Road Accident Avoiding System using Drunken Sensing Technique

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Abstract—**The purpose of this project is to develop vehicle accident prevention by method of alcohol detector in an effort to reduce traffic accident cases based on driving under the influence of alcohol. This project is developed by integrating the alcohol sensor with the microcontroller. The alcohol sensor used in this project is MQ-2 which detects the presence of alcohol content in human breath. An ignition system with spark plugs is build up as a prototype to act like the ignition starter over the vehicle's engine. The ignition system will operate based on the level of Blood Alcohol Content (BAC) in human breath detected by the alcohol sensor.**

Keywords—accident avoidance; drunker system; mechatronics;

I. INTRODUCTION

Now a day's road accident is a major problem all over the world. The recent report says [19] that annual average of 700,000 road accidents, 10 percentages occur in India which has overtaking China. The latest annual statistics revealed by the World Health Organization (WHO) in its first Global status report on road safety, 80,000 people are killed on Indian roads due to speeding, drunk driving, less usage of helmets, seat belts and child restraints in vehicles. Another latest report of National Crime Records Bureau or NCRB [20] says that 40 people under the age of 25 die in road accidents all around the world. It states that the drunk driving is a major factor for the rise of death on roads. The drunken driving fatalities in the year 2012, till the 27th November was 11,769. The numbers for 2010 and 2011 were 12,998 and 11,773 respectively. It shows that the problem of drunken driving is far from over. In the 2012 DUI national statistics released by the NHTSA (National Highway Traffic Safety Administration) 11,773 people died in alcohol-related crashes. Most of the accidents occurring outside the cities are due to drunk driving and no testing methodology has yet been adopted to avoid these fatalities on highways. Motorists parking their vehicles in ―No parking area increase the rate of traffic in the metropolitan cities. In Indian road system, widening of roads is not an alternate solution to avoid traffic in such cities. The Statistics of law breakers is depicted below in Table 1.

Table1: Statistics of lawbreakers

Law Breakers	Two wheelers	Four wheelers
Signal jumping	2,20,859	1,46,945
Drunken driving	36,727	17,237

II. PROBLEM DEFINITION

Now a day's road accident is a major problem all over the world. After reviewing the literature survey in the previous section it was clear that the more number of accidents was mainly because of drunk drivers, driving under the influence of alcohol, which is responsible for about one-third of all road accidents. Every year people are injured or killed on the road because another driver was driving under the influence of alcohol & the alcohol impairs human beings ability to determine distance, reaction time, judgment and vision. None of the advance technique in vehicles detects alcohol consumption in drivers.

We are going to develop a mechatronic system which consists of MQ-2 gas sensor (alcohol sensor) which is suitable for detecting alcohol content from the breath. So it can be placed in the proximity of the driver. The surface of the sensor is sensitive to various alcoholic concentrations. It detects the alcohol from the driver's breath; the resistance value drops leads to change in voltage (Temperature variation occurs). Generally the illegal consumption of alcohol during driving is 0.08mg/L as per the government act. But for demonstration purpose, we programmed the threshold limit of BAC as 500 PPM.

The decoded radio frequency signal is sent to the controller in the vehicle unit to start /stop the vehicle. If there is no control signal of BAC (below the threshold limit) from alcohol sensor then the vehicle will start, otherwise if it detects the BAC (above the threshold limit) the vehicle will not start.

III. METHODOLOGY

Methodology is the systematic, theoretical analysis of the methods applied to a field of study, or the theoretical analysis of the body of methods and principles associated with a branch of knowledge. It typically, encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques.
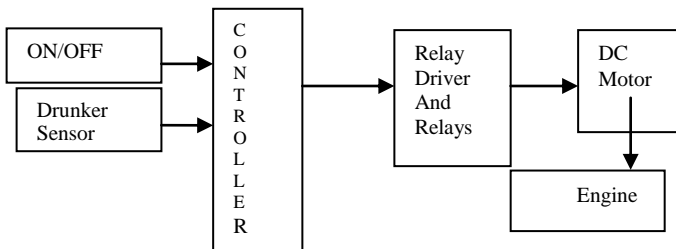
Figure 1: Block Diagram of the System

The above figure 1 shows the block diagram of the controller based drunker sensing vehicle. The block consists of switches and sensor, controller, relays and motors. The required actions of vehicle are first programmed and then stored in controller. So we can get signal from controller only.

Start Button is used to start the operation of the vehicle. We can press the start button and then vehicle action can perform. Controller reads the input signals and it can produce the output according to the assembly language program stored in it. The output signals to drive the DC motor is used to forward & reverse direction using relay driver & relays and then the vehicles action can perform like forward and reverse. If any alcohol content is sensed, the controller stops the DC motor using relay driver and relays. In this way sensor can sense the drunk driver in vehicle using controller.

IV. COMPONENTS SELECTION

A. Alcohol sensor

The he alcohol sensor will detect the alcohol content depending on human breath and the signal will send data to PIC16F877C as a controller to other circuits. The result of alcohol content in human breath that has been detected from alcohol sensor will be displayed on the LCD 16 x 2 displays. The alcohol sensor MQ-2 has been selected in this system due to its sensitivity in detection of small value of BAC. This sensor is manufactured by Huawei Electronic Co. Ltd and has high sensitivity to alcohol and small sensitivity to benzene. The sensor is able to detect BAC with different concentration and classifies the range of BAC detected into a few level. Figure shows the overview of alcohol sensor MQ-2.
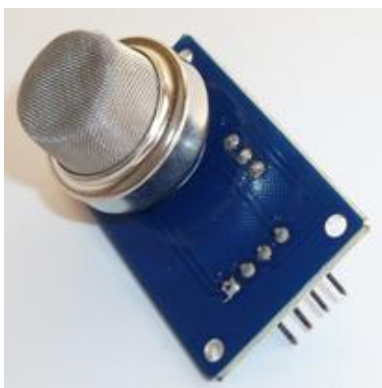

Figure 2: Alcohol sensor

B. Microcontroller

PIC stands for Peripheral Interface Controller given by Microchip Technology to identify its single-chip microcontrollers. These devices have been very successful in 8-bit microcontrollers. The main reason is that Microchip Technology has continuously upgraded the device architecture and added needed peripherals to the microcontroller to suit customer's requirements.

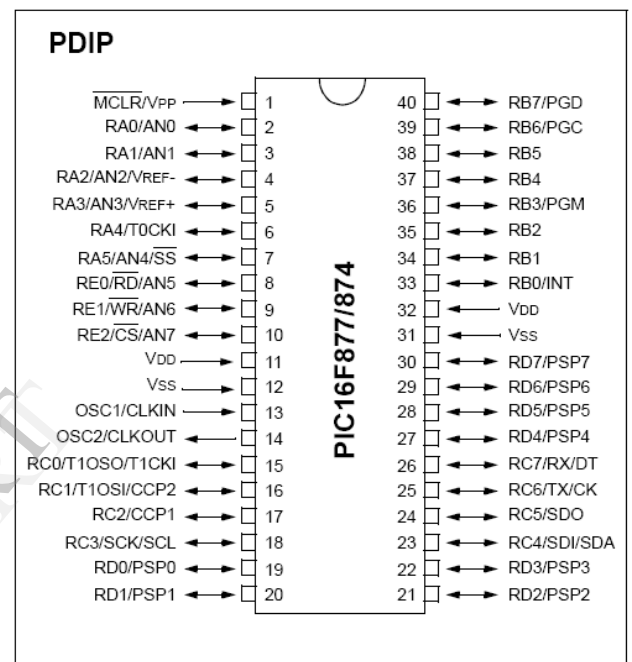The architectures of various PIC microcontrollers can be divided as follows:

Figure 3: PIN Configuration of PIC Controller

1) Low - end PIC Architectures:

Microchip PIC microcontrollers are available in various types. When PIC microcontroller MCU was first made available from General Instruments in early 1980's, the microcontroller consisted of a simple processor executing 12-bit wide instructions with basic I/O functions. These devices are known as low-end architectures. They have limited program memory and are meant for applications requiring simple interface functions and small program & data memories. Some of the low-end device numbers are

- 12C5XX
- 16C5X
- 16C505

2) Mid range PIC Architectures

Mid-range PIC architectures are built by upgrading low-end architectures with more number of peripherals, more number of registers and more data/program memory. Some of the mid-range devices are

- 16C6X
- 16C7X
- 16F87X

Program memory type is indicated by an alphabet.
- C = EPROM
- F = Flash
- RC = Mask ROM

Popularity of the PIC microcontrollers is due to the following factors:-

a) Speed:

Harvard Architecture, RISC architecture, 1 instruction cycle = 4 clock cycles. Instruction set simplicity: The instruction set consists of just 35 instructions (as opposed to 111 instructions for 8051).

b) Power-on-reset and brown-out reset:

Brown-out-reset means when the power supply goes below a specified voltage (say 4V), it causes PIC to reset, and hence malfunction is avoided.

A watch dog timer (user programmable) resets the processor if the software/program ever malfunctions and deviates from its normal operation.

PIC microcontroller has four optional clock sources.
- Low power crystal
- Mid-range crystal
- High range crystal
- RC oscillator (low cost).

3) Interfacing 16 Character x 2 Line LCD

The HD44780U dot-matrix liquid crystal display controller and driver LSI, displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4 or 8 bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver. A single HD44780U can display up to one 8-character line or two 8-character lines. The HD44780U has pin function compatibility with the HD44780S which allows the user to easily replace an LCD-II with a HD44780U. The HD44780U character generator ROM is extended to generate 208 5 ´ 8 dot character fonts and 32 5 ´ 10 dot character fonts for a total of 240 different character fonts.

Figure 4: LCD Display

The low power supply (2.7V to 5.5V) of the HD44780U is suitable for any portable battery-driven product requiring low power dissipation.

C. Gear Motor

Geared motors are complete motive force systems

Figure 5: Gear motor

consisting of an electric motor and a reduction gear train integrated into one easy to mount and configure package. This greatly reduces the complexity and cost of designing and constructing power tools, machines and appliances calling for high torque at relatively low shaft speed or RPM. Gear motors allow the use of economical low-horsepower motors to provide great motive force at low speed such as in lifts, winches, medical tables, jacks and robotics. They can be large enough to lift a building or small enough to drive a tiny clock.

D. Capacitor

A capacitor (formerly known as condenser) is a passive electronic component consisting of a pair of conductors separated by a dielectric (insulator). When there is a potential difference (voltage) across the conductors, a static electric field develops in the dielectric that stores energy and produces a mechanical force between the conductors. An ideal capacitor is characterized by a single constant value, capacitance, measured in farads. This is the ratio of the electric charge on each conductor to the potential difference between them. In our project, we are using 470□F capacitor.

Capacitors are widely used in electronic circuits for blocking direct current while allowing alternating current to pass, in filter networks, for smoothing the output of power supply, in the resonant circuits that tune radios to particular frequencies and for many other purposes.

The effect is greatest when there is a narrow separation between large areas of conductor; hence capacitor conductors are often called "plates", referring to an early means of construction. In practice the dielectric between the plates passes a small amount of leakage current and also has an electric field strength limit, resulting in a breakdown voltage, while the conductors and leads introduce an undesired inductance and resistance.

V. ASSEMBLY

After selection of the components used for the project, the final assembly is done which is shown in the figure below.

Figure 6: Full Assembeled model

VI. CIRCUIT DIAGRAM OF THE SYSTEM
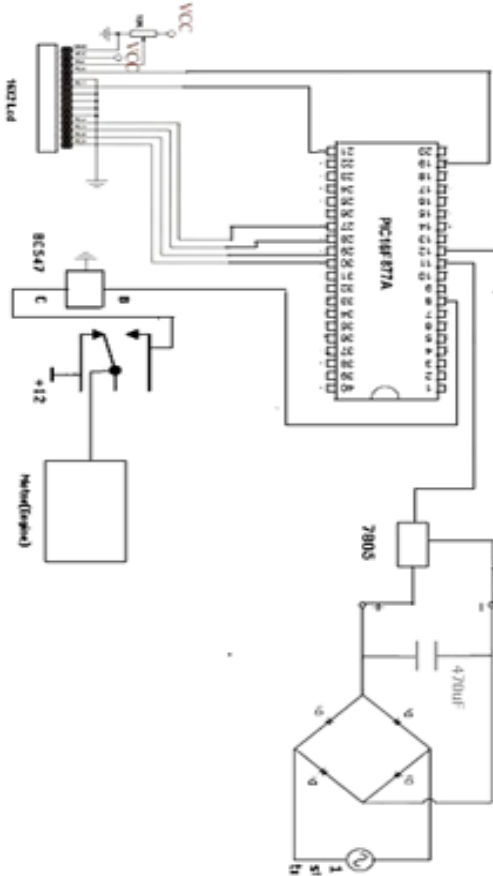
Figure 7: Circuit diagram of the vehicle

VII. MICROCONTROLLER CODING

```
#include<ppm.h>
void main()
{
int g;
INTCON = 0;        // disable all interrupts//
ANSEL  = 0x04;   // Configure AN2 pin as analog
input//
TRISA  = 0x04;
ANSELH = 0;      // Configure other AN pins as digital
I/O//
Lcd_init(&PORTD);             //Lcd_Init_EP5,see
Autocomplete//
LCD_Cmd(LCD_CURSOR_OFF); // send command to
LCD (cursor off)//
LCD_Cmd(LCD_CLEAR); //send command  to LCD
(clear LCD)
ADCON1= 0x82;    // configure VDD as Vref, and
analog channels//
TRISA = 0xFF;    // designate PORTA as input//
Delay_ms(2000);
while (1)
 {
 adc_rd  = ADC_read(0);    // read analog data//
g=ppm(adc_rd);            // send to header file//
inttostr(g,text);         //convert into string//
Lcd_Out(1,1,text);         //display value//
Lcd_Out_cp("ppm");     //add unit as a string//
}
}
```
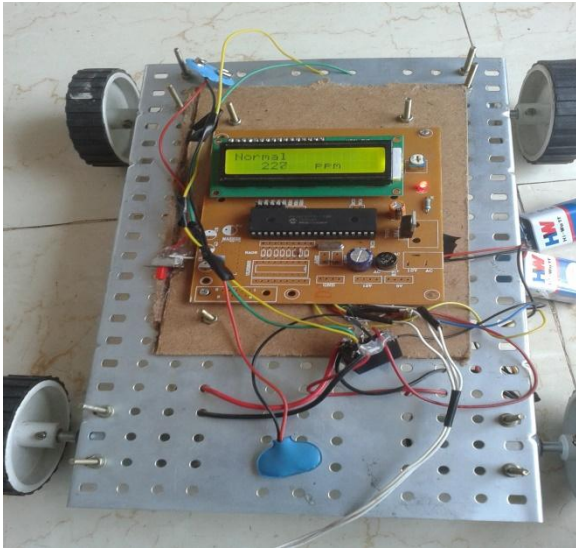
VIII. EXPERIMENTATION

Based on the design configuration presented, we executed a completely operational prototype based vehicle with 4 gear motors and the drunker sensing technique to detect the alcohol content. When the alcohol is sensed then the vehicle automatically stops.

As we switch on, the vehicle starts running. When the sensor senses the alcohol it sends the signals to the
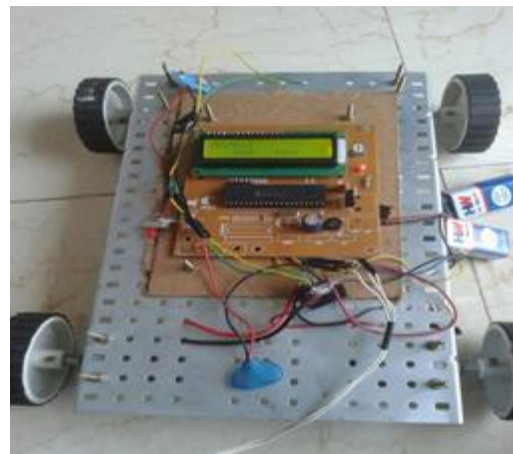

Figure 8: Prototype Mechatronic System

controller unit, the controller unit in turn automatically gives signal to the relay drivers to stop the vehicle. This project mainly focuses on avoidance of drunk driving. Hence this system will not turn on the vehicle, when the user is in drunken condition.

Figure 9: Reads Normal BAC

Figure 10: Reads Detected BAC

The figure 8 shows the setup for alcohol detection system vehicle. The setup consists of PIC16F877C Microcontroller, LCD, Analog sensor MQ2, Regulator 7805, Relay, Capacitor, Solenoid Valve and Gear Motor.

The figure shows the LCD display in the normal condition along with the BAC in ppm.

The above figure shows the LCD display when the alcohol content (>500 ppm) is detected with the observer and the vehicle stops.

IX. RESULT AND DISCUSSION

The system begins to operate when the alcohol sensor detects BAC level of the driver. Then it will send the signal to PIC 16F877 for further process which will involve the LCD display and ignition system.

Table 2: Results achieved in different level of drunkenness in ppm

Output	Level of drunkenness	
	Below 500 ppm	*500 ppm & above*
LCD display	Normal	Alcohol detected
Ignition system	Enable	Disable

BAC level detected by alcohol sensor is based on gas or alcohol concentration in ppm (parts per million). This system is tested by alcoholic drinks as the input to the experiment. The alcohol sensor can sense the alcohol quantity from human breath. The result is categorized into two conditions of the driver with different value of BAC level which are below 500 ppm and above it. Above table

shows the results achieved while experimentation. For the first condition, LCD will display "Normal" when the alcohol sensor detects BAC level below 500 ppm. This condition shows that the driver's BAC is below the threshold value for which the ignition system is enabled, means the driver is conscious and can drive the vehicle on the road safely.

In the second condition, LCD will display "Alcohol Detected" when the alcohol sensor detects BAC level 500 ppm & above. The ignition system is deactivated as the level of BAC is too high. The driver is totally unconscious and not safe for driving.

X. CONCLUSION AND FUTURE SCOPE

A. Conclusion

An efficient system of vehicle accident prevention system embedded by alcohol detector has been proposed. It consists of PIC 16F877 as the main controller, alcohol sensor as the input and LCD display as output. This system is capable to alert the driver about the level of drunkenness by indicating the condition on LCD display. The most safety element provided by this system, is that the driver in high level of drunkenness is not allowed to drive a car as the ignition system will be deactivated. Ultimately, this system helps to prevent the driver to drive in risky situation and will avoid road accidents.

1) Advantages

• This method of analyzing or detecting the presence of alcohol in breath is relatively a quick analysis as compared to other techniques.

• The sensors used in this project are smaller in size, not so bulky, hence can be carried.

• The project based on this technology is self-sufficient within it and thus can be used as a safety system for any vehicle and, the human being driving it by preventing the accidents to occur.

• The system isn't police dependent.

• In case if the driver is drunk, the family members can drive him/her safely. Also unauthorized access to the car and rash driving is not possible.

B. Future Scope

This project can be modified with the help of a GPS track and GSM modem, for communication with the remote control station. The system used in the vehicle will continuously send the readings obtained from various sensors and current position of the vehicle which will be obtained from GPS receiver to the control station. As a result one could get immediate information related to the driver's condition

There has been a very large increase in road accidents due to drowsiness of driver while driving which leads to enormous fatal accidents .The driver loses his control when he falls asleep which leads to accident. In this system, eye blink sensor continuously monitors the driver's drowsiness and intimate to reduce the speed of vehicle, which prevents such accidents.

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