

# Real Time Alcohol Detection and Accident Prevention System for Four Wheelers

Kowsalya Devi A <sup>[1]</sup>, Joys Shanthini B <sup>[2]</sup>, Aparna Murali <sup>[3]</sup>, Arthi M <sup>[4]</sup>

Department of Electronics and Communication Engineering

Adithya Institute of Technology

Tamil Nadu – India

## ABSTRACT

Our proposed system would be constantly monitoring the driver breath by placing it on the steering. So if a driver is drunk and tries to drive the system detects alcohol presence in his/her breath and blocks the fuel supply to the engine so that the vehicle fails to start. In another case if the driver is not drunk while he starts the vehicle and engine is started but he/she drinks while driving the sensor still detects alcohol in his breath and blocks the fuel supply to the engine using Solenoid Valve so that the car would not accelerate any further and driver can steer it to roadside. In this system we use PIC16F877A microcontroller interfaced with an alcohol sensor along with an LCD screen and a dc motor to demonstrate the concept. So here the alcohol sensor is used to monitor user's breath and constantly sends signals to the microcontroller. The microcontroller on encountering high alcohol signal from the alcohol sensor displays percentage of alcohol in LCD. If there is no alcohol content and in the opening condition of vehicle we provide the features of Accident Alert using Vibration sensor which detects the mechanical stress due to accidents sends SMS to the ambulance about the location of the vehicle. Then it provides ROLL OFF Mitigation using accelerometer and u-slot sensors to detect the position of wheel and speed of vehicle if both are above the threshold value the speed is automatically reduced it provide Roll over mitigation. Finally the system also detects bump and pit provides alert message and a warning signal to prevent accident

**Keywords:-** PIC16F877A, MQ-3 Alcohol Sensor, Vibration sensor, Accelerometer Sensor, U-slot Sensor, Ultrasonic Sensor.

## I. INTRODUCTION

Alcohol affects the central nervous system of a person. Even 0.05% BAC (Blood Alcohol Content) makes the sense of judgement impaired and the ability to control steering is affected. In this paper we have designed an automatic alcohol detector which is integrated with the steering wheel. When the sensor detects presence of alcohol in the breath of the driver, the microcontroller on encountering high alcohol content from the alcohol sensor displays alcohol detection note on LCD screen and also stops the dc motor to demonstrate as engine locking and a relay circuit is activated which has the control over the fuel supply to the engine of the car. so that the fuel supply is cut-off and the car is brought to halt. Then the percentage of alcohol content detected by the alcohol sensor is displayed using LCD.

This system uses an GSM module which sends an automatically generated SMS to the family members by Collecting the information about the current location of the vehicle through the GPS (Global Positioning System).

## II. STATISTICS

- Drunk driving remains a serious national problem that tragically affects thousands of victims annually.
- Over 20% of all traffic fatalities in the India each year are caused by drunk drivers.
- The National Statistical report on road accidents in India says that more than 70% of all accidents which occurs all over in India and about 90% of deaths in the world is due to drunken driving.
- Around 1.34 fatalities die every year.

A study conducted in Bangalore on the proportions of injuries linked to alcohol use: 59% of accidents were linked to alcohol use as against 41% which were unrelated to alcohol. out of 59%, 24% cases were accidents due to own driving by the drivers, while 35% were due to other's drinking. In short, 35% were victims of somebody else's irresponsibility.

## III. OBJECTIVE

- The object of this invention is to provide a novel and innovative way of preventing drunken driving of a Motorcar by cutting-off the Fuel supply.

- To design the system in such a way that it detects alcohol content only from the breath of the driver.
- To extend this idea with more technological advancements and make it available in a cost effective way.

#### IV. BLOCK DIAGRAM

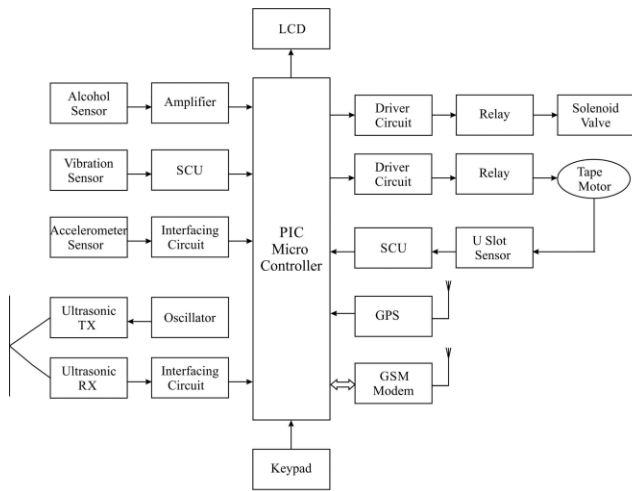


Fig1. Block Diagram

#### V. SYSTEM FLOWCHART

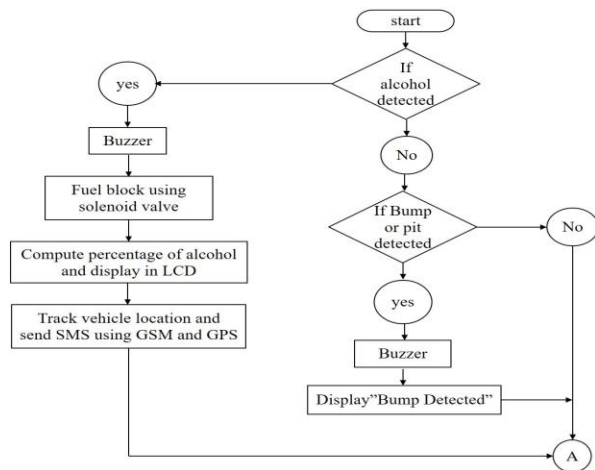


Fig2. Flowchart

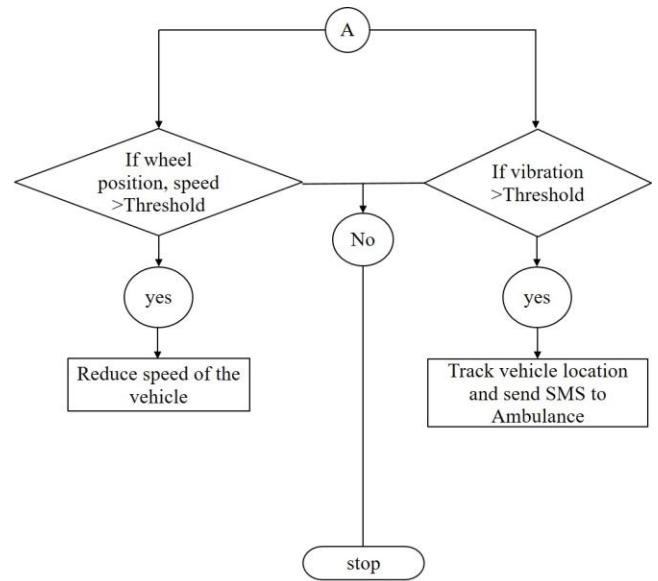


Fig3, Flowchart

#### VI. COMPONENTS DESCRIPTION

##### A. Alcohol Sensor (MQ-3)

- Alcohol Sensor for use to detect the presence of alcohol vapors. This sensor unit offers very high sensitivity, combined with a fast response time. The unit will work with a simple drive circuit and offers excellent stability with long life.
- This circuit is mainly designed to sense the present of alcohol in the human Respiration. The alcohol is sensed by the alcohol sensor. The alcohol sensor is the one type of transducer which produces the voltage signal depends on the alcohol level. Then the voltage signal is given to inverting input terminal of the comparator. The comparator is constructed by the operational amplifier LM 741. The reference voltage is given to non inverting input terminal.
- The comparator compares with normal reference signal and produces the corresponding output error signal. Then the output voltage is given to microcontroller in order to determine the alcohol content is present or not in the atmosphere or human respiration.

##### i. Features:

- High Sensitivity
- Detection Range: 10 - 1,000 ppm Alcohol

- Fast Response Time: <10s
- Heater Voltage: 5.0V
- Dimensions: 16mm Diameter, 10mm High excluding pins, Pins - 6mm High

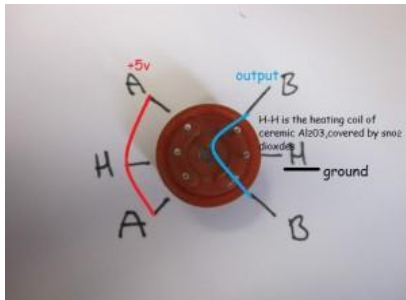


Fig.2 MQ-3 alcohol Sensor

**B. Accelerometer**

An accelerometer is an electromechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic - caused by moving or vibrating the accelerometer.

**i. Features:**

- Selectable Sensitivity (1.5g/2g/4g/6g)
- Low Current Consumption: 500  $\mu$ A
- Sleep Mode: 3  $\mu$ A
- Low Voltage Operation: 2.2 V – 3.6 V
- 6mm x 6mm x 1.45mm QFN
- High Sensitivity (800 mV/g @ 1.5g)
- Fast Turn On Time
- Integral Signal Conditioning with Low Pass Filter
- Robust Design, High Shocks Survivability
- Pb-Free Terminations
- Environmentally Preferred Package

**ii. Pin Diagram:**

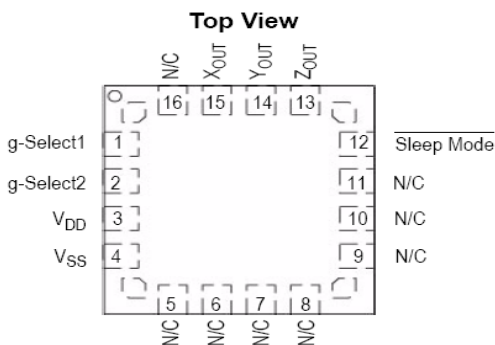


Fig.3 Accelerometer pin diagram

**iii. Pin Description:**

Pin no	Pin Name	Description
1	g-select 1	Logic input pin to select g level
2	g-select 2	Logic input pin to select g level
3	V <sub>DD</sub>	Power supply input
4	V <sub>SS</sub>	Power supply ground
5-7	N/C	No internal connection leave unconnected
8-11	N/C	Unused for factory trim Leave unconnected
12	Sleep mode	Logic input pin to enable product or sleep mode
13	Z <sub>OUT</sub>	Z direction output voltage
14	Y <sub>OUT</sub>	Y direction output voltage
15	X <sub>OUT</sub>	X direction output voltage
16	N/C	No internal connection leave unconnected

Table1.Pin Description

**IV. Applications:**

- HDD MP3 Player: Freefall Detection
- Laptop PC: Freefall Detection, Anti-Theft
- Cell Phone: Image Stability, Text Scroll, Motion Dialing, E-Compass
- Pedometer: Motion Sensing
- PDA: Text Scroll
- Navigation and Dead Reckoning: E-Compass Tilt Compensation
- Gaming: Tilt and Motion Sensing, Event Recorder
- Robotics: Motion Sensing

**V. Block Diagram:**

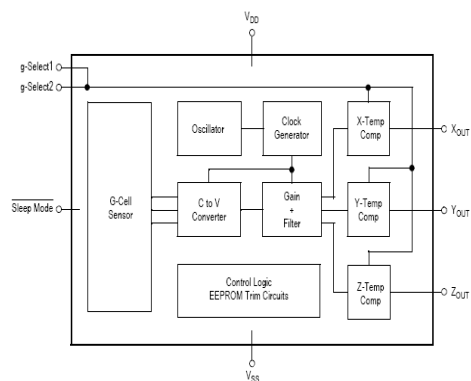


Fig 4. Block Diagram

**C. GPS MODULE WITH PATCH ANTENNA**

- This is a standalone GPS Module and requires no external components except power supply decoupling capacitors. It is built with internal RTC Back up battery.
- It can be directly connected to Microcontroller's USART. The module is having option for connecting external active antenna if necessary.
- The GPS chipsets inside the module are designed by MediaTek Inc., which is the world's leading digital media solution provider and largest fab-less IC company in Taiwan. The module can support up to 51 channels.
- The GPS solution enables small form factor devices. They deliver major advancements in GPS performances, accuracy, integration, computing power and flexibility. They are designed to simplify the embedded system integration process.



Fig 5. GPS Module

**i. Specifications:**

- Supply: 3.3V, 45mA
- Chipset: MTK MT3318
- Antenna: High gain GPS patch antenna from Cirocomm
- Data output: CMOS UART interface at 3.3V
- Protocol: NMEA-0183@9600bps (Default) at update rate of 1 second.
- Protocol message support: GGA, GSA, RMC, VTG
- No. of Satellite simultaneously tracked: 51
- Tracking Sensitivity: On-module antenna : -157 dBm
- Position Accuracy : <3 m
- Max. Update Rate?5Hz (Default: 1 Hz)

- Time to First Fix (Open sky and stationary position)
- Obscuration recovery: 0.1 second average
- Hot start: <1 seconds average
- Warm start: <34 seconds average
- Cold start: <36 seconds average
- Size: 26mm x 26mm x11.7mm

**D. GSM MODULE**

- This is a plug and play GSM Modem with a simple to interface serial interface. Use it to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from micro controllers and computers.
- It uses the highly popular SIM300 module for all its operations. It comes with a standard RS232 interface which can be used to easily interface the modem to micro controllers and computers.
- The modem consists of all the required external circuitry required to start experimenting with the SIM300 module like the power regulation, external antenna, SIMHolder, etc.



Fig 6. GSM Module

**i. Features:**

- Uses the extremely popular SIM300 GSM module

- Provides the industry standard serial RS232 interface for easy connection to computers and other devices
- Provides serial TTL interface for easy and direct interface to microcontrollers
- Power, RING and Network LEDs for easy debugging
- Onboard 3V Lithium Battery holder with appropriate circuitry for providing backup for the modules' internal RTC
- Can be used for GSM based Voice communications, Data/Fax, SMS,GPRS and TCP/IP stack
- Can be controlled through standard AT commands
- Module's operation mode can be controlled through the PWR Switch connected to the PWR pin (refer the SIM300 datasheet for more information)

**E. Vibration Sensor**

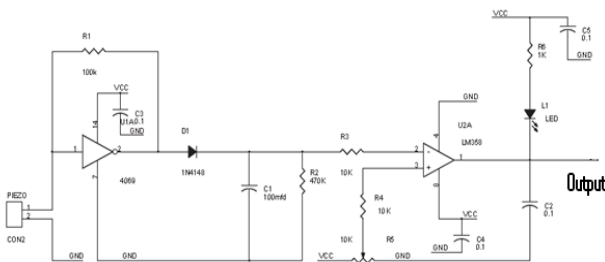


Fig 7.Circuit Diagram

- This circuit is using for detecting the vibration using piezo-electric plate. Piezoelectricity is the ability of crystals and certain ceramic materials to generate a voltage in response to applied mechanical stress.
- Piezo electric plate converts the mechanical vibration to electrical signal. The converted electrical signal is in the range of milli voltage signal.
- Then the electrical signal voltage is given to amplifier unit. The amplifier circuit is constructed with hex inverter IC 4069. The amplified output is in the form of AC signal the diode is used to rectify the negative signal.
- Then the electrical signal voltage is given to comparator unit through 0.1uF capacitor in order to filter the noise signal.

- The rectified signal is given to comparator. The comparator circuit is constructed with LM358 operational amplifier in which the signal is given to inverting input terminal.
- The reference voltage is given to non inverting input terminal. It converts the input signal to +5V to 0V square pulse.
- The square pulse is given to microcontroller. Comparator output is always in digital form so we can connect directly to the microcontroller.
- At the time of vibration the output will be in zero state. So the LED already gets the positive 5 volt power supply in anode side. Now LED receive ground potential and it will be in a forward bias so the will glow.
- The output pin is monitoring by using any microcontroller or processor.

**F. Ultrasonic Sensor**

- The Parallax ultrasonic distance sensor provides precise, non-contact distance measurements from about 2 cm (0.8 inches) to 3 meters (3.3 yards).
- It is very easy to connect to BASIC Stamp® or Javelin Stamp microcontrollers, requiring only one I/O pin.
- The sensor works by transmitting an ultrasonic (well above human hearing range) burst and providing an output pulse that corresponds to the time required for the burst echo to return to the sensor.
- By measuring the echo pulse width the distance to target can easily be calculated.

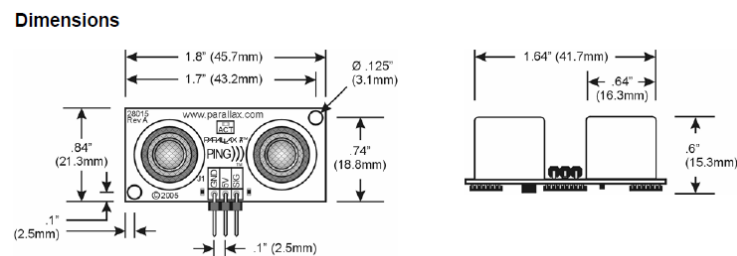


Fig8.Ultrasonic sensor

**i. Features:**

- Supply Voltage – 5 VDC
- Supply Current – 30 mA typ; 35 mA max
- Range – 2 cm to 3 m (0.8 in to 3.3 yds)
- Input Trigger – positive TTL pulse, 2 uS min, 5 uS typ.
- Echo Pulse – positive TTL pulse, 115 uS to 18.5 ms
- Echo Hold-off – 750 uS from fall of Trigger pulse

**G. LCD Display**

- LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is 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.
- A **16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.
- The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

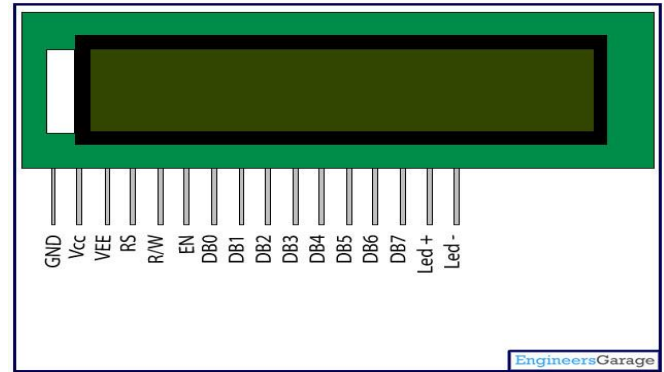


Fig9. LCD Display

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	VEE
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8		DB1
9		DB2
10		DB3
11		DB4
12		DB5
13		DB6
14		DB7
15	Backlight Vcc (5V)	Led+
16	Backlight Ground (0V)	Led+

Table 2.Pin Description

**H. Microcontroller**

- Micro controller is a stand alone unit ,which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory.
- The heart of the microcontroller is the CPU core. In the past, this has traditionally been based on a 8-bit microprocessor unit.

- For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 microcontroller devices.
- In the recent years, microcontrollers have been developed around specifically designed CPU cores, for example the microchip PIC range of microcontrollers.
- The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.
- The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

**ii. PIC16F877A:**

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The picstart plus development system includes PIC start plus development programmer and mplab ide.

The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under mplab provides for full interactive control over the programmer.

**iii. Core Features:**

- High-performance RISC CPU
- Only 35 single word instructions to learn

- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input
- DC - 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory,
- Up to 368 x 8 bytes of Data Memory (RAM)
- Up to 256 x 8 bytes of EEPROM data memory
- Pin out compatible to the PIC16C73/74/76/77
- Interrupt capability (up to 14 internal/external
- Eight level deep hardware stack
- Direct, indirect, and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC Oscillator for reliable operation
- Programmable code-protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low-power,high-speed,CMOS EPROM/EEPROM technology
- Fully static design
- In-Circuit Serial Programming (ICSP) via two pins
- Only single 5V source needed for programming capability
- In-Circuit Debugging via two pins
- Processor read/write access to program memory
- Wide operating voltage range: 2.5V to 5.5V
- High Sink/Source Current: 25 mA
- Commercial and Industrial temperature ranges
- Low-power consumption:
  - 2mA typical @ 5V, 4 MHz
  - 20mA typical @ 3V, 32 kHz
  - 1mA typical standby current

**iv. Peripheral Features:**

- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, can be incremented during sleep via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, prescaler and postscaler
- Two Capture, Compare, PWM modules
  - Capture is 16-bit, max resolution is 12.5 ns,
  - Compare is 16-bit, max resolution is 200 ns,
  - PWM max. resolution is 10-bit
- 10-bit multi-channel Analog-to-Digital converter
- Synchronous Serial Port (SSP) with SPI. (Master Mode) and I2C. (Master/Slave)
  - Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with
  - 9- bit address detection.
  - Brown-out detection circuitry for **Brown-out Reset (BOR)**

Table3.Specifications

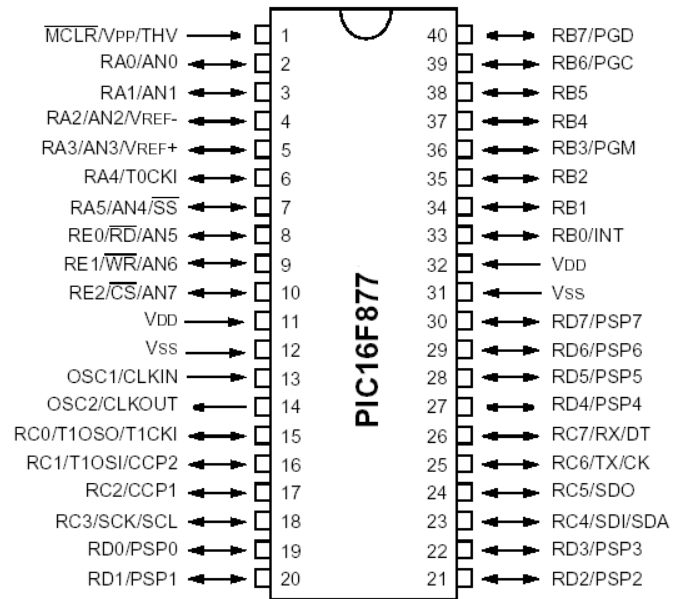


Fig11.Pin Diagram

**v. Memory organization :**

There are three memory blocks in each of the PIC16F877 MUC's. The program memory and Data Memory have separate buses so that concurrent access can occur.

**vi. Program Memory Organization:**

The PIC16f877 devices have a 13-bit program counter capable of addressing 8K \*14 words of FLASH program memory. Accessing a location above the physically implemented address will cause a wraparound. The RESET vector is at 0000h and the interrupt vector is at 0004h.

**vii. Data Memory Organization:**

The data memory is partitioned into multiple banks which contain the General Purpose Registers and the special functions Registers. Bits RP1 (STATUS<6>) and RP0 (STATUS<5>) are the bank selected bits.

**viii.General Purpose Register File :**

The register file can be accessed either directly or indirectly through the File Selected Register (FSR). There are some Special Function Registers used by the CPU and peripheral modules for controlling the desired

DEVICE	PROGRAM FLASH	DATA MEMORY	DATA EEPROM
PIC 16F877	8K	368 Bytes	256 Bytes

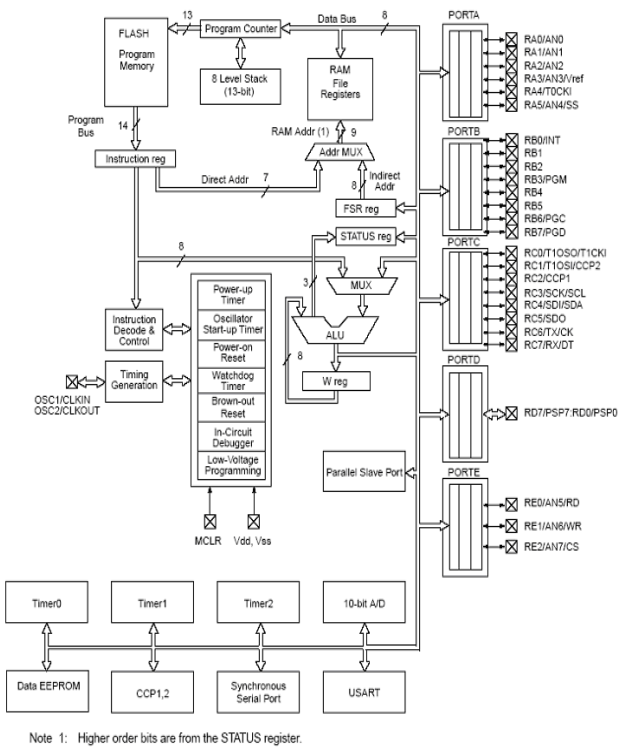


Fig10.Architecture of PIC 16F877A



operation of the device. These registers are implemented as static RAM. The Special Function Registers can be classified into two sets; core (CPU) and peripheral. Those registers associated with the core functions.

**ix. Instruction Set Summary:**

- Each PIC 16f877 instruction is a 14-bit word, divided into an OPCODE which specifies the instruction type and one or more operand which further specify the operation of the instruction.
- The PIC16F877 instruction set summary in Table 2.13 lists **byte-oriented**, **bit-oriented**, and **literal and control** operations. It shows the opcode Field descriptions.
- For **byte-oriented** instructions, 'f' represents a file register designator and 'd' represents a destination designator. The file register designator specifies which file register is to be used by the instruction.
- The destination designator specified where the result of the operation is to be placed. If 'd' is zero, the result is placed in the w register. If 'd' is one, the result is placed in the file register specified in the instruction.
- For **bit-oriented** instructions, 'b' represents a bit field designator which selects the number of the bit affected by the operation, which 'f' represents the address of the file in which the bits is located. For literal and control operations, 'k' represents an eight or eleven bit constant or literal value.
- The instruction set is highly orthogonal and is grouped into three basic categories:
  - **Byte-oriented** operations
  - **Bit-oriented** operations
  - **Literal and control** operations
- All instructions are executed within one single instruction cycle, unless a conditional test is true or the program counter is changed as a result of an instruction.
- In this case, the execution takes two instruction cycles with the second cycle executed as a NOP. One instruction cycle consists of four oscillator periods.
- Thus, for an oscillator frequency of 4 MHz, the normal instruction execution time is 1 ms. If a conditional test is true or the program counter is

changed as a result of an instruction, then the instruction execution time is 2 ms.

## VII. CONCLUSIONS

By using this system the number of accidents will be decreased to a touchable percent. This system can be used by government s in order to make it as a law before that should be used in any automobile. This system can be applied on any automobile or motor cycle because the system needs only a power supply between 7-12 volt. The cost of this system is low if it is compared with the world systems that applied on the modern automobiles. Alcohol sensor is accurate enough to sense the alcohol not by direct breath only but by the whole automobile environment.

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