a days, due to heavy population of vehicles, the drivers are not able to instantly control the vehicles, when the obstacles and pedestrian are crossing suddenly. This may lead to accident, sometimes pedestrian loss may occur. There are many existing system available to control the problem but not efficient. The proposed work aims at designing a system which automatically detects the presence of any pedestrian nearer to the vehicles and stop the vehicle motors automatically by using ultrasonic sensors and also alert the driver automatically through AVR voice module. Including that the fuel level and pressure level also alerted to the driver automatically, when it reaches below the threshold level. This work can prevent human life and also control the traffic collision efficiently.**

***Index terms*—accident avoidance, collision reduction, and automation.**

1. INTRODUCTION

In today, heavy population of automobile increases the number of accidents. These accident are mostly caused by the delay of driver to hit the brake, when pedestrian or any object is detected. To prevent the accident caused by this delay, a new system that can solve this problem where drivers may not brake manually, but the vehicle can stop automatically due to obstacle or pedestrian detection. This system uses two sensors. i.e. ultrasonic wave emitter and ultrasonic wave receiver. The ultrasonic wave emitter provided in front portion of an automatic breaking vehicle producing and emitting ultrasonic waves in a predetermined distance in front of the car. Ultrasonic wave receiver is also provided in front portion of the vehicle receiving the reflected ultrasonic wave signal from the obstacle. The reflected wave is measured to get the distance between vehicle and the obstacle. Then PIC microcontroller is used to control the motor based on detection pulse information and servo motor in turn automatically control the breaking of the vehicle. Thus, this new system is designed to solve the problem where drivers may not be able to brake manually, exactly at the required time, but the vehicle can still stop automatically by sensing the obstacle to avoid an accident.

2. EXISTING SYSTEM

The existing approaches uses for safety measures and preventing accidents are emergency braking systems(EBS), traction control and stability control. Even infrared sensor are also widely used as a proximity sensor and for obstacle avoidance, but not successful due to some drawbacks. They also uses camera to observe the pedestrian. The camera will capture the image on each side of the car, and the captured image will displayed in the LED display by frame by frame. So, If the driver is in drowsiness or not monitored frequently, it may leads to accident and the camera will not give accurate results and the driver should want to apply break manually, not automatically. So we can only observe pedestrian but we cannot prevent the pedestrian from accident. The air level in the vehicle tyre also should monitor manually in the existing system. If the car tyre air reduces suddenly while driving in a highway, it may cause accidents. Air cooler level inside the car will also change manually, not automatically.

3. PROPOSED SYSTEM

The aim of work is to develop an accident avoidance vehicle braking system using ultrasonic sensor and to design a vehicle with less human attention to the driving. Currently in cars there are not technologies to prevent accidents. But they have introduced sensors to detect any obstacles. We have designed this system using ultrasonic sensor to detect the pedestrian and ABS breaking system to stop the vehicle automatically. There is also another concept in this project. That is vehicle automation. Monitoring the air level in vehicle tyre is only through manually in existing system. But we have designed that the air level and fuel level and temperature level in car will monitor automatically and if any of the things goes to the lower level than recorded level, then it will alert the driver using AVR voice module and LCD display.

a.COMPONENTS

- Ultrasonic sensor
- Level sensor
- Pressure sensor
- Temperature sensor
- Pic16f887
- Driver circuit
- LCD

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- Braking system
- AVR

b.DESCRIPTION

(i) ULTRASONIC SENSOR:

This sensor is used to measure distance between objects or any obstacles. It uses high frequency sound waves called ultrasonic waves to detect presence of any obstacles and its range. Normal frequency range of human ear is 20 Hz to 20,000 Hz. Here, we are sending ultrasonic waves and the waves reached the object and reflect back to the sensor. Ping sensor output is a variable-width pulse. Ultrasonic sensor provides an easy method of distance measurement. This sensor is perfect for any number of application that require you to perform measurements between moving or stationary objects.

Ultrasonic transmitter:

Before transmitting the ultrasonic wave, transducer is used to generate ultrasonic waves. The transducer is given a signal. After that ultrasonic transmitter sends the waves at predetermined distance frontward. The maximum distance for which obstacle can be detected depends on the range of ultrasonic sensors used.

Ultrasonic receiver:

If the ultrasonic wave detects the obstacle, it will produce reflected wave. An ultrasonic receiver is used for receiving the ultrasonic wave reflected from the obstacle. The received ultrasonic wave is converted into a reception signal with the help of a transducer. The signal is amplified by an amplifier. The amplified signal is compared with the reference signal to detect components in amplified signal due to obstacles on the road.

The time taken for transmitting the wave and receiving the echo from object is used to calculate the distance. This easy to use distance sensor from parallax employs sonar to detect from approximately 0.75-120 inches (2cm-3meters).It can be calculated by using formula,

Distance=speed*time/2

Fig 1: PING ultrasonic sensor

Specification:

- Supply voltage-5v
- Ultrasonic frequency-40KHz
- Power consumption-15mA
- Temperature range-(+32 to+158F)

(ii) TEMPERATURE SENSOR

Temperature sensor is used to calculate temperature of room, or vehicle, etc… here why we are using temperature sensor means, depends on temperature level in a car, the ac level will change automatically. The temperature sensor will sense the temperature in a car and then the ac level will change automatically depends on temperature. This temperature sensor does not require any external calibration. It is used for single power supplies. The low output impedence, linear output and precise inherent calibration of device makes interfacing to read out or control circutary especially easy. It is also low self heating.

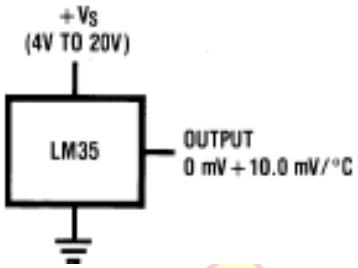

Fig2: LM35 temperature sensor

Specification:

- Operates from 4 to 30 volts
- Calibrated directly in ° Celsius.

(iii) PRESSURE SENSOR

Pressure sensor is used to calculate pressure level in the car tire. Sometimes, it acts as a transducer. If the air level in the car tire reduces, the pressure sensor will sense the air level and give some alert to the driver. It is also provides a very accurate and linear voltage output directly proportional to the pressure applied. These standard, uncompensated sensors permit manufacturers to design and add their own external temperature compensation and signal conditioning networks. Compensation techniques are simplified because of the predictability of free scale's single element strain gauge design.

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Fig3: MPX53 piezo resistive pressure sensor

Specification:

- Min pressure- 175 kPa
- Max pressure-200 kPa
- Power supply- 3-6v
- Pressure range- 0to 50kPa
- Sensitivity- 1.2mv-kPa
- Output- 0mv -60mv(3v)

(iv) LEVEL SENSOR

Level sensor is used to measure the level of any liquid such as water, fuel, oil, etc.., here, we are using level sensor to measure the level of fuel level and if the fuel level goes to the lower level of stored value, it will give alert to the driver using AVR voice module.

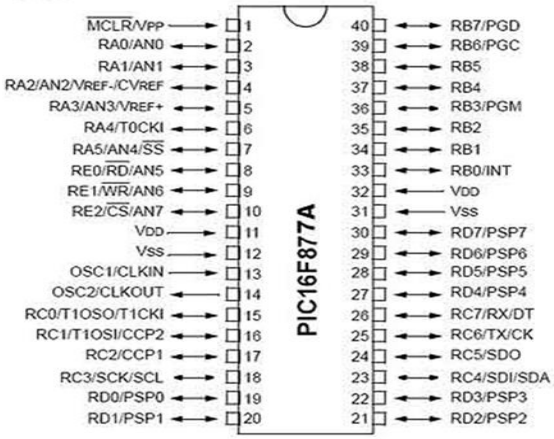
Fig4: floating type fuel level sensor

Specification:

- Supply voltage- 12 to24 vdc
- Current consumption-12mA
- Diameter-8 to 11mm

(v) PIC16f877A

Programmable Interface Controller is the heart of the circuit. It is the 8Bit microcontroller. It is a 40pin package. In that 32 pins for input and output. 4 pins for voltage supply and ground. 2 pins acts as an analog to digital converter. It consists of EEPROM which is used to reprogramming. It consists of 368bytes RAM and 2 comparator.



The pic16f877A futures 256bytes of EEPROM data memory, self-programming, an LCD, two comporates, 8 channels of 10 bit anlog – digital converter, to capture, the synchronizes serial port can be configured as either 3-wire serial peripheral interface and a universal asynchronies receiver transmitter. Each pins are only shared between two or three functions. Low –endrange, midrange and high endrange of controllers.

(vi) DRIVER CIRCUIT

The driver circuit is used to drive the DC motor. The input of driver circuit is +5V from the microcontroller unit is passed through the resister to keep the electronic devices from the over voltage. The relay have four parts: two relays for first driver circuit and another two relays for next driver circuit. It is used to regulate or convert the voltage from 12V to 5V. A relay is an electrical swap that opens and closes under the control of one other electrical circuit.

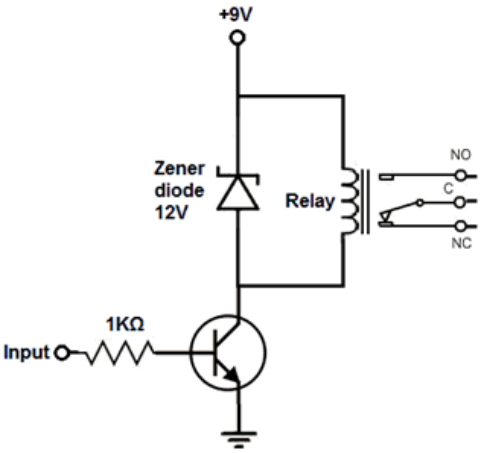


Fig5: driver circuit

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(vii) AVR VOICE MODULE

Automatic Voice Response is acts as an indicator. Example of AVR voice module is ISD1820. It is a multi-storage device used for recording purpose. It is a nonvolatile storage device.it is very easy to use and it can be placed in arduino, pic microcontroller. We can record our voice up to 20s using this AVR voice module.

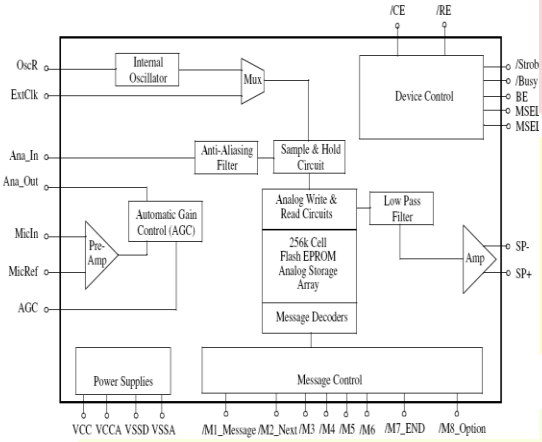


Fig6: block diagram of AVR voice module

Specification:

- Single-chip, high-quality voice recording.
- No external ICs required
- Non-volatile Flash memory technology
- No battery backup required
- Operating current: 25 mA typical
- Standby current: 1 uA typical

(viii) LCD

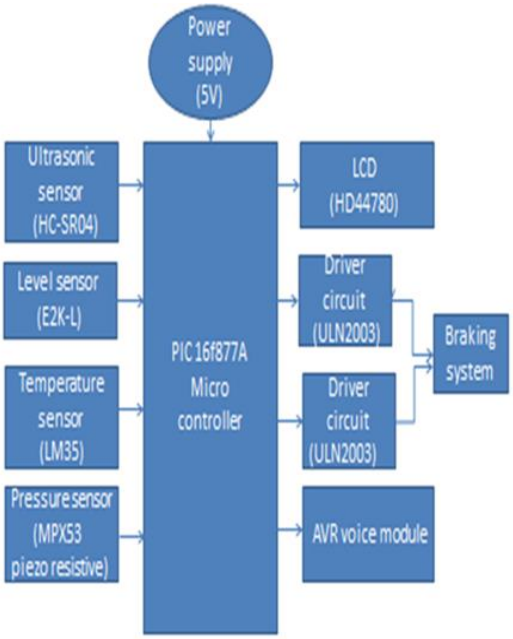
Liquid crystal display is 16X2 matrix display. Here, 16 is column and 2 is rows. LCD is used to display the output. It is also used to display the images using some codes. It is also called as electronic visual display. LCD is also used in television, computers, etc.

Fig6: 16X2 LCD display

c.OPERATION

There are two processes

1. Prevent the pedestrian from accident.
2. Maintaining recorded distance between two vehicles.



(i)ACCIDENT AVOIDANCE

The transducer acts as an ultrasonic sensor. There are two processes. Transmitting and receiving. It transmits the ultrasonic wave and it will reach the object and then reflect back to the sensor. The time taken between transmitting and receiving the echo from object issued to find the distance between object and obstacle. Now the distance is calculated by using ultrasonic sensor. Already we programmed some constant distance in a pic controller. (i.e.) 3 to 5 meters for pedestrian detection and 10m for avoiding traffic collision. If the calculated distance is less than the recorded distance of 3m to 5m, then the first driver circuit goes to ON position and the break will apply automatically. This will prevent the human being from accident. If the calculated distance is more than 5m to less than10m, the second driver circuit will goes to the ON position and then the car will maintain a distance of 10m automatically by applying ABS brake. It is to apply break by reducing the speed of the car. It is used to avoid the car by skidding. We can also place a multiple ultrasonic sensor on each side of the car to observe the pedestrian or object nearer to our vehicle.

(ii)VEHICLE AUTOMATION

AIR LEVEL

Monitoring the air level in the car tire is not that much easy for all drivers. It may cause accidents if the level of air is low in the car tire. We have designed this to avoid that accident and maintaining air level in the tire automatically using MPX53 piezo resistive pressure sensor. It will sense the pressure level in the car and if the level of pressure is less than the recorded level in the program, it will give alert to the driver using AVR voice module. This MPX53 piezo resistive sensor will produce very accurate results. The unit of pressure is kPa.

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TEMPERATURE LEVEL

The temperature level inside the car will increase or decrease depends on weather. We have to change the air cooler level manually if the car is heat, in the existing system. But we have designed this system to change the ac level automatically depends on whether using temperature sensor. It also consists of amplifier, analog to digital converter. Temperature sensor will act as a transducer, which is fixed inside the car. This transducer will produce some analog output by changing the resistance value. Then the analog signal is given to the amplifier. If the analog output is weak, then the amplifier will strengthen the signal. The amplified signal is given to analog to digital converter to convert the analog signal into digital signal. The digital signal is given to pic16f877A, in that controller we have stored some value. It will compare the digital output with stored output using comparator. If the digital output is less than the stored output, then the ac level will automatically reduce. If the digital output is more than the stored value, then the ac level will automatically increases.

FUEL LEVEL:

To measure the fuel level in the fuel tank of the car, we are using floating type fuel level sensor. In the existing system, the fuel level is displayed in the meter, when the car is started. But sometimes the driver forgot monitor the fuel level. We are designed this system to monitor the fuel level automatically and it indicates through AVR voice module. The float type sensor is connected to pic microcontroller. It is made up of plastic. If the fuel level is full, the sensor floats in water at the top of the tank, so that the microcontroller switch goes to ON position and indicates the tank is full. If the level of fuel decreases, the sensor also goes to the lower level depends on fuel level, then the microcontroller will goes to the ON position and indicates to the driver that the fuel level is low through AVR voice module.

4. CONCLUSION

The proposed system is developed to prevent the human beings from accident and also to avoid the traffic collision at a same time by using ultrasonic sensor. It is not expensive and we can implement it in all vehicles. We can also use radar for long distance but it is very expensive. We have also included vehicle automation which is very useful to monitor our vehicle automatically.

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