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Alcohol Detection and Vehicle Controlling

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ABSTRACT

This system is aimed at making vehicle driving safer than before. This is implemented using Arduino. We have derived the driver's condition in real time environment and we propose the detection of alcohol using alcohol detector connected to Arduino such that when the level of alcohol crosses a permissible limit, the vehicle ignition system will turn off and the GPS module will capture the present location of the vehicle. Also the GSM module will automatically send distress message to police or family members.

Keywords:- Alcohol detection system, Vehicle controlling system, Accident prevention system, GSM, GPS, Arduino.

I. INTRODUCTION

India had earned the dubious distinction of having more number of fatalities due to road accidents in the world. Road safety is emerging as a major social concern around the world especially in India. Drinking and driving is already a serious public health problem, which is likely to emerge as one of the most significant problems in the near future[1]. The system implemented by us aims at reducing the road accidents in the near future due to drunken driving. The system detects the presence of alcohol in the vehicle and immediately locks the engine of the vehicle. At the same time an SMS along with the location of the vehicle is send to three pre-selected contacts. Hence the system reduces the quantum of road accidents and fatalities due to drunk driving in future.
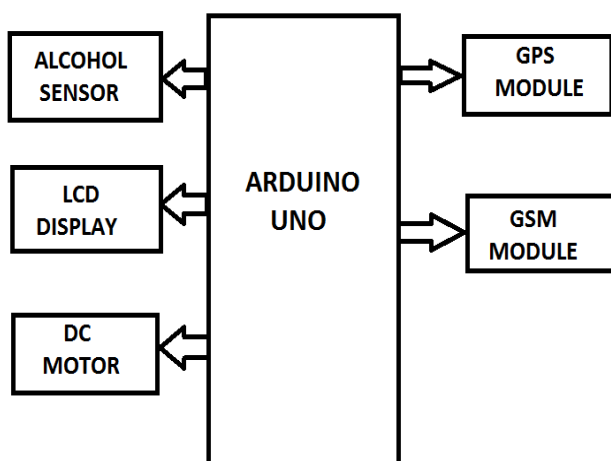
II. HARDWARE MODULES

Fig.1 Hardware Modules

The entire system adopted the Arduino Uno Microcontroller Board (based on ATMEGA 328), the principle of the hardware chart as shown in figure 1. The core functions modules are   Arduino Uno, Alcohol Sensor module (MQ-3),

GPS Module GSM Module, 16x2 LCD Display and DC Motor.

ARDUINO: The arduino board is the central unit of the system. All the components are interfaced to the board and programmed as per their functionality to operate in synchronization.

ALCOHOL MODULE: It is used to sense the alcohol. The analog output of which is applied to the arduino board.

GSM: It is used to send an SMS to the contacts of the user about the location of the vehicle. It is beneficial in emergency situations.

GPS: It is used to track the location of the user which is send via SMS through GSM module.

LCD: If alcohol is detected it displays the message indicating "ALCOHOL DETECTED".

DC MOTOR: It is used as a dummy for indicating the engine locking facility whenever alcohol is detected.

A. Arduino Microcontroller Board

The Arduino board is the central unit of the system. [8]

1) Introduction: The Arduino Uno is a microcontroller board based on the ATmega328. It is a programmable micro controller for prototyping electromechanical devices. You can connect Digital and Analog electronic signals:

- Sensors (Gyroscopes, GPS Locators, accelerometers)
- Actuators (LEDS or electrical motors)

It has 14 digital Input / output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic Resonator, a USB connection, a power jack, an ICSP header and a reset

button as shown in figure 2. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB to-serial converter
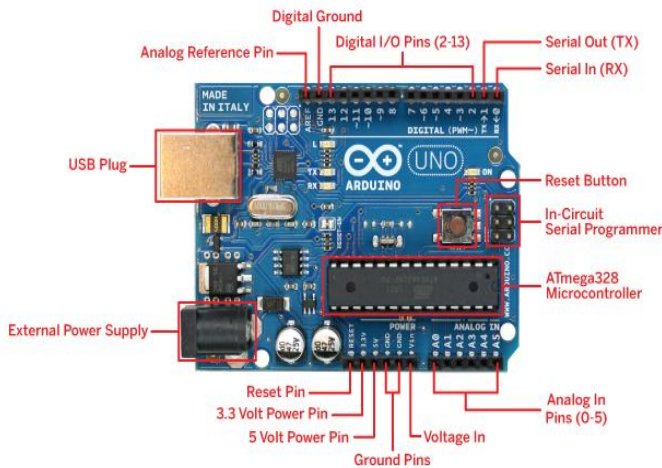

Fig.2 Arduino Board Description

2) Features:

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (Recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

3) Communication: The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and

USB connection to the computer (but not for serial communication on pins 0 and 1).

B. Alcohol Sensor MQ-3

The analog gas sensor - MQ3 is suitable for detecting alcohol, this sensor can be used in a Breathalyzer. It has a high sensitivity to alcohol and small sensitivity to Benzene. The sensitivity can be adjusted by the potentiometer. Sensitive material of MQ-3 gas sensor is SnO_2, which with lower conductivity in clean air. When the target alcohol gas exist, the sensor's conductivity is higher along with the gas concentration rising, use of simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration.[7]
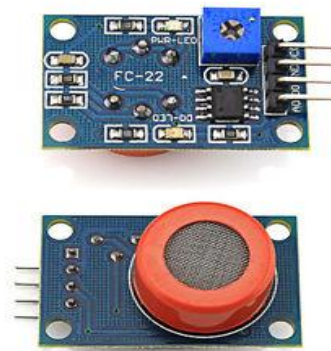

Fig.3 Alcohol Sensor

MQ-3 gas sensor has high sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor. The sensor could be used to detect alcohol with different concentration; it is with low cost and suitable for different application.

1) Sensitivity Adjustment: Resistance value of MQ-3 is difference to various kinds and various concentration gases. So, when using these components, sensitivity adjustment is very necessary. It is recommended to calibrate the detector for 0.4mg/L (approximately 200ppm) of Alcohol concentration in air and use value of Load resistance that (RL) about 200 KΩ (100KΩ to 470 KΩ). When accurately measuring, the proper alarm point for the gas detector has to be determined after considering the temperature and humidity influence.

2) Character configuration:

• Good sensitivity to alcohol gas

• Simple drive circuit

• Long life and low cost

• High sensitivity to alcohol and small towards benzene

- Fast response and High sensitivity and stability and long life.

3) *Specifications:*

- Power supply needs: 5V

- Interface type: Analog

- Pin Definition: 1-Output 2-GND 3-VCC

- High sensitivity to alcohol and small sensitivity to Benzene

- Fast response and High sensitivity

- Stable and long life

- Simple drive circuit with size: 40x20mm

C. GSM Module

The GSM net used by cell phones provides a low cost, long range, wireless communication channel for applications that need connectivity rather than high data rates. Machinery such as industrial refrigerators and freezers, HVAC, vending machines, vehicle service etc. could benefit from being connected to a GSM system.
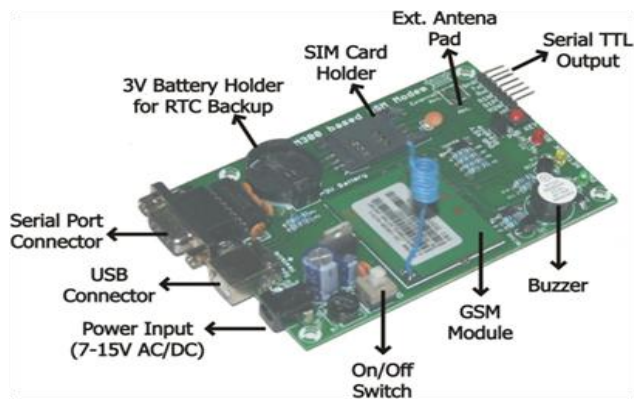

Fig.4   GSM Module

Take a given example. A garage offers a very special package to their customers. Based on the mechanics knowledge and the given vehicle, tailored service intervals can be specified. A part of the service agreement is installation of a GSM modem in the vehicle. An on board service application can then notify the garage when the vehicle approaches its service interval. The garage will schedule an appointment and inform the customer.

The customer will benefit from a reliable and well-serviced vehicle at a minimum cost. The garage on the other hand can provide excellent customer support, vehicle statistics, efficient work scheduling, and minimum stocks.

This application note describes how to use an AVR to control a GSM modem in a cellular phone. The interface between modem and host is a textual protocol called Hayes AT-Commands. These commands enable phone setup, dialing, text messaging and many such features.

1) *Theory of Operation:* The protocol used by GSM modems for setup and control is based on the Hayes AT-Command set. The GSM modem specific commands are adapted to the services offered by a GSM modem such as: text messaging, calling a given Phone number, deleting memory locations etc. Since the main objective for this application note is to show how to send and receive text messages, only a subset of the AT-Command set needs to be implemented. [9]

The European Telecommunication Standard Institute (ETSI) GSM 07.05 defines the AT-Command interface for GSM compatible modems. From this document some selected commands are chosen, and presented briefly in this section. This command subset will enable the modem to send and receive SMS messages.

2) *AT-Command set overview:* Figure 5 describes the AT-Command set. The commands can be tried out by connecting a GSM modem to one of the PC's COM ports.

Command	Description
AT	Check if serial interface and GSM modem is working.
ATE0	Turn echo off, less traffic on serial line.
AT+CNMI	Display of new incoming SMS.
AT+CPMS	Selection of SMS memory.
AT+CMGF	SMS string format, how they are compressed.
AT+CMGR	Read new message from a given memory location.
AT+CMGS	Send message to a given recipient.
AT+CMGD	Delete message.

Fig.5 AT-Command Set

2.1) *Message format (AT+CMGF):* The "AT+CMGF" command is used to set input and output format of SMS messages. Two modes are available:

- PDU mode: reading and sending SMS is done in a special encoded format.
- Text mode: reading and sending SMS is done in plain text.

PDU mode format saves message payload and is default on most modems. PDU mode is implemented in the source code for this application note, it is possible to use text mode to reduce code footprint if the connected modem supports this.

In text mode header fields as sender address, message length, validation period etc. can be read out in plain text together with the sent message.

2.2) Read Message (AT+CMGR): The "AT+CMGR" command is used to read a message from a given memory location. Execution of "AT+CMGR" returns a message at [index] from selected memory [M1]. The status of the message and the entire compressed message (PDU) is returned. To get any useful information out of the compressed message it should be decompressed.[9]

2.3) Send Message (AT+CMGS): This command enables the user to send SMS messages.. After the user defined fields are set, the message can be compressed and sent using the "AT+CMGS" command. [9]

D. GPS Module

The **Global Positioning System** (**GPS**) is a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites. The system provides critical capabilities to military, civil and commercial users around the world. It is maintained by the United States government and is freely accessible to anyone with a GPS receiver, an example of which is shown in figure 6.[12]

Fig.6 GPS Module

GPS devices may have capabilities such as: [12]

- Maps, including streets maps, displayed in human readable format via text or in a graphical format turn-by-turn navigation directions to a human in charge of a vehicle or vessel via text or speech.
- Directions fed directly to an autonomous vehicle such as a robotic probe.
- Traffic congestion maps (depicting either historical or real time data) and suggested alternative directions.

- Information on nearby amenities such as restaurants, fueling stations, and tourist attractions.

GPS may be able to answer [12]:

- The roads or paths available, traffic congestion and alternative routes, roads or paths that might be taken to get to the destination.
- If some roads are busy (now or historically) the best route to take.
- The location of food, banks, hotels, fuel, airports or other places of interests,
- The shortest route between the two locations.
- The different options to drive on highway or back roads.

Other GPS devices need to be connected to a computer in order to work. This computer can be a home computer, laptop, PDA, digital camera, or smart phones. Depending on the type of computer and available connectors, connections can be made through a serial or USB cable, as well as Bluetooth, Compact Flash, SD, PCMCIA and the newer Express Card. Some PCMCIA/Express Card GPS units also include a wireless modem.

- GPS module is an ideal for applications involving navigation, tracking or surveying. [12]
- 5V power 40mA current draw.
- 45s cold start, 38s warm start, 8s hot start.
- -159dB sensitivity.

E. LIQUID CRYSTAL DISPLAY

1) Introduction:

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.
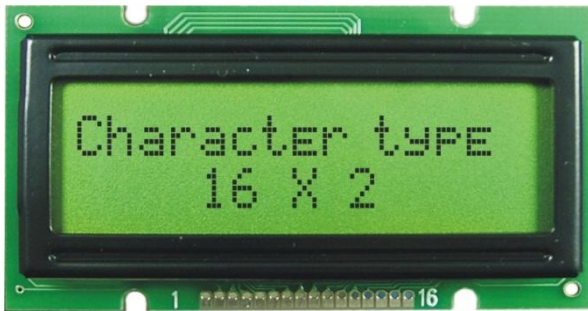

Fig.7 16x2 LCD

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. A typical LCD is shown in figure 7.

2) Features: [5]

- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

F. DC Motor

This DC or direct current motor works on the principal, when a current carrying conductor is placed in a magnetic field, it experiences a torque and has a tendency to move. This is known as motoring action. If the direction of current in the wire is reversed, the direction of rotation also reverses. When magnetic field and electric field interact they produce a mechanical force, and based on that the working principle of dc motor established. The direction of rotation of a this motor is given by Fleming's left hand rule, which states that if the index finger, middle finger and thumb of your left hand are extended mutually perpendicular to each other and if the index finger represents the direction of magnetic field, middle finger indicates the direction of current, then the thumb represents the direction in which force is experienced by the shaft of the dc motor.[11]
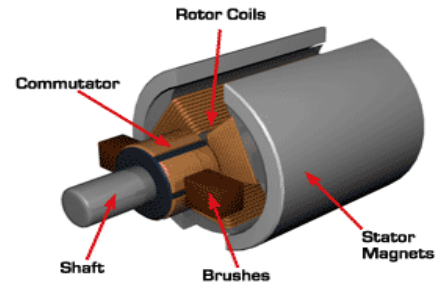

Fig 8 . Dc motor principle and construction

Structurally and construction wise a direct current motor is exactly similar to a DC generator, but electrically it is just the opposite. Here we unlike a generator we supply electrical energy to the input port and derive mechanical energy from the output port. We can represent it by the block diagram shown below.
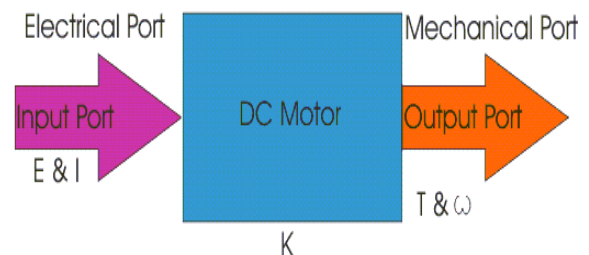

Fig. 9 Dc motor

Here in a DC motor, the supply voltage E and current I is given to the electrical port or the input port and we derive the mechanical output i.e. torque T and speed ω from the mechanical port or output port. The input and output port variables of the direct current motor are related by the parameter K.   [11]

$$T = KI \ and \ E = K\omega$$

So from the picture above we can well understand that motor is just the opposite phenomena of a DC generator, and we can derive both motoring and generating operation from the same machine by simply reversing the ports

III. CONCLUSION

An effective solution is provided to develop the intelligent system for vehicles which will monitor various parameters of vehicle in-between constant time period and will send this data to the base unit as explained in this paper, by using hardware platform who's Core is Arduino, Alcohol sensor mq3, GPS & GSM module. The designed system would finish the function of communicating with the base station via GPS, GSM and control of various parameters. The whole Control system has the advantage of small volume and high reliability. Future scope of this system is to control the accidents and providing useful details about the accidental vehicle, thereby reducing the rate of accidents taking place due to drunken driving. This system brings innovation to the existing technology in the vehicles and also improves the safety features, hence proving to be an effective development in the automobile industry.

ACKNOWLEDGEMENT

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