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Alcohol Detected Engine Turn Off System

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Abstract: A number of fatal lives are lost in the Indian roads day by day due to number of accidents. The prime ones being rash driving, negligence in driving and drunk & drives. Here a prototype is designed to avoid drunk & drives by using an automated system. Here the engine is inhabited from starting and running once alcohol is detected in the breath of the driver which is higher than the prescribed level permissible by law. Also provisions have been given in the system to indicate the level of alcohol in the drivers breath. This may allow him to be aware of physical and mental preparedness of his own-self and may help himself in handling the situation. This system as a whole consist of a MQ3 sensor, arduino board, LEDs, bipolar junction transistor, DC sugar cube relay, IC LM35DM,A plug to B plug cable and Permanent Magnet Direct Current motor(PMDC) with which the performance of this automated system is enabled. By mandating the installation of this prototype in automobiles the accidents due to drunk & drives can be considerably prevented and can efficiently save the valuable human lives.

Keywords: *Arduino, DC Sugar Cube Relay,MQ3 Sensor, PMDC Motor*

I. INTRODUCTION

A. Automated Drunk & Drive Prevention System

A traffic accident is defined as any vehicle accident occurring on a public highway (i.e.originating on, terminating on, or involving a vehicle partially on the highway). These accidents therefore include collisions between vehicles and animals,vehicles and pedestrians, or vehicles and fixed obstacles. In higher-income countries, road traffic accidents are already among the top ten leading causes of disease burden in 1998 as measured in DALYs (disability-adjusted life years). In less developed countries, road traffic accidents were the most significant cause of injuries, ranking eleventh among the most important causes of lost years of healthy life. In Indian road system, widening of the road is not an alternative solution to avoid traffic in such a cities [2]. The problems with state drunk driving control systems can be solved in many ways. The most effective will follow several principles. They will invest authority and responsibility in people and organisations at all levels, local to national, because drunken driving control requires action at all levels. They will operate in the public eye, using the media to report on problems and solutions, because ultimate decisions on priorities and resources to control drunk driving must have public support. They will not promise instant solutions based on a single action but rather will take steady steps towards long-term improvement. And they will establish mechanisms for identifying and solving problems rather than attempting to apply one-size fits- all methods.

Application of electronics in the automobile field is very much popular now. Because of the low prices and various varieties available in the market people prefer motorbikes to buy over 4 wheelers. Hence Road Safety becomes a major issue of concern. Therefore it becomes necessary to implement such a technique which is not easy to bypass the basic rule of wearing helmet and to avoid drunken driving.

II. ALCOHOL DETECTION

A prototype is designed to check the conditions before turned ON the engine of the bike. The system includes an alcohol sensor. Alcohol sensor is used to detect the biker is drunk, the output is fed to the MCU. The alcohol sensor is fit in the helmet. If the condition is violated the engine will not turn ON.

Alcohol sensor MQ3 is used here for detecting the alcohol concentration present in the driver's breath. Sensor provides an analog resistive output based on the alcohol concentration. MCU is the micro controller unit ,which controls all the functions of other blocks in this system. MCU takes or read data from the sensors and controls all the functions of the whole system by manipulating these data. Alcohol sensor is connected to the MCU through an interfacing circuit and the helmet sensing switch is directly connected to the MCU. MCU receives data from these sensors and it gives a digital data corresponding to the output of sensors to the encoder only if the two conditions are satisfied. Most of the accidents occur outside the cities are due to drunken driving and no testing methodology is adopted to avoid these fatalities in highways. Motorists parking their vehicles in No parking areas increase the rate of traffic in the metropolitan cities. In Indian road system, widening of the road is not an alternative solution to avoid traffic in such a cities.

III. OPERATION OF THE CIRCUIT

The Block diagram shown in fig(1) is designed to turn off the automobile and inhibit it from starting in case alcohol is detected in the breath of the driver. Here in the prototype an MQ-3 sensor is used to detect the vapours of alcohol It in turn produces a voltage proportional to the percentage of alcohol in the breath of the driver.This voltage is harnessed and amplified using an LM35 IC to produce an output voltage in a scale of 5V.A bias voltage of 5V is given to

the IC.Thus (voltage/5)*100 gives the percentage of alcohol in the driver's breath.This voltage is read by the arduino micro controller using the command" analog read(sensor pin)" If the percentage of alcohol in driver's breath is more than 50% then the 13thdigital pin of the arduino is turned to a logic HIGH which in further stages can be amplified to trigger the relay.The percentage of alcohol is again rated on a scale of ten and the corresponding number of LED's (Light Emitting Diode) are turned on.

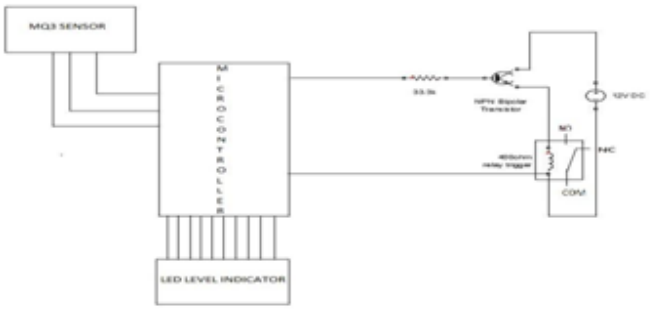

Figure 1: Block Diagram

In the LED level indicator which actually contains 10 LEDs that are connected in common cathode configuration. Thus the percentage of alcohol in the driver's breath can be indicated using the LED level indicator resistors with a resistance of 220ohms are connected in series with the LEDs to reduce the voltage across the LED to 0.7V.They are also called as current limiting resistances as the limit the current passing through the circuit the which otherwise may be short circuited due to the forward biasing of the Light Emitting Diodes.

Array concepts and "for" loop are used in turning ON all the LEDs till the LED that indicates the percentage of alcohol in driver's breath. The voltage output of the LM35 which is connected to the sensor and the number of LED's turned ON are indicated in the serial monitor of the Arduino which is possible by using a USB cable (A plug to B plug) Which is a two way communication wire that can be used to transfer data from arduino to the laptop.Here a DC sugar cube relay is used for turning ON/OFF of the motor,but the trigger of the relay should be given a 12V supply whereas the arduino operates at 5V thus a device is required for amplifying the voltage from 5V to 12V.A bi-polar junction transistor is used for this purpose, it is properly biased to make it to move to active mode and when a 5V supply is given to the base of the transistor current begins to flow in the collector and emitter terminals the emitter current is made to drop over the trigger coil of the sugar cube relay which which is sufficient enough for the switching operation of the relay .

Under normal conditions the NC(Normally Closed) terminal and the common terminal are short circuited using a connector wire and when the trigger coil of the relay is energised the effect of interference between the the effect of electromagnetic field lines of the trigger coil and the connector wire generates a pulling force that causes the connector to short circuit the NO(Normally Open)terminal the common.Thus the NC-Common terminals are open circuited due to the triggering of relay and the supply to the started motor is disrupted by the relay's action.the same technique can be extended to disrupt the supply to the spark plug of the automobile to turn off the engines if alcohol is being consumed by the driver during the course of running of the vehicle.

The reason for using the relay as a switch rather than using transistor as a switch is that the relays are relatively cheaper than transistors for the same rating and are commonly available in the market.i.e, A BJT that is designed for a current rating of 80A costs RS.4000 (approx.) whereas a relay for the same rating costs only Rs.120.

IV. ARDUINO UNO MICROCONTROLLER BOARD

Figure 2: Arduino Uno Micro-Controller Board

The Arduino Uno is a micro controller board shown in Fig 2 is based on the ATmega328 (data sheet). 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. It contains everything needed to support the micro controller; 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. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

A. Features

Micro controller 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

B. MQ-3 Semiconductor Sensor for Alcohol Detection

MQ-3 sensor is shown in Fig 3.Sensitive material of MQ-3 gas sensor is SnO2, which with lower conductivity in clean air. When the target alcohol gas exist, the sensor's conductivity is more higher along with the gas concentration rising. It converts change of conductivity to corresponding output signal of gas concentration.MQ-3 gas sensor has high sensitivity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapour. The sensor could be used to detect alcohol with different concentration, it is with low cost and suitable for different application.

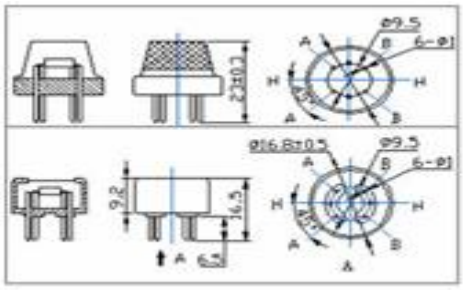

Figure 3: MQ3Sensor

Fig. 4 shows the typical sensitivity characteristics .Fig 5 shows the typical temperature and humidity the MQ-3, ordinate means resistance ratio of the sensor characteristics. Ordinate means resistance ratio(Rs/Ro), abscissa is concentration of gases. Rs means of the sensor (Rs/Ro), Rs means resistance of sensor resistance in different gases, Ro means resistance of in 0.4mg/l alcohol under different. and humidification in 0. 4mg/l alcohol. All test are under standard Ro means resistance of the sensor in environment of test conditions.
0.4mg/l alcohol, 20°C /65% RH3P.S.Sensitivity to smoke is ignite 10pcs cigarettes in 8m room, and the output equals to 0.1mg/l alcohol.

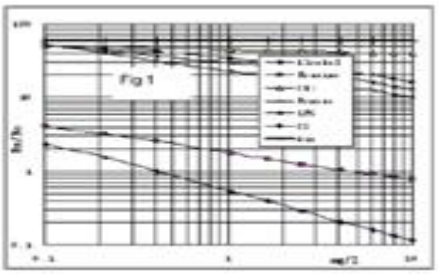

Figure 4: Sensitivity Characteristic

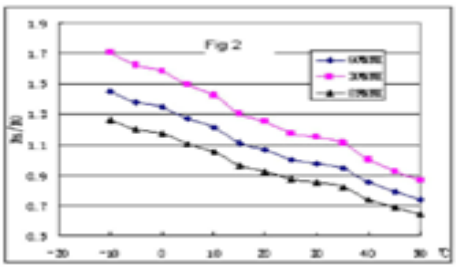

Figure 5: Influence of Temperature

V. RELAY CIRCUIT

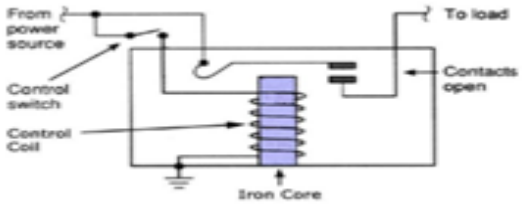

Figure 6: Relay Circuit

The diagram shows an inner section diagram of a relay. An iron core is surrounded by a control coil. As shown in Fig 6, the power source is given to the electromagnet through a control switch and through contacts to the load. When current starts flowing through the control coil, the electromagnet starts energizing and thus intensifies the magnetic field. Thus the upper contact arm starts to be attracted to the lower fixed arm and thus closes the contacts causing a short circuit for the power to the load. On the other hand, if the relay was already de-energized when the contacts were closed, then the contact move oppositely and make an open circuit .As soon as the coil current is off, the movable armature will be returned by a force back to its initial position. This force will be almost equal to half the strength of the magnetic force. This force is mainly provided by two factors. They are the spring and also gravity. Relays are mainly made for two basic operations. One is low voltage application and the other is high voltage. For low voltage applications, more preference will be given to reduce the noise of the whole circuit. For high voltage applications, they are mainly designed to reduce a phenomenon called arcing.

A. Relay Operation

As shown in the Fig 7, the current flowing through the coils represented by pins 1 and 3 causes a magnetic field to be aroused. This magnetic field causes the closing of the pins 2 and 4. Thus the switch plays an important role in the relay working. As it is a part of the load circuit, it is used to control an electrical circuit that is connected to it. Thus, when the relay in energised the current flow will be through the pins 2 and 4.

As soon as the current flow stops through pins 1 and 3, the switch opens and thus the open circuit prevents the current flow through pins 2 and 4. Thus the relay becomes de-

energised and thus in off position as shown in Fig 8.

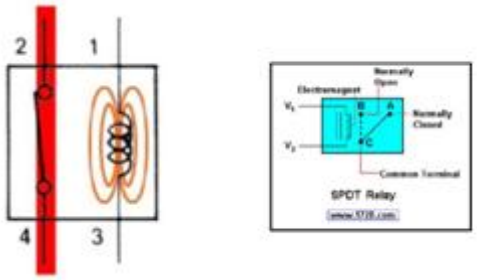

Figure 7: Energised relay (ON)

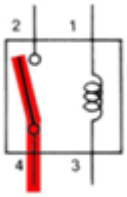

Figure 8: De- Energised relay (OFF)

In simple, when a voltage is applied to pin 1, the electromagnet activates, causing a magnetic field to be developed, which goes on to close the pins 2 and 4 causing a closed circuit. When there is no voltage on pin 1, there will be no electromagnetic force and thus no magnetic field. Thus the switches remain open.Sugar cube relay is shown in Fig 9.

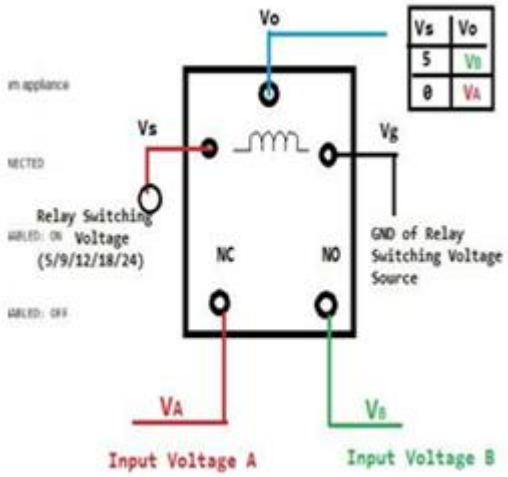

Figure 9: Sugar Cube Relay

VI. HARDWARE OUTPUT

A. Case1: Hardware output before alcohol detection:

The Hardware output of the circuit is shown in Fig.10.It shows that there are no vapours of alcohol around the MQ-3 sensor, thus the output of the MQ-3 sensor is in logic "0" which is indicated by the turned off red LED in the LM358 amplifier board. The 13th pin of the arduino is also in logic"0" which is also indicated by the built in LED of arduino which is turned OFF.In the LED level indicator only one LED is turned on which shows that the alcohol level indicator is in working condition and the concentration of alcohol in the sensor is very low.

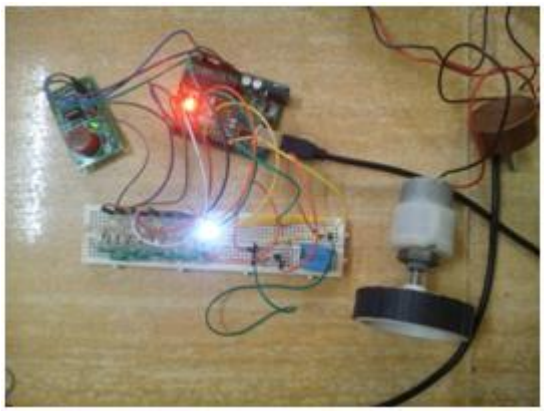

Figure 10: Hardware Output before Alcohol Detection

B. Case 2: Hardware output after alcohol detection

The motor that is connected in NC (Normally closed) mode is in running condition indicating that the trigger coil of the relay is not energised. Fig 11 shows that image when alcohol is sprayed from the can to the MQ-3 sensor the output of the LM358 amplifier board goes to a logic level"1" which is indicated by the burning red LED in the board. Since the input to the pin A1 of the arduino goes above the prescribed limit the 13th pin of the arduino goes to a logic level "1" that is indicated by the glowing of the built-in LED connected to the 13th pin of the arduino ,and the percentage of alcohol is indicated in the LED level indicator which is indicated by the glowing of the array of nine LEDs. The motor that is connected in NC (Normally closed) mode is turned off indicating that the trigger coil of the relay is energized and the connection in the relay has shifted from NC(Normally Closed) mode to NO(Normally Open) mode.

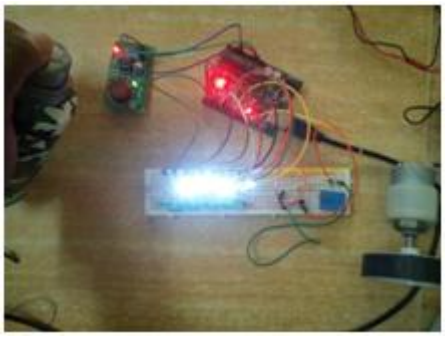

Figure 11: Hardware Output after Alcohol Detection

C. Provisions for Engine Speed Control

Provision for speed control of the vehicle can also be implemented in the project as given below:

Speed control in engines is generally achieved by changing the the supply of fuel into the carburettor by adjusting the cam shaft. Changing volume of supply of fuel into the carburettor changes the air fuel mixing ratio that

effects this strategy. Speed limiting can be achieved in geared vehicles by limiting the fuel supply in accordance to the gear that is coupled to the engine at that particular moment. For example, if the first gear is in operation major portion of the valve might be left open as major part of the output power will be spent on the starting torque .but if the vehicle's fifth gear is in operation a small part of the valve must be left open as most of the output energy will be used for attaining speed of the vehicle and this limits speed to a constant value for both the gears. The valve that is meant here is the one that supplies fuel to that carburettor thus an algorithm has to be framed that changes the value of the servo motor that controls the opening of inlets to the carburettor valve in accordance to the gear that is coupled and the percentage of alcohol in driver's breath.

CONCLUSION

Thus a completely automated system has been designed and prototyped to prevent drunk and drive in automobiles, which improves the level of safety in automobiles.

This system has a LED level indicator that indicates the percentage of alcohol content in the breath of the driver using an array of nine LEDs.The trigger coil of the relay is also energised/de-energised accordingly to turn ON/OFF the supply to the starter motor and the spark plug of the engine. The minimum percentage of alcohol content that must turn on the supply to the trigger of the relay can be varied by programming the arduino accordingly,thus providing a system that is much flexible.

Thus ensuring a completely drunk and drive free roads that reduces the risk of accidents and enhancing the level of driver's safety.In future the project may be extended to the harnessing and processing of the brain waves of the driver using specialised electrodes and to find whether the driver has consumed alcohol or not using open source Brain Computer Interface(BCI) technology. By using this the verification check can be implemented to confirm whether the driver has consumed alcohol or not before inhibiting the working of the engine.

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